THE DEVELOPMENT AND VALIDATION OF AN INSTRUMENT TO MEASURE VALUES IN MATHEMATICS CLASSROOMS OF MATRICULATION LECTURERS

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ABSTRACT

The purpose of the study was to develop and validate a self-report instrument which could measure values in mathematics classrooms for matriculation colleges' lecturers. The universal integrated perspective which is based on faith and belief in God is the basis for the conceptual framework. The ADDIE model which stand for analysis, design, develop, implementation, and evaluate was adapted as the research design. The model is normally used by instructional designers and content developers, in which the implementation stage was dropped in this study. The population of the study consisted of mathematics lecturers from 17 matriculation colleges in the country in which 325 of the lecturers took part. Document analysis protocol was used during the analysis and design phases, clinical interview protocol and survey questions were used for participants in the focus group, survey question was used for the panels of experts, and self-report survey was used for the pilot and the real study. The new self-report instrument consisted of 36 items and used 5-point Likert scale. There were eighteen, eight, and ten values items representing the general education, mathematical education, and mathematics values. Each of this sub construct contained four, two, and three dimensions respectively. Qualitative and quantitative analysis were used during the development stage for content validity and quantitative analysis was used for construct validity during the evaluation stage. The instrument recorded high Cronbach alpha values for the construct and sub-constructs indicating high internal consistencies. Goodness-of-fit indices for the structure of the model indicated that several fit indices values although close, failed to meet commonly accepted standards for the three sub-constructs. Principal component analysis (PCA) of the residuals showed multi-dimensionality for general education values and unidimensional for mathematics education values and values in mathematics. Teaching experience was the only factor contributing towards the score of the mathematics education values and only the pairs of 3-5 with 6-10 and 6-10 with 11-15 were found to have significance mean difference. It was also found that respondents with more teaching experience were inclined towards the the empiricism and universal integrated views of mathematics. The instrument may contribute towards providing more knowledge towards values development in teaching and learning of mathematics subjects.

PEMBANGUNAN DAN PENGESAHAN INSTRUMEN PENGUKURAN NILAI DALAM KELAS MATEMATIK BAGI PENSYARAH MATRIKULASI

ABSTRAK

Kajian ini bertujuan untuk membina dan mengesahkan skala pengukuran nilai dalam kelas matematik bagi pensyarah dari kolej matrikulasi. Pendekatan perspektif bersepadu sejagat yang berteraskan keimanan dan kepercayaan kepada Tuhan adalah dasar kepada kerangka konsepsi kajian. Model ADDIE yang merujuk kepada Analysis (analisis), Design (reka bentuk), Development (pembangunan), Implentation (Perlaksanaan) dan Evaluation (penilaian) telah diadaptasi sebagai rekabentuk kajian. Model ini seringkali digunapakai oleh pereka bentuk pengajaran dan pereka kandungan, di mana peringkat perlaksanaan telah digugurkan dalam kajian ini. Populasi kajian terdiri dari pensyarah matematik dari 17 kolej matrikulasi di dalam negara di mana hanya 325 dari mereka mengambil bahagian. Protokol dokumen analisa digunakan semasa fasa analisis dan fasa reka bentuk, protokol temu bual klinikal dan borang soal selidik digunakan di dalam kumpulan fokus, borang soal selikdik digunakan untuk mendapat maklumbalas panel pakar, dan soal selidik penilaian kendiri digunakan semasa kajian rintis dan sebenar. Skala penilaian kendiri yang dibina mengandungi 36 item dan mengunakan skala Likert 5-poin. Terdapat lapan belas, lapan, dan sepuluh item nilai yang mewakili nilai umum, nilai pendidikan matematik, dan nilai matematik. Setiap sub konstruk mengandungi empat, dua, dan tiga dimensi. Analisis kualitatif dan kuantitatif digunakan semasa peringkat pembinaan bagi kesahan kandungan dan analisis kuantitatif digunakan bagi penentuan kesahan konstruk semasa peringkat penilaian. Skala telah mencatatkan kebolehpercayaan yang baik dengan nilai alfa Cronbach yang tinggi untuk

konstruk dan subkonstruk. Indeks *Goodness-of-Fit* untuk struktur model menunjukkan terdapat beberapa ujian yang memberi nilai walaupun agak hampir dengan julat yang boleh diterima, tetapi gagal memenuhi piawai bagi ketiga tiga subkonstruk. Ujian *Principal Component Analysis (PCA)* pula mencatatkan bahawa nilai pendidikan umum bersifat multidimensi sementara nilai pendidikan matematik dan nilai matematik bersifat unidimensi. Responden dalam kategori skor tinggi bagi konstruk dan subkonstruk merupakan mereka yang peringkat umurnya di antara 31 – 40 tahun, mempunyai ijazah sarjana muda, dan mempunyai 6 -10 tahun pengalaman. Hanya jumlah tahun pengalaman dikenalpasti sebagi faktor penyumbang kepada nilai pendidikan matematik dan hanya pasangan kumpulan 3 – 5 dengan 6 – 10 serta 6 - 10 dengan 11 – 15 mendapat perbezaan yang signifikan. Adalah didapati responden yang mempunyai lebih lama pengalaman mengajar mempunyai pandangan terhadap matematik yang lebih cenderung ke arah empirisisme dan perspektif bersepadu. Skala ini berpotensi untuk memberi lebih banyak maklumat berkaitan pengembangan nilai dalam pengajaran dan pembelajaran subjek matematik.

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Chapter 1 Introduction

The chapter provides some backgrounds to the study, explaining the research problems, and outlining the direction of the study in eight sub-topics. The first is the background of study which will start with a short narrative hook concerning the study for the readers to prepare their minds, slowly focusing the readers' attention, and to attract the attention of the readers to the area of study. The narrative hook is followed by introducing the area of study, mathematical topics involved, the setting of the study, history on the development of the study, differences in opinions on the topic, past and current related significant studies, present status of the research, and some critical issues related to the study particular

The second sub-topic is the problem statement which covers (a) issue statement that describes the problems which have been solved and those which have not been solved, (b) the unresolved problems chosen to being studied, and (c) the rationales of why specific issues were taken and why solving the problem is important. The third sub-topic is the theoretical framework which includes topics on (a) explanation on the characteristics of theory used as the basis, (b) justifications and rationales of choosing a specific theory, and (c) some theoretical assumptions. The fourth sub-topic will discuss the purpose of study and the research questions which is followed by the fifth sub-topic covering the definitions of all the important terms used in the study. The sixth sub-topic focuses on the limitations and delimitations of study and the seventh sub-topic is on significant of studies. The chapter ends with a conclusion section summarizing important fact of chapter one and briefly explains on how the rest of the chapters will be arranged.

Background of Study

Value is an innate part of any educational process which transpires at various levels such as the education system, education institutional, curriculum expansion, academic administration, and students' interactions (Le Metais, 1997). However, it receives less attention in research despite the influence it has on students' inner personality and social behavior since it is more stable if compared to other related affective constructs. Value has been identified as one of the most important element in the teaching and learning mathematics (Seah, 2002) where any studies in relation to it, will improve the quality of mathematics education including the study on values development and assessment.

The development and reformation of education system in Malaysia has always included values education as part of the Malaysian educational curriculum. The essence of this is clearly stated in the National Philosophy of Malaysian Education (NPME) which is based on belief in God as stated in the first principle stated in the Rukun Negara (National Principles). The Integrated Curriculum for Secondary School or better known as KBSM (Kurikulum Bersepadu Sekolah Menengah), emphasize the teaching of values across the curriculum, ensuring values to be integrated into the teaching of all subjects including mathematics as well as indirect infusion through the teacher as the role model.

Integrating values in the teaching and learning mathematics demands for teachers to become teachers of values who know which values are important to be integrated and how to teach them. Currently, the quality of values development and ethics in mathematics education remained at low level and the activities conducted are not exhaustive and not integrated (Lim & Ernest, 1997). We are still far from fulfilling the pinnacle of values development which is to produce civilized individuals who would act and behave approriately according to specific guidelines and able to make righteous decisions of critical situations (Nik Azis, 2014).

The values and ethical considerations were also stressed for the pre-university and higher learning institutions of the country, as they face tremendous and increasingly more complex situations and challenges in their pursuit of preparing students to become professionals and future leaders. Ethics related courses were offered to students as a national requirement to enhance the quality of professional individuals who have high ethics and moral values and capable to compete and innovate at exceptional level to meet the nation's aspirations and become a world citizen who is spiritually wise in making the correct decisions. (Ministry of Higher Education, Malaysia).

Mathematics subject can play a role in helping students develop values and ethics, however, although it may be relatively easier to integrate values in humanities subject. An extensive analysis of values from the universal integrated perspective which is based on faith and religion was done by Nik Azis (2009a). He productively and successfully produced a framework for the hierarchy of values in mathematics education and even suggested a model for values development. Values development in mathematics class required serious thoughts on questions pertaining values to be taught, how values should be taught, which methodologies to adopt to construct or uncover values, what types of trainings, how can values being assessed in class, what are the effective delivery methods, and factors influencing values of teachers and students are some of the aspects to ponder on before integrating and developing values in mathematics subject (Nik Azis, 2009a). This study focuses on instrument development to measure values in mathematics classrooms for lecturers of matriculation colleges in Malaysia.

There are several critical issues pertaining values development in mathematics classrooms which are of interest to researchers and educationists. Among the issues are (a) the imbalanced scope of conceptions on values in mathematics classrooms; (b) the minimal number of research concerning values and values development in mathematics education and; (c) the limited availability of assessment instruments of values in mathematics education especially in Malaysia.

Imbalanced scope of conceptions can be detected in many academic areas such as social psychology, sociology, anthropology, education, philosophy, literature, medicine, nursing, religion, administration, and history (Feather, 1975; Matthews, Lietz, & Ngurah, 2007). Conceptions on values are made under the assumptions that it is a multidimensional in theory and methodology (Atweh & Seah, 2008) and it is closely linked with the dimension of humans' emotions, thoughts, and behaviors. A review of relevant literature shows that researchers have not come to an agreement on the conceptions and definitions of values and suitable categorization (Bishop 1988, Beck 1990, & Halstead, 1996). Conceptualizations of values were based on the context of usage, suggesting that a single definition may not suit the many arising situations concerning values. Popular definitions of values include the one from Rokeach (1973) who thought values as ideal culture with the focus on evaluation (Raths, Harmin & Simon, 1966) and discussed values from the context of relativism epistemology where man is the authority in evaluating and determining values focusing on explanation of values, Halsted and Taylor (2000) focused on the sociological factors especially on principles and standards which guide human behavior. Values in mathematics classrooms is often attributed to the earlier socio-cultural definitions constructed by Bishop (1988) where values are considered as deep affective values. However, these definitions were not concrete, not analytical, is not bind by anything specific, and values are considered as abstract. Furthermore the construct for values in mathematics classrooms have not been clearly conceptualized in mathematics education (Bishop, 2007). This makes research on values complicated and still in the formative and exploratory phase. Adding to the complication is the situation where instruments and constructs were borrowed from other fields like psychology and sociology while ignoring the basic assumptions of the constructs.

In clarifying the mathematics educational values, Seah and Bishop (2000) proposed that the values are made of five complementary pairs. The values are formalistic and activist view, instrumental and relational understanding, relevance and theoretical nature of mathematics, accessibility and specialism of mathematics content, and mathematical skills as part of a procedure or as an outcome (Dormolen, 1986, Skemp, 1979).

Researchers from Turkey categorized Bishop's mathematical and mathematical education components into positivist and constructivist values. Positivist values emphasizes on teaching mathematics as an abstract knowledge, focusing on teachers' objectives, and not relating it to any real-life situation while constructivist values concentrates on students' interest and ability, focusing on physical matter, and relates it to the experiences outside classrooms (Dede, 2009 & Durmus & Bicak, 2006).

Taiwanese researchers did not base their study on Bishop's concepts on values in mathematics, instead they study specifically the pedagogical values of secondary mathematics teachers. Values in mathematics education is the pedagogical identities of teachers concerning mathematics and mathematics of teaching. Their social nature of personality is transformed into effective pedagogical, thinking and acting (Chin & Lin, 2000) and how they view values as the concepts of worthiness (Chang, 2000).

The last dimension is interpreting values as the outcome of a valuing process which include the activities of finding alternatives, evaluating the choices, and acting or repeating the satisfactory actions (Rath, Harmin, and Simon, 1987). The above theoretical positions are used to study the pedagogical conceptions of values and identities in teachers' personal development in teaching and learning (Chin, 2006).

The only conception which is based on spiritual is the one proposed by Nik Azis (2009). The conception of values in mathematics education defined by Nik Azis is viewed from a holistic lens where both the physics and the metaphysics elements are being addressed. His idea is mainly based on the work of Al-Ghazali (1990) and Syed Muhammad Naquib (1995). Syed Muhammad Naquib al-Attas is a contemporary Muslim philosopher and thinker of the country defined the meaning of education and knowledge from the Islamic perspective. Al Ghazali is an Islamic philosopher of religion and ethics, and a thinker for nearly nine centuries, a jurist, theologian and mystic of the 12th Century. He contributed in a wide range of knowledge including jurisprudence, theology, mysticism and philosophy. The integrated perspective has a wider scope of value in mathematics education context covering not only classrooms but also personal, institution, epistemology, society, nation and the community. Values of mathematics in classrooms were categorized into three sub-constructs like Bishop with significant addition to the values indicators of the dimensions. The values indicators added were closely related to the spiritual domain which is missing from the available definitions. Nik Azis suggested a list of hierarchal values for the components under mathematics values instead of following Bishop's complimentary pairs of values.

Most studies were focused on the empiricism experiences and rationale thoughts where the conceptions on values in mathematics classroom were mainly restricted to the secularized thoughts, as these conceptions were based on the development of mathematics in the western culture with the exception of the studies done by Nik Azis (2009, 2014). Researchers were seen not to provide explicit definitions to the constructs and theoretical framework being used, for researchers who discussed the theoretical framework and construct explicitly, there are instances when in which there are contradictions between theory and data collection techniques, data analysis techniques, and interpretations provided for the findings.

The next critical issue is the minimal studies related to values in mathematics education and its development. This is because value in mathematics classrooms is a comparatively new area of research interest in the context of mathematics education as compared to other affective constructs such as beliefs, attitude, motivation, attitude, and perceptions (Seah & Bishop, 2000). In addition to that, teaching mathematics is aimed at acquisition of knowledge, giving minimum emphasis on the values in mathematics education (Bishop, 1988). Primarily, mathematics has always been a subject which is value free by teachers, employers and parents, a reason for lack of studies in values in mathematics education (Nik Azis, 2009). Mathematics is a field with numerous values in which the values are usually introduced or taught implicitly rather than explicitly (Dede, 2006). Moreover, values in mathematics classroom were delivered implicitly rather than explicitly. Explicit deliveries would be more beneficial since it is a crucial component in enhancing qualities of mathematics teaching and learning (Seah, 2002) and an influential factor on teachers' and students' decisions and behaviors related to mathematics (Corrigan et al., 2004) affecting their interest, thoughts, choices and behaviors towards mathematics education (Seah, 2002). It is not easy to a have a discussion on intended and implemented values of teachers for example, as the topic on the implicitly delivered values were rarely brought up and teachers have limited vocabularies to be involved in further investigations of values in mathematics education.

The studies of values started to become prevalent about a decade ago exploring topics such as: values in mathematics education from the cultural perspective (Bishop, 1988), intended and implemented knowledge on values in mathematics education (Clarkson and Bishop, 1999), values and culture in the context of mathematics classrooms (Clarkson, FitzSimons, & Seah, 2000), Lim and Ernest (1997) studied whether the intended values in the Malaysian curriculum are mentioned by teachers in class, role of values in mathematics education (Leu & Wu, 2000), appreciation on the connection of mathematics and culture by mathematics and how it contributes to the quality of teaching and learning mathematics (D' Ambrosio, 2001), relationship amongst values, mathematics and society (Seah, 2002), enactment and perceptions of elementary teachers' mathematics pedagogical values (Leu, 2005), similarities and difference of values between mathematics and science teachers (Bishop, 2006, 2008a), practices and norms in mathematics instructions (Atweh and Seah, 2008), teachers' mathematical values in developing mathematical thinking (Bishop, 2008b), mathematics teachers as agents of values (Hoon, 2006), values in mathematics textbooks (Dede, 2006a), values in learning functions (Dede, 2006b), awareness and willingness to teach (Lin, Wang, Chin & Chang, 2006), conceptualizing pedagogical values and identities in teachers' development (Chin, 2006), and mathematics values and teaching anxieties (Yazici, Peker, Ertekin, and Dilmac, 2011).

The values development in mathematics and science education is a project of the Faculty of Education of Universiti Malaya supervised by Professor Dr. Nik Azis Nik Pa. About 27 research were executed covering areas on values from the aspects of curriculum, learning, and teaching. Targets of the studies include primary and secondary schoolchildren, primary and secondary teachers, and documents analysis focusing on textbooks, study plan, and homework. The topics being researched were values in the schools' curriculum, values in textbooks in Singapore, students' understanding of values using technology, values in homework, teachers' understanding on values in the topic of fraction and round numbers, and understanding of the teachers on the development of values in mathematics classrooms.

However, little is known on how students and teachers construct, defend, accommodate, handled conflicts and perturbation on the values of mathematics education which they owned and how they develop values in mathematics classes in the local context. This is due to limited research done on values in mathematics classrooms and development of values in mathematics teachers and students although many believe that education quality can be improved if teachers have clear conceptual understanding and development of values (Bishop, Clarke, Corrigan, & Gunstone, 2005 & FitzSimons, Seah, Bishop, & Clarkson, 2001). It is believed that teachers could assist students to understand and develop values (Hannula, 2002).

The third critical issue is on the limited availability of instruments measuring values in mathematics classrooms although measuring values and other affective constructs in mathematics education is essential due to its importance in the teaching and learning processes (Grootenboer & Hemmings, 2007). Several prominent researchers attempted to develop tools which could measure values in mathematics education and mathematics as a subject such as: Mathematics Values Instrument (Bishop, 1988), Mathematics Values Scale (Durmus & Bicak, 2006), and Mathematics Education Values Questionnaire (Dede, 2011). Bishop, Clarke, Corrigan and Gunstone (2005) designed an instrument to learn more on teachers' inclinations and teaching practices in exploring the mathematics and sciences subjects. On the other hand, the Teachers' Beliefs Survey (Beswick, 2005a) measures the problem solving's views which the teacher has and the related corresponding perspective in their teaching and learning mathematics. Other instruments were instruments developed by Durmus and Bicak (2006) and Dede (2006, 2009, & 2010) from Turkey which categorized the values of mathematics and mathematics education into teachers and students centered values.

The limited instrument is probably due to the fact that value in mathematics education is the least discussed affective element as compared to other affective constructs such as attitude, beliefs, and motivation. Value is also regarded as complex constructs involving several sub-components and quantifying these components is challenging. Conceptual definitions of values in mathematics education have not fully evolved from rudimentary to sophisticated one to establish better validity and reliability (Johnson & Mc Clure, 2002) which results in limited instruments in assessment of values in mathematics education. Currently there is limited instrument available to assess values in mathematics classrooms especially one which is conceptually based on religion and faith to suit the education system which has religion and belief in God as the principle, like Malaysia.

Problem Statement

There were initiatives to measure values of mathematics teachers and students, however, the focus of each of the instrument is narrowed towards the interest of individual researcher. The instruments measuring values in mathematics as a subject and mathematics education are in various forms such as survey questionnaire, observation, interview, and open ended questionnaire are some of the methods used to collect data. These instruments were built based on definitions of values which were formulated from the social-cultural, social constructivism, rationalism and information processing, mathematics education, behavioral, cognitive constructivist and constructivism approaches. One common aspect of these definitions was that they were all education theories which came from the western culture.

The literature indicated the absence of valid and reliable instruments with holistically well-defined constructs for measuring values in mathematics classrooms for the last two decades. Limited instrument suitable to measure values in mathematics classroom in Malaysia is the catalyst of this research. Although questionnaire have been developed to study perceived values, these studies were unsuitable for the study since the instruments were designed for values development in the Western culture and education system. Using existing instrument may optimize time and expenses, and increase the chance that the results are valid (Passmore, Dobbie, Parchman, & Tysinger, 2002). However, the Malaysia education system is based on faith and religion which is the missing element from all the instruments.

Malaysia is different from Western countries particularly from the aspects of religion, politics, economy, culture, language, and education. As suggested by Seah (2003) cultural differences will influence the teaching approach and different cultures affect the associated values, suggesting that an instrument suitable for local usage need to be developed. Values education in Malaysia is very much related to religion. For example, the Islamic Study and the Moral Study are among the core subjects in the national curriculum. Malaysia education system is based on faith and religion which consider the meta-physic aspects unlike the western perspective. This believe is enhanced by the Rukun Negara which includes a principle on believing in God and the national education philosophy which stresses on the development of physical, emotion, intellectual, and spiritual aspects. Thus, there is a need to develop an instrument where values in mathematics classrooms are conceptualized holistically in a universal integrated manner with evidence of reliability or validity.

This research will focus on: identifying suitable sub-constructs, dimensions and values indicators to be used in assessing values in mathematics education to a chosen philosophy. A suitable format and design for the instrument will be decided and procedures in ensuring validity and estimating reliability will be determined. Issues on validity and reliability will be handled at various levels using interviews, open ended questions, and statistical tests. The research also identifies contributing factors such as age, education background, and teaching experiences contribute towards the scores of values in mathematics classrooms of the respondents. It is helpful for educators related education players to identify and understand how certain interrelated factors such as age, education background, and teaching experiences contributed towards the development of values in mathematics classrooms. The conceptions of the constructs and sub-constructs are based on the universal integrated theory.

Theoretical Framework

The complication in researching values in mathematics classrooms were due to the differences and the vagueness in definitions of concept (Zan, Brown, Evans, & Hannula, 2006). In other words, extensive efforts are needed to build a stable theoretical framework and using methodological instrument which has a larger scope covering the conception and definition comprehensively on values and values development.

The instrument constructed is parallel to the National Education Policy Malaysia. It is based on the National Ideology (commonly referred as Rukunegara), where "Belief in God" stand as its first principle. The study used the universal integrated perspective which is free from the secularism ideology and an integrated and faith-based perspective developed by Nik Azis (1994, 1999, 2009). It is based on the conceptions and elaboration on values and ethics developed by Al-Ghazali (1992) and Syed Muhammad Naquib (1995). Definitions on Islamic values and ethics development were systematically structured by Syed Muhammad Naquib (1995) following Al-Ghazali (1990), who is an intellectual discipline, known as *adab.* The word *adab* refers to the appreciation that knowledge and human are both methodically arranged in relation to one's physical ability, intellectual status, spiritual capacities and potentials (Syed Muhammad Naquib, 1995).

Definition, conception and developments of values in mathematics classrooms from the perspective of socio-cultural proposed by Bishop (1988) is based on the development and categorization of values proposed by White (1959) where values are affective qualities which should be nurtured through mathematics in school. Value in mathematics education is discussed from the contexts of classrooms, personal, the institution and society. The integrated perspective on the other hand had a wider scope of context covering classrooms, personal, institution, epistemology, society, nation and the community.

Bishop's view is based on the development of mathematics in the western culture which is influenced by the secularism philosophy as opposed to the universal integrated perspective which is based on principles of Islam (worldview) as its foundation. It is based on the foundation of pragmatism and realism which adopted the approach of the radical constructivism, information processing and symbolic interactionism while the integrated perspective used the Islamic psychology.

Nik Azis viewed values in mathematics education as: judgment on the importance, utility, prioritizing, experiences, phenomenon, or actions which were based on certain principles, guidance or standards. This principles, guidance or standards will influence one's decision in executing activities in mathematics education or determining things to be appreciated in mathematics education. Value is thought to exist in the human soul, constructed in the minds, obtain its meaning in the heart, operated in the soul and manifested through behavior, mental, cognitive and spiritual. Values which were determined by the Creator is divine knowledge which is considered as absolute knowledge while values determined by man and society are considered as relative.

Value of mathematics is the result of how experts and mathematics educators develop mathematics discipline in the western culture as suggested by Bishop (1988). It is a form of profound affective quality which is one of the many goals of general education expected to be cultivated through mathematics subjects. He suggests that values development is a cognitive process where one would receive the knowledge, analyze and scrutinize their beliefs and attitudes and become aware of it. One would than enhance this value through the process of internalization and build the affective-cognitive system inside them. These deep affective qualities will be exhibited through the actions and decisions made, the reason why it is sometimes known as “beliefs in action”. Thus, values were thought to be constructed in the domain of cognitive and operate in the domain of cognitive-affective. All values were considered relative and subjective since they were determined by human and what the society would like to have.

In the integrated approach, components of values comprised of the cognitive, affective, spiritual, and behavior. Manifestation of values could be reflected from these components where what one knows is created in the cognitive domain, how one feels is from the affective domain, one’s actions is the reflection of the behavior domain, and one’s beliefs and principles are form in the spiritual domain. The socio cultural on the other hand, looked at values as the internalization of beliefs and attitudes into one’s values system of the social cultural (Seah & Bishop, 2002).

The following are factors integral to the study which are assumed to be true for the study to progress through the lens of universal integrated perspective:

1. The universal integrated perspective is based on the Islamic teaching, used to conceptualize the constructs in which divine knowledge is the absolute truth, implies that a measurement can be made on values in mathematics classrooms.
2. Values is developed in the affective and spiritual cognitive domain needed to construct meaningful mathematics knowledge and used to develop sensitivity, judgment ability, motivation, excellent characters and willingness to act.
3. Value is related to beliefs, attitude, emotions, motivations and tendency which can only be measured through individuals’ perceptions.

4. The knowledge of values is from God, but they are actively constructed by the respondents through their active participation in reflection, abstraction or by intuition.
5. The lecturers' knowledge on values is relative and subjective.
6. The lecturers have some values which they have actively construct through their formal or informal experiences as mathematics teachers and they will respond honestly to an item which taps the related value.
7. The choices made by the respondents indicate the strength of the underlying values that they hold.

The above underlying assumptions were made to ease the process of the study. Assumptions also narrow the scope of study to ensure that the process, analysis, and results were all reliable and valid. The universal integrated perspective is more suitable for this study as compared to the socio-cultural perspective of values in mathematics education. The perspective chosen took into consideration both the physic and the meta-physic elements. Meta-physics domain cannot be disregard in the Malaysian education system since the National Education Philosophy of the country is based on spiritual and faith. In this study, the universal integrated perspective is used as the basis of discussion on the research design, purpose of study, research questions, data collections, data analysis and interpretations of the findings.

Purpose of Study

The main purpose of this study is to develop and validate a measurement instrument for values in mathematics classrooms for lecturers in matriculation colleges in Malaysia. Applicability of the instrument is demonstrated by studying the profile of the respondents and identifying contributing factors for values in mathematics classrooms. The objectives of the study are as follows:

1. To identify the sub-constructs, dimensions and values items suitable to measure self-perceptions of values in mathematics classrooms of lecturers from matriculation colleges

2. To identify suitable design by studying the existing instruments.

3. To measure the validity and reliability of instrument in measuring values in mathematics classrooms.
4. To profile the respondents in relation to their values of mathematics in classrooms scores.
5. To identify the contributing factors affecting the values in mathematics classrooms scores.

In order to achieve the above objectives, the following research questions are generated.

1. What are the sub-constructs, dimensions and values items suitable to measure self-perceptions of values in mathematics classrooms of lecturers from matriculation colleges?
2. What is the suitable design of the instrument to be used?

3. What is the validity and reliability of instrument in measuring values in mathematics classrooms?

4. What is the profile of the respondents in relation to the values in mathematics classrooms?

5. What are the factors contributing towards the values in mathematics classrooms?

The study uses instrument development model as the research design. Qualitative and quantitative data are collected during the processes. Statistical software like SPSS and the Rasch analysis will be used to provide evidence of validity and reliability using item analysis and confirmatory factor analysis.

Definition of Terms

This section provides the conceptual and operational definitions for the terms, psychological concepts, and mathematical concepts within the topic of the research with supporting literature. These definitions are to be used consistently throughout the study. All definitions are based on the integrated universal perspective, the theory which this study is based on. The conceptual definitions are used for the constructs, sub-constructs, dimension, and development of instrument, measurement of values, validity and reliability. On the other hand, the operational definitions are used for the total scores for constructs, sub-constructs, and dimensions.

Values in mathematics classrooms. The universal integrated perspective, refers values as the conceptions and beliefs of individuals concerning the importance of something which act as general guides to their behaviors (Nik Azis & Ruzela, 2013; Nik Azis, 2009a). Values in mathematics classrooms refer to the values in the teaching and learning of mathematics in the context of classrooms and values which are implicit or explicitly embedded in the curriculum, textbooks, and anything related to the teaching and learning of mathematics (Bishop, 1988). The construct is categorized into general education values, mathematics education values, and mathematics values (Nik Azis & Ruzela, 2013; Nik Azis, 2009a).

General education values are qualities which are not directly involved with the knowledge of mathematics or mathematics education, instead it focuses on developing good characters in man. General education is defined hierarchically into four dimensions: basic, core, main, and expanded values. *Basic values**:*** Foundation principles of life where faith and religion play a big role. The three values indicators are awareness of the importance of faith, prioritizing the importance of faith, and practicing the faith; *Core values:* These are the basic guides to individual in life and it contains excellent characteristics, courageous, wisdom, and justice; *Main values:* These are the primary value system which can be seen through individuals' characteristics and personality. The dimension contains discipline, working together, accountability, and innovative as the value indicators; *Expanded values*: The expanded values are combinations of two or more of the basic, core or main values and contains worth of knowledge, success of perseverance, importance of quality, virtue of precision (Nik Azis, 2009a).

Mathematics education values refer to the values which occur during the processes of teaching and learning mathematics which are multi-dimensions, dynamic, and complex and values in mathematics education involved several different aspects. The dimensions of these sub-constructs are the teaching and the learning values. *Teaching values:* Values which are the foundations of the teaching of mathematics with four values indicators: theoretical, utilitarian, functional and internalization; *Learning values*: Values which are the foundations of the learning of mathematics with four values indicators: mastering of skills, skills in information processing, construction of knowledge, and knowledge acquisition (Nik Azis, 2009a).

Mathematics values rise from the way mathematicians and mathematics educators develop the discipline of mathematics based on different culture setting (Bishop, FitzSimons, & Seah, 1999). The mathematics values consisted of ideological, sentimental and sociological values as its dimension. *Ideological*: Values which underlie the epistemology of mathematical knowledge and consists of rationalism, empiricism, pragmatism, and integrated perspective as values indicators; *Sentimental:* Values which are concern with the relationship between individual and mathematics. It has control, development, and civilization as the values indicators; *Sociological:* Values which are concern with the relationship between society and mathematics. Mystery, openness, and integrated values are the three values indicators for this dimension (Nik Azis, 2009a).

Instrument development. Instrument development is a process of accumulating evidence related to translation, validity, reliability, or interpretability. It can involve the construction of a wholly new instrument, a substantial modification of an existing instrument, or integration of two or more existing instruments into a new combined one. The procedural model for developing measurement instruments are generally related to relevant language translation, responsiveness, clarity, and relevancy. The process includes: identifying suitable conceptual definition, identifying suitable theory, construction of item pool, deciding on instrument's format, determination of item bank properties, confirming content validity, confirming reliability, construct validity, and interpretation (DeVellis, 2003).

Measuring the values in mathematics classrooms. The scores are calculated using the mean value for the scale. This is recommended especially when measuring latent values, where a single survey item is unlikely capable to measure a concept fully (Rickards, Magee, & Artino, 2012). The mean for the three sub-constructs are also calculated.

Total for the general education value is measured by taking the mean of the score for the eighteen (18) items representing the four dimensions. Total for the mathematics education value is measured by taking the mean score of the eight (8) items from dimension of teaching and learning. Total for the mathematics value is measured by the mean of the last ten (10) items from three dimensions. Total values in mathematics classrooms is measured by the mean of all the subjects' responses on the 36 items from the three sub-constructs (DeVellis, 2003).

Validity of instrument. Validity in this study refers to content validity and constructs validity. Content validity in this study refers to expert opinion concerning whether the value items in the instrument represent the proposed sub-constructs and dimensions the instrument is intended to measure. It will be accomplished through the focus group and experts' evaluation (DeVellis, 2003). Construct validity of the instrument on the other hand, is validated by checking how well the empirical result coincides with the results suggested by the theory chosen using respective statistics tests like item analysis, first and second order of confirmatory factor analysis and the Principal Components Analysis of Residuals (Cronbach & Meehl, 1955).

Reliability of instrument. Reliability is the degree to which an instrument consistently measures the items, dimensions, and sub-constructs and maybe tested by investigating the inter-rater reliability (different person answering the same instrument), test-retest reliability (same person responding to the instrument at different time), inter-method reliability (same target, different instrument), and internal consistency reliability (regularity of results across the items in a test).

In this study, reliability is estimated by investigating the internal consistency using Cronbach's alpha (Howell, 2013), for (i) Cronbach's alpha of the three sub-constructs, (ii) Cronbach's alpha of the nine dimensions, (iii) Cronbach's alpha of the instrument, and (iv) Cronbach's alpha if respective item is deleted for the three sub-constructs, nine dimensions and the instrument.

Limitation and Delimitation

This section will discuss both the limitations and the delimitations of the study. These are the situations and circumstances which may affect or restrict the study. Limitations are potential weaknesses which are out the control of the researcher. Since they are integral to the study, the researcher will discuss on actions taken to minimize the impact of the limitations towards the internal validity. There are several limitations to the study and three of them are related to the study involving the theory, research design, and data collection method.

The first limitation is on the theory used as the base of the study. The study is established on the theory of universal integrated in which religion and faith is taken into consideration. One of the distinctive features of the theory is that the source of knowledge is from the Divine and considered as absolute truth. To obtain and understand the knowledge, man had to be active in constructing them and any knowledge from man is considered as relative in absolute. This means the knowledge is considered true if it does not go against the Divine knowledge. However, in the search of finding and obtaining the truth in manipulating the knowledge, men are open to make their own interpretations. Thus, it is expected that there's some differences in the interpretations of values and values in mathematics classrooms provided by researchers even though the same theory is used. In this study for example, the perspective of the Islamic teachings will be the foundation of the theory. By doing this, all interpretations will be based on one source only avoiding contradictions and arguments on definitions and meaning of constructs, sub-constructs.

The second limitation is on the research design chosen by the researcher in instrument development. The researcher employs the instrument development model which consists of the analysis, design, development, and evaluation phase. The analysis stage is the first step in instrument development where critical decisions pertaining to the research questions, constructs, and sub-constructs, design of instrument, data collection technique, and data analysis were made. Insufficient literature review may result in inaccurate decisions on important matters pertaining developing a reliable and valid instrument. The development model does not specify methodologies to be chosen to enhance the validity and reliability. In conclusion, although the development model is reliable in guiding the process of instrument development, the researcher has a great role in ensuring that at each stage, all possible steps and precautions were taken to ensure the internal validity of the instrument.

The last limitation is on the data collection technique to obtain the construct validity. Quantitative data is collected using a survey. The researcher is open to the risk of poor responds since hardcopies of questionnaires were distributed to the respondents. Low responds will affect the validity of the instrument. To reduce the casualty, the researcher gets the help from one of the lecturers in each branch campus to ensure that as many will participate. The researcher had discussion with the representative of the branch campus before sending the questionnaire. This is to figure out whether there is a need for the questionnaire to be distributed through e-mails. An honorarium is given to the representative and the respondents were given a token of appreciation for their participations.

As for the delimitations, the researcher outlined the parameters of the study which are related to the setting of the research, research area and research questions. Although value in mathematics is critical at all levels of mathematics teaching and learning, this study will focus only on mathematics lecturers from a higher learning institution in the country. However, once the instrument is validated, adjustment could be made to the instrument to suit other targeted samples like primary school teachers and secondary school teachers.

The value under study is on the perspective of the mathematics teachers towards values of mathematics in classrooms, thus it is not considering the perspective of mathematics students and does not cover the values related to the curriculum, textbook, policy, implementation of values or values development. It is important to study values that teachers adopt because, they face the students, refer to the text, use the curriculum, and implementing the policies during the teaching and learning processes. What they implement, disseminate, and enact, in classrooms depends on the values they adopted.

The last delimitation is on the research question relating to enhancing the validity and the reliability of the instrument. Although there are four distinct types of validities, namely the construct, concurrent, predictive, and content validity, which were commonly used by researcher instruments development, this study is focusing only on the content and constructs validity due to time constraints.

The delimitations mentioned above are necessary to ensure that the goals of the study are possible to achieve with the limited time available. What have been left out are possible topics to be studied by the researcher or other interested parties. For example, the instrument being developed can be the catalyst for measuring values, as it could be adjusted for other users in the education line. The validity of the instrument can be compared with other targets or using other statistical packages or statistical models. Topics of further research may also include verifying for example the predictive and concurrent validities.

Significance of the Study

As educational and political leaders push for more emphasis on mathematics and science performance, the needs to explore all possible avenues especially on measuring affective domains like values in mathematics classrooms are apparent. The instrument developed and the findings obtained from this study will fill in the gap of knowledge in terms of the limited amount of material and inventories in values in mathematics classrooms. It could be the initial stage for mathematics education researchers in values in mathematics classrooms to further explore the topic in the local context. The self-evaluation inventory is hoped to provide empirical data for researchers to base their research on.

One of the promising avenues to determine the success of the newly implemented curriculum is the values embraced by the teachers. The instrument may provide data to the curriculum developer on whether values embraced by the teachers are parallel to the values expected or outlined in the newly implemented curriculum. The reform will not be successful if the values uphold by teachers contradicts with the values in the curriculum reform. If the teachers have contradicting values, they will tend to reject the transformation. Thus, the instrument may provide data as basis to improve values development amongst teachers and students. It can be a diagnostic measure to help identify the type of values lacking from the lecturers.

The information on the level of values in mathematics classrooms is vital for education administrators from the training department. The instrument could provide some insights on the levels of values among mathematics teachers. It can be used as indicators in designing in-service training program for the teachers to further improve their skills in teaching and learning. On the contrary, the instrument could be used as evaluation tool to assess the degree of success of intervention training programs for in service teachers. More vital information was needed to assist profound future studies on values development and values assessment in which conceptions of the sub-constructs and dimensions and constructions of related values indicators are based on the integrated perspective.

Summary

The chapter has provided the foundation of the study in which several critical issues in values in mathematics classrooms were discussed. The gap of knowledge and lack of suitable instrument for the local context are the catalysts of the research. The universal integrated perspective which is used as the foundation in developing the instrument is the main reference in forming an instrument which suits the Malaysia education which is based on religion and faith. Definitions for important terms were provided based on the universal integrated theory from prominent researchers of the area.

Chapter 2 Review of Literature

The chapter on literature review consists of six sub-topics: introduction, universal integrated perspective, values in mathematics classrooms, mathematics content, related study on values in mathematics classrooms and summary. The introduction section of Chapter Two consists of the list of main topics and brief information on related matters to be covered. The introduction section is followed by a discussion on universal integrated perspective, the theory chosen for the study. The section contains explanation on justification on why the theory is chosen by comparing it with another theory, how the theory is used by other researchers, and the conceptual framework used.

Next is the topic on values in mathematics classroom, in which the meaning of the related terms, constructs, sub-constructs and dimensions are introduced. The discussion includes the usage of these constructs, sub-constructs and dimensions by other researchers and reasons on why these definitions were chosen for this study. Next is a section on content of mathematics, discussed from the perspective of universal integrated and the view of mathematics adopted by the matriculation colleges. The chapter ends with rationales on why and how the theory and related literature assist in developing the instrument.

Universal Integrated Perspective

This section focuses on (a) the chosen theory for the study, (b) the justifications on why the theory is chosen, (c) how the theory was used in other literature, and (d) the conceptual framework. The study uses universal integrated theory as basis in providing perspectives for interpreting the psychological constructs, writing research questions, research design, data analysis and basis for interpreting the research findings. In this study, the discussion on values and its development, viewed from the lens of universal integrated perspective is based on the teachings of Islam. The worldly human affairs were carried out following the law of the Creator, will shaped human to be the best of mankind and to live the best possible way on earth. The socio-cultural perspective is used by the researcher to highlight characteristics of the universal integrated perspective. The discussion will cover the aspects of conceptual definitions, ontological, epistemology, axiology and logic for values in mathematics classroom and the related sub-constructs from both perspectives.

The universal integrated perspective is a psychological perspective which is based on believing in God or religion (Nik Azis, 2008, 2013). The universal integrated perspective refers values as individuals' conceptions and beliefs on the importance of something which guides individuals in their behaviors (Nik Azis 2009a, 2009b). The socio-cultural perspective on the other hand is a social psychology formed within the modern Western setting which is known to be secular. The view emphasizes that students' behavior and thinking are not solely influenced by the education experience or thinking abilities, instead the institution, education system, socio cultural entity, and politics play significance roles. Bishop (1996) defines mathematics values as values which are related to the qualities of the discipline to which we worth, prioritized, feel the importance or appreciate most. The socio-cultural proponents define values as the deep affective quality nurtured through mathematics education and is believed to be more prevalent as compared to the mathematical procedures, concepts, definitions and knowledge which will fade away unless enhanced through continuous usage. This is probably because mathematics is a socio-cultural knowledge where the knowledge is developed uniquely within a certain culture encompassing the societal, institutional, pedagogical and individual levels.

The socio-cultural is based on pragmatism and realism and the integrated perspective on the other hand is based on spiritual, beliefs and surrender to God. The distinctive characteristic of the universal perspective is its ability to provide not only the physical domain of reality but to also include the meta-physics domain which lacks in other theory. This implies that the values determined by Allah is absolute and values determined by human beings or society are relative in nature. Bishop's definition is based on the development of mathematics in the western culture which is influences by the secularism. This explains why Bishop regards all values as relative and subjective since values are determined by human rational thinking or the society norm.

The psychological aspects of the universal integrated perspective in this study are based on the Islamic teachings. The socio-cultural on the contrary is based on the social constructivism, information processing theory and symbolic interaction. Manifestation of values of universal integrated perspective values reflects the affective feelings, behavior and one's spiritual beliefs. On the other hand, the socio-cultural perspective portrays values as the cognitive internalization where the affective construct is free of any context.

The context of values in mathematics education suggested by Bishop is limited to classrooms, personal, institution and community as compared to the universal integrated perspective which offers a wider context beyond mathematics classrooms such as personality, institution, epistemology, society, the nation and the ummah. Both perspectives suggested categorization of values in mathematics education to be the general mathematics education values, mathematics education and mathematics values (Nik Azis & Ruzela, 2013; Nik Azis, 2009a, Bishop, 1988). However, Bishop (1988) pays little attention to the general mathematics education values and focus on the five pairs of complementary mathematics educational values such as: formalistic versus activist view, instrumental versus relational understanding, relevance versus theoretical knowledge, evaluating versus reasoning (Seah & Bishop, 2000 & Bishop, 1988). He also defines the three pairs of mathematics values to be: rationalist versus empiricism, openness versus mystery and progress versus control (Bishop, 1988). The proponents of universal integrated perspective categorized general education values into four dimension, mathematics education into two dimensions, and mathematics values into three dimensions. The universal integrated perspective did not discuss the mathematics education and the mathematics values as pairs of complementary values to promote the idea towards the process of balancing the different values instead the discussion is within a holistic and integrated framework. The general education values for example consist of four dimensions arranged in a hierarchal manner.

The universal integrated perspective can be compared to the socio-cultural theory from the ontological, epistemology, axiology and logic. The integrated perspective believes that human is created by God in the best shape and form of the physical or body and the intangible part which is the soul or spiritual (roh). The body is known to have components comprising of elements from the earth, can be seen, is real but it is temporary due to death, which is a natural phenomenon. Death overtakes the human body when the body dies and decays in the ground. The soul on the other hand, cannot be seen, is abstract, everlasting and is a person's essence, feelings, memories and senses, which remains intact and does not die with its physical counterpart. God created man for a noble purpose which is to worship Him by surrendering to Him and functioning as the leader (caliph) of Allah. Worshipping God and seeking for His blessings makes life more purposeful and meaningful, especially within the framework of Islam. Since humans have souls, they are responsible for whatever they do before God and that there is a hereafter in which their actions will be judged. Universal integrated perspective suggests that human have freedom of choice to either act in a good way or in an evil way.

On the contrary, the socio-cultural viewed the creation of human was not related to the meta-physic domain instead they strongly believed that the existence of individual is based on his or her own experiences. They avoid spiritual, mystical or revealed knowledge, mainly focus on things that human mind can handle, and appreciates rational and thinking. Worldly human affairs would be the main objective in life without any influence from spiritual or sacred intervention. In effect, in this study, the researcher assumed seemingly from the ontological perspective that values in mathematics classroom is a construct which is often mentioned, described, targeted, or assessed.

In terms of epistemology, the revealed knowledge is considered as the absolute knowledge as compared to knowledge constructed by man, which are based on science, empirical evidence, research, and observations. The limited ability in the thinking process of men, made the knowledge from God more superior than the knowledge created by men. Meanwhile, the Muslim laws consist of the principal law from the Quran and the Sunna or the tradition of Prophet Muhammad. The Sunna is either based on consensus or the analogue reasoning and complemented by sources such as personnel effort, discretion, public interest, and custom (Yusuf al-Qardawi, 2002). This knowledge was arranged in a hierarchy, based on the source of the knowledge; God's knowledge, ilham, intuition, rational, to empirical. Empirical and rational are both physical knowledge and the other three being metaphysics knowledge.

In the process of acquiring knowledge, the perspective emphasizes criteria such as development, God-centeredness, actualization, holistic, unity and meaning which contributes for better understanding in knowledge (Nik Azis, 2009a). Ultimate understanding of knowledge will assist human in getting the real meaning of knowledge and able to place something at the right and proper place portraying fairness in human actions, decisions and thoughts. This at the end will create a sense of satisfaction and happiness within human minds (Nik Azis, 2009a). The socio-cultural perspective's sources of knowledge are merely from rationalization and empirical evidences from human experiences, while the universal integrated perspective in addition take intuition and ilham as their sources of knowledge.

Proponents of integrated perspective believe that values are constructed and developed while the socio-cultural believes that values are inculcated and absorbed. The socio-culturists believe that values are formed in the cognitive domain and operate in the affective-cognitive domain. In contrast, the universal integrated proponents thought that values exist in the human soul, constructed in the mind, obtain its meaning in the heart, manifested through behavior, mental, cognitive and spiritual. In terms of values education, the socio-cultural focused on inculcating, nurturing and transferring of values within individuals and society. The ultimate of values development to the universal integrated perspective was achieving adab and akhlaq, internalization of ilm (meaningful knowledge) and self-purification. The act of putting oneself in the proper place in accordance with the requirements of the knowledge concerning the correct and proper places of things is adab, known to be the condition of justice ('adl). In other words, adab is the right action illuminated by the right knowledge that results in justice establishing the connection between adab, knowledge, wisdom and justice as suggested by Syed Muhammad Naquib-Attas (1995).

The socio-cultural perspective appreciates rational thinking and empiricism experiences, thus development of values in classrooms were thought be to done through inculcating, transferring, and embedding values into individuals and society. They are merely interested in the forming the values without taking into consideration the aspect of affective and spiritual. The universal integrated perspective view on value construction is different from the radical constructivists. Thus, value in mathematics classes is assumed to be constructed by students and teachers through their experiences. However, development of values to the universal integrated perspective was ultimately towards the development of adab and akhlaq which is strongly related to faith and believe in God, internalizing knowledge, and self-cleansing while the development of values to the radical constructivists happen within the perspective of viable development based on secularism. The radical constructivist does not reject religion, instead they separate religion from daily activities. They discarded the content and meaning related to spiritual and meta-physics from all discussion concerning ethics, politics, education, law, and economy. The radical constructivist focused more on individualistic and study values within individuals; the socio-culturists study values within the interactions of several groups of human; and the integrated perspective study values involving oneself, society, environment and one's relationship with God.

However, both radical constructivism and universal integrated share the fact that learners must be active participants in construction of knowledge, do reflective thinking, and some abstraction. The processes of reflective abstraction may bring about either assimilation or accommodation where learning takes place. The radical constructivism proposed by von Glasersfeld (1995) viewed the sources of knowledge as the result of one's active involvement, reflection and abstraction. The knowledge possessed by one is subjective. This means the knowledge or values can be changed or developed depending on the experiences or knowledge that one perceived.

In this study, all activities which were involved in the development of instrument need to rely on reliable literature review, authorities or experts as the critical source of knowledge. The collected data in this research is assumed to be accurate source of information for the researcher to proceed in reporting the findings and analyzing. The researcher is very much involved in decision making and reflections were done at every stage of the development process for validity and reliability.

The axiology aspect of the universal integrated perspective regards the absolute knowledge can only be determined by God and values determined by human through their knowledge and thinking are all relative (Nik Azis, 2008). The proponents of social cultural, on the other hand, believe that human have the choice on the values that they want. To them values were relative, temporary and subjective. Individual's perspectives on values of mathematics they have are unique and based on certain innate or inborn skills and aptitudes of what they perceive. Their perceptions may differ, contradicts or inaccurate in nature. The universal integrated perspective had relative and subjective values which were parallel to the absolute values revealed from the divine sources or values outlined by the authorities. This concept makes it possible for values in mathematics classes to be measured as accurately as possible and maybe in doing so becomes the standard, or measuring scale. The study takes the stand that value in mathematics classes involved organization of beliefs system adopted by teachers and students. These values can be seen along a continuum of relative importance, implying values observed as important to an individual, group or community may not be as important to others

From the logic point of view, the universal integrated perspective views the human logic and the divine logic as two totally different concepts. Human reasoning is bound to be faulty due to countless inherent limitations and handicaps where else the divine logic on the other hand is undeniably flawless, since there is nothing that can escape or hidden from the knowledge of God. Radical constructivist believed that reasoning was based on empirical evidence and rational thinking, unlike universal integrated perspective which referred the revealed knowledge as the absolute reference in which all rational thinking is considered relative. Putting the revealed knowledge as the absolute reference the researcher adhere to consistency, validity, completeness and soundness in the four stages of instrument development adopted for the study. Activities like analyzing validity and reliability tests were done to ensure a logical system is in place.

Studies on assessing and developing values in mathematics where faith and religion were taken into consideration were found to be limited. However, there are studies in which researchers investigated how certain spiritual beliefs affected teachers' teaching and learning values. Among them is a case study done by Leu (2005) on the relationship of elementary teachers' mathematics pedagogical values and the perception of students on her pedagogical values. The study took place in Taiwan and used the valuing theory developed by Raths et al. (1987). Data were collected through questionnaire, observation, interviews and instructional artifacts. The mathematical and pedagogical values which surfaced were seen to be inclined towards the teacher's individual beliefs on Buddhism, Confucianism, and the curriculum.

Researchers from Taiwan extended the study by Bishop (1988) which portrayed that the different culture influenced on what and how values were taught in classrooms in Taiwan. In gaining insights in this matter, the researcher adopted an active and dynamic interview sessions and in-depth dialogue where interviewer was prepared to listen more (Wu & Lin, 1999 and Chin & Lin, 1999a).

Clarkson and Bishop (1999) commented that are traits of Confucian's teachings among the teachers and those with deep and strong Confucian's characters would be depicted as model teacher for the rest to follow. There was also a lack of a shared vocabulary between researchers and teachers, which influences the findings. Masduki, Rita, and Sri Sutarn (2011) pointed out like religious teachings, mathematics learning can be a medium to inculcate good values from the teaching of the Islamic values. Thus, they proposed several relevant good values which can be developed in mathematics classes such as patience, honesty, consistency, and tolerance.

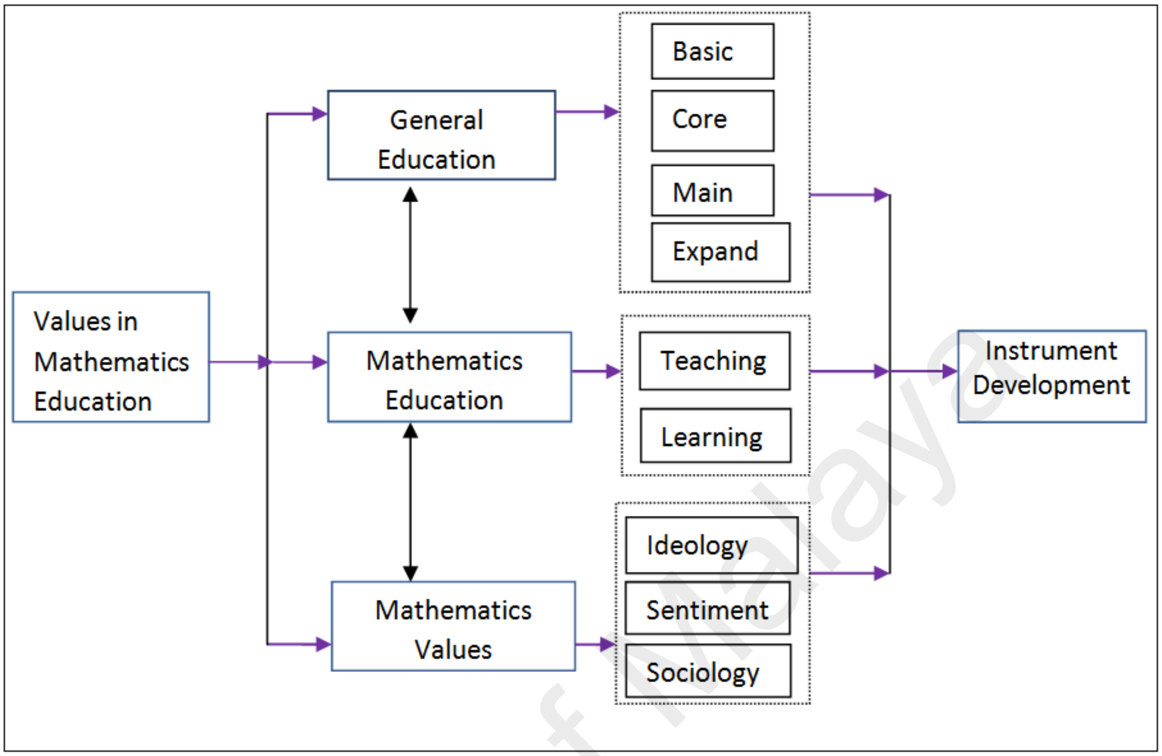


Figure 2.1 Conceptual framework of development of instrument

The conceptual framework was built based on the universal perspective. The three sub-constructs, which are general education values, mathematics education values and the mathematics value have several dimensions (Bishop, 1988). The universal integrated perspective arranges the values of general education values in hierarchal starting from the basic, core, main and expanded values. Values in mathematics education comprises of two dimensions which are teaching and learning. On the other hand, the mathematical values have ideology, sentimental and sociology as the dimensions.

Values in Mathematics Classrooms

The universal integrated perspective believes that value which is an abstract concept which cannot be observed directly. When discussing about values, researchers can only make inferences on values uphold by someone through their behavior, oral communication, or any feedback when a specific question is asked (Nik Azis, 2014). This section explains the meaning of the constructs, sub constructs, and the dimensions involved in developing an instrument measuring values in mathematics classrooms. The discussion includes how other researchers use related constructs, sub-constructs, and dimensions in their research. The researcher provides justification on why specific meanings are used in this study. Table 2.1, Table 2.2, Table 2.3, and Table 2.4 in Appendix A display definitions for the sub-constructs, dimensions, and respective values used by other researchers.

General education values. Values in this category are not directly related to the knowledge of mathematics or mathematics education. These are values associated with the standards of a specific society and the practices and system of the educational institution (Bishop, 1988 & 2008). For example, the topic on time discussed in class, may include the discussion on importance of appreciating time, the meaning of appreciating time that respecting other people's time. The general education values were very much influenced by the norm of a certain community, the institution of education.

Value was first developed cognitively in the mind (aqal), receives its true meaning in the heart (qalbu) and operates in the soul (ruh) to the universal integrated approach. This implies that value is inseparable from faith, knowledge, and individual practices. The universal integrated perspective discusses values in the context of *adab* and *akhlaq* of the Islamic teachings. *Adab* refers to the spiritual discipline, thoughts, feelings and actions which guides individuals and position values in life at the right place so that harmony, fairness, and happiness is found in one's life, making one a person with good characteristics. *Akhlaq* in Islam is the situation in which a soul regularly guiding the individuals to act and behave, provide the guidance to the teaching and Islam.

The Hierarchy Model of the General Education values from the universal integrated perspective list the basic as the most important values followed by the core, main and expanded values. The basic value is the foundation principles of life where faith and belief in Allah are the basis (Nik Azis, 2009). The value indicators are attention to values, respond to values, evaluate values, build values and act out values. The opposite values to the basic values are values which are against the shariah and Allah and not believing the existence of God and religion.

The next level of value is the core values which refer to four main characteristics such as fulfilling life needs ethically, fulfilling safety needs ethically, wisdom, and justice, which are also described as the *akhlaq* by Islam (Al-Ghazali, 1990). Essentially, the core values were basic guides to individual in life. Excellent personality was being shaped and developed to fulfill necessities in life and bravery is developed in respond of wanting to be safe and secured. The values of wisdom were developed as a reaction to the social, emotional, self-achievements and purifying the spiritual and the physical challenges in life and the fairness values were being developed to fulfill the needs of fulfilling the psychological aspect and the demand in life. All activities resulting in positive values in this category are aligned to the teaching of Islam and the values to be avoided are not aligned to the religion or anything going against the religion.

The main values consist of the primary value system which can be seen through individuals' characteristics and personality like cleanliness, truthful, trustworthiness, sincere, respectful, integrity, loyal, humble, moderate, thankful, steadfast, tolerances and diligent. Characteristics such as dishonesty, bribing, bad thoughts on others, looking down at people, treacherous, pride, arrogant, not serious, are values to be avoided. Discipline, team work, accountability and innovativeness are the dimensions for the main value.

Examples of the expanded values among others are prioritizing productivity, mannerly, social fairness, integrity, punctual, creative collaboration, fulfilling promises, creative and innovative, appreciating knowledge, and enjoying work. The development values are combinations of two or more of the basic, core or the main values. Culture of knowledge, culture of diligence, culture of quality, culture of precision and culture of integrity are dimensions for the expanded values.

Mathematics education values. Values in mathematics education as described by Nik Azis (2009) is the judgment of individuals or certain groups of people on the importance, priority, applications, experience, phenomenon, or behavior which were made based on their principles, guidelines, or standards which influence their activities in relation to mathematics education. These values refer to values which occur during the teaching and learning in mathematics classrooms which are generally motivated and supported by teachers, textbooks, and school culture. Besides being very dynamic, classroom situations are also very complicated and multi-dimensional making it very important to pay attention to: values in teaching mathematics, values in learning mathematics, values in textbooks, values while doing mathematics homework, while doing the exercises, and when solving mathematics problems. The integrated perspective does not discuss values as complementary values instead as appropriate, holistic and integrated. All values related to teaching mathematics are being developed in an integrated manner which is based on the faith and belief in Allah. In total there are eight values indicators in the mathematics education values and these contexts can be utilized not only through the teaching and learning activities but they can be embedded into other classrooms activities such as assessment, evaluations, homework, textbooks, softwares and lesson plans. It is also important to be able to understand what to stress on when one is performing mathematics representation, reasoning, relation, or communicating Nik Azis (2009). The values also include accurateness, clarity, making conjectures, consistency, working systematically, flexible in thinking, diligent, creative, check the working, following procedures, neat and following the regulations of certain algorithm. The dimensions for the teaching sub-constructs are theoretical values, utilitarian values, functional values, and internalizing knowledge. The theoretical values refer to teaching mathematics with the main intention that student can understand higher level mathematics later. The utilitarian values refer to the teaching of mathematics which focuses on daily utility and application while the functional values refers to teaching students to build sophisticated mathematics for specific usage. Lastly teaching mathematics is to fulfill the responsibility toward the Creator, oneself, community, and the environment.

The learning dimension consists of four psychology of teaching: behaviorism, cognitivism, constructivism, and integrated perspective. These approaches held by students maybe prone to the approaches of behaviorism which focuses on memorizing, drilling, doing lots of exercises, skills, and receiving knowledge. Students who are prone to the cognitivism approach are more into sharpening of thinking skills, information processing, meta-cognitive thinking, and problem solving. Students preferring the constructivism approach were those who built and develop the knowledge. Lastly, universal integrated perspective is focusing more on learning which involves mastering of skills, problem solving, constructing knowledge, developing and internalizing knowledge.

Mathematics values. Mathematics values rises from the way mathematicians and mathematics educators develop the discipline of mathematics based on different culture setting. From the lens of universal integrated perspective, the mathematics values are being categorized as ideological, truth, sentimental and sociological aspects. There are values belonging to each category, and they are not depicted as complementary values to be balanced as suggested by Bishop (1988). Instead it is viewed in a more duly, holistic and integrated manner where the focus is now on the values and the process of values development in mathematics classes. All aspects of values contexts were given duly attention and being constructed and developed in an integrated manner based on the faith and believe in Allah. The universal integrated perspective believes that values in mathematics can be taught in an implicit or explicit manner, however, for the pupils to obtain them it needs to be constructed. This results in limited teachers' role to prepare suitable activities, provide encouragement, portray examples and assist students to experience the constructions of mathematics knowledge efficiently.

The ideological aspect is divided into empiricism, rationalism, pragmatism and the philosophical of Islam. The empiricism can be identified when teachers encourage her students to develop their ability in expanding the idea of mathematics by concretizing and using the symbol, model, figures, tables, graphs to collect empirical data. For the rationalism aspects, teachers normally would use the mathematics ideas, allow arguments, encourage thinking logically and stress on hypothetical reasoning. The pragmatism value is a mixture of both the rationalism and empiricism values. On the other hand, the Islamic values stress on the combination of empiricism, relational and spiritual, in which the knowledge of mathematics is based on beliefs in God and a tool to surrendering oneself to God.

When discussing on mathematics knowledge, the truth aspect of mathematics values was either the relative, absolute or relative in absolute knowledge. The relative aspect of truth in mathematics knowledge changes depending on the domain and context used. Thus, the truth in mathematics propositions, statements, and knowledge will depend on the context or other factors that it is taken. In contrary, if the knowledge of mathematics is thought as having values which are absolute, the truth of mathematics proposition, knowledge and statements do not depend on any domain or context. It will remain true since the knowledge is thought as has been in existence (a priori) and human works towards getting it. Lastly, the relative in absolute means that the truth of mathematics is regarded as relative because the knowledge is built by human from their experiences and thinking, however it is relative in absolute if it is being interpreted as absolute reference system.

The sentimental aspect of values in mathematics is divided into control, developmental, and integrated values. The values of control involve situation where there are rules to be followed, able to predict results or procedures, able to react by providing ideas to situations. The opposite of control is progress which involves abstraction and generalization in understanding knowledge. The integrated values involved exploring the mathematical knowledge by utilizing facts, procedures, mathematics criteria, development mathematical knowledge through generalization process, deep understanding, usage of alternative theory, scrutinizing existing ideas and development of new ideas and methods, and integration of mathematical knowledge with religion (Nik Azis, 2009a).

The sociological aspect has three types of values. They are the mysterious, openness and ownership values. The mysterious values stress on the wonders, mystifying, wonderful, and surprises in the quest of learning mathematics. The openness value appreciates public verification of mathematical ideas by proofs, articulation, sharing of ideas and demonstration. Value of ownership depicts that mathematics knowledge is owned by Allah and human may be obtained through the process of knowledge construction.

Related Study

This section provides a summary from the literature consisting of the general findings, differences among researchers' findings, and justifications of research questions based on unanswered questions from the literature search. The literature indicated that although there were a reasonable amount of studies focusing on values in mathematics classrooms, it seems that the research has not gone beyond the exploration stage. There are still several critical issues regarding values in mathematics classrooms which need close attention from researchers. Amongst the issues are the unclear conceptual framework, superficial conceptual of values, focus of research which are more towards utilitarian rather than values development, minimal work on theory construction, assessment of values, and the influence of the western education in decision making and the operations of some research. More thoughts should be given on the multidimensional construct involving spiritual, cognitive, affective, and behavioral which may contribute towards assisting school children to construct, modify, and develop values within them through the process of spiritual awakenings, intellectual reflections, emotions, social interactions, and suitable empirical experiences.

The study on the values in mathematics education were mainly from the aspects of cognitive, affective, teaching, learning, teacher's training, and curriculum. These literatures portrayed that there is still a big gap in knowledge in values development in mathematics education. For example, not much is known on teachers and students' conception on values in mathematics education and its development, assessment of mathematics in values development, the influence of affective element on students' conceptions, how teachers should develop values in mathematics classrooms, perceptions of students on values thought in mathematics classrooms. Similar findings for the students were found. For example, not much is known on how students construct and develop values in mathematics in classrooms, influential factors towards developing these values, values developed explicitly and implicitly in teachers' training programs, expected explicit and implicit values in the curriculum of primary and secondary schools, explicit and implicit values implemented in classrooms, values achieved by students in classrooms, and the relationship between the understanding of teachers on the National Education Policy and objectives of primary and secondary mathematics education with their conceptions on values and development of values in mathematics classrooms.

Another aspect of research is the assessment of values. The literature showed that the number of instruments available is limited. Besides that, these inventories which were designed to measure value in mathematics education were not holistic and integrated covering both the physical and meta-physic perspectives. The instruments available were designed mainly for the secular education system where the aspect of spiritual and religion were excluded, which is not suitable for the local education system use in Malaysia. The National Education Philosophy of Malaysia is based on faith and religion as being stated in the Rukun Negara or the National Principles of Malaysia.

The literature search indicated also that there is a need to construct a new instrument measuring values in mathematics classrooms based on a holistic theoretical framework which takes into consideration not only the cognitive, affective, and behavioral aspects but also the spiritual aspects. The theory chosen has the potential to provide clearer conceptual framework more suitable for the Malaysian education environment. A holistic and integrated conceptual framework will provide a clearer pathway in producing students with excellent characteristics and able to fulfill their responsibilities to God, himself, the community, and the environment. The instrument to be designed would be a tool to advocate research to produce more knowledge on values and values development in mathematics classrooms.

Assessment on human values. The study of human values in this decade is very much influenced by instrument based on the nature of values in a cognitive framework based on the work of Rokeach (1973). Value was defined from the social psychological as a lasting and continuous belief that the specific manner of behaviour or is a personal or communally preferable as compared to the opposite manner of conduct. In 1980, Rokeach enhanced the definition of values by saying that value is a prescriptive belief to evaluate whether something is right or wrong or the expected or unexpected.

Schwartz' Values Theory is very much influenced by Rokeach (1973) where concepts of beliefs concerning trans situational desirable goal varies with regards to its importance and how it helps to guide one's standards in dealing with life (Schwartz, 1992). The model was elaborated widely and consisted of ten distinct types of nearly comprehensive set of values abstracted into four dimensions: opposing self-transcendence (universalism, benevolence), self enhancement (power, achievement), opposing conservation (tradition, conformity, and security), from openness to change (self-direction stimulation) (Schwartz, 1992, 2006).

Common value in a culture or society was identified from interviewing 60000 people in 82 countries. Value or attitude were found to be distinct to the culture and did not share the same conceptual meaning across all examined cultures. When the average data was analysed, he found that the values fall into seven different clusters: embedded, harmony, egalitarian commitment, intellectual autonomy, affective autonomy, mastery, and hierarchy (Schwartz, 1973).

It was found that there was a smaller number of research on values in mathematics classrooms which involved students as compared to adults. The Portrait Values Questionnaire (PVQ-29) was used on 1555 German subjects aged 10 to 17 to investigate children's value structures and value preferences. Although the results confirmed the validity of Schwartz' theory, it did not support the hypothesized relationship between age and value structure (Schwartz, Melech, Lehmann, Burgess, Harris, & Owens, 2001).

Assessment of values in mathematics education. **T**he exploratory Values and Mathematics Project (VAMP) which explore values amongst teachers of primary and secondary school and how values contributed towards mathematical thinking of the teachers in Australia was the first robust study done on measurement of the latent trait. In that project, Bishop took values as a deep affective quality which are describing values as adjectives. His axiomatic mathematics structure values were complimentary pair sets: rationalism-objectivism, control-progress, and mystery-openness. Since Bishop only focus on the mathematics values, Seah (2009) who also worked with Bishop in the VAMP project further refined the mathematics education values as five complimentary categories of values which are formalistic versus activist views, instrumental versus relational understanding, relevance versus theoretical knowledge, accessibility versus special, and evaluating versus reasoning. He further suggested that values in mathematics are soft knowledge. He explained that these values although were cognitive and affective but they were often underpinned by the social and cultural aspects. The hard knowledge referred to the part of learning experience involving mental processing and affective to reach certain levels of awareness and understanding, while soft knowledge referred to part of learning process that draws on the individual experience and internalizations within the socio-cultural contexts (Seah, 2009).

The Values and Mathematics Project (VAMP) in Australia were executed to analyse intended and implemented values, regulation of these values in their teaching, and improvement of mathematics teaching through values education of teachers. Thirty teachers were involved in a workshop in which they share their primary intuitions of values. In a further group discussions participants were asked to discuss their weekly entries journals related matters to values. This study found that teachers were rarely aware of the values associated with teaching mathematics (FitzSimons, Seah, Bishop & Clarke, 2000).

The VAMP employed mathematics teachers from primary and secondary schools as sample of the case study. One of the crucial information which emerged from the study was difficulty in finding the common language to allow for meaningful and successful dialogue to take place. Teachers were found apprehension since the subject of values seemed to provoked teachers' judgment and notion of values and fault findings. They also understood the importance of executing the research although there are some who thought teaching values as a new idea, not realizing that their teaching of mathematics involved implicit teaching of values (Clarkson et al., 2000). The study came out with themes which surround teachers' understanding of values in the mathematics classroom, institutional and socio-cultural influences, and mathematical values and there were indications that teachers failed to nominate values which were observed in teaching mathematics (Seah, Bishop, FitzSimons & Clarkson, 2001).

The VAMP research on eight in-service teachers dealt with the values that teachers taught and the how these values develop their students' values. The teachers involved were being made aware of a wider definition of values in mathematics classrooms which include values associated with mathematics as a discipline, mathematics education and how these values can be explicitly planned (Seah & Bishop, 2000). Teachers were not aware of these values until mentioned by the researchers, who offered them a language to be used in discussing values and helped conceptualization of values. This enable teachers to further explore the issues with colleagues leading to a greater personal and professional control over the nature and the range of values which can be shared with students during mathematics classes.

Bishop's perspective in the VAMP research on role of value and the impact of social-cultural factors on teaching values is a catalyst to researchers in values in mathematics classrooms from Taiwan (Chin & Lin, 2000; Leu & Wu, 2000; Chin, Leu & Lin 2001) and Turkey (Dede, 2009). In 2010, Dede developed and validated a questionnaire measuring mathematics educational values. After a series of validation and reliability processes, the 52-items instrument known as the Mathematics Education Value Questionnaire (MEVQ) was distributed to 107 teachers in training as a pilot study. The instrument was not made available for viewing and limited information were shared on the validation processes. This time the study categorized mathematical values in three pairs following Bishop (1988) and the mathematics educational values in five pairs following Seah & Bishop (2000). The instrument identified that the group of teachers uphold the mathematics education and pedagogical values, compatible with the education reform recently implemented in Turkey which is based on the constructivism philosophy. Some of the mathematics education values based on the western culture were not accepted by the Turkish pre-service mathematics teachers. Data was collected and analysed to investigate the construct validity using exploratory factor analysis and item analysis.

A project known as the Values in Mathematics Teaching in Turkey and Germany [VMTG] covers cross-cultural comparative study on how gender and nationality influence values of mathematics teachers (Dede, 2014). The sample was made of twenty-seven German and thirty-three Turkish mathematics teachers from primary and secondary schools and descriptive and inferential statistics were used to compare the findings. The Mathematics Education Values Questionnaire (MEVQ) by Dede (2011) was used. The MEVQ is a 5-point Likert scale instrument consisted of 15 items covering the theoretical nature of mathematics teaching, concrete mathematics teaching, and the value in mathematics teaching, and affective and cognitive outcomes in mathematics teaching. Nationality was shown to have significant effect while gender group did not show any significant effect.

Assessment on values on Buddhism and Confucianism. A similar project like the VAMP led by Bishop in Australia was carried out by Taiwanese researchers in Taiwan. The VIMP project in Taiwan was aimed to investigate and document mathematics teachers' values about mathematics and pedagogy, how teachers can clarify their values positions, and teacher-student values interactions. They carried out an action research on values in Mathematics Teaching (VIMP) with three theoretical positions which were based on the social-psychological aspect for the three VIMP projects. Although the VIMP project was supposed to be the same to the VAMP, the researchers did some adjustments to suit the Taiwanese education culture and beliefs. In the first stage of the study, they employed case study as the research design which involved classroom visits and observation and pre-lesson and post-lesson interviews of seven experienced teachers with 10 to 30 years of experience.

A survey and a pre-study observation were used to examine the teaching activity and lesson plan of the teachers. The questionnaire items were used as probes in the interview to bring out values indicators for further investigation. The interview process adopted was more rigorous than the VAMP projects, the ‘dynamic interview technique” where observations anecdotes were used to motivate discussion where teachers were to analyse the situation. The researchers executed about twelve or more multiple, intensive interviews in a year with the sample to figure out what the teacher really meant (Chin, Leu, & Lin 2001).

The VIMP project in Taiwan on the other hand found that mathematical and pedagogical values which surfaced were very much influenced by the teacher’s own individual’s faith towards Buddhism, Confucianism, and the curriculum (Leu, 2005). Among the findings were: teachers believe that they are to reinstate the students’ students’ respect for ethics, teachers are experts, teachers’ values were built upon their efforts and personal understanding, and teachers had to cultivate problem-solving skills. The researcher concluded that the teachers who were influenced by Confucianism and the teaching of Buddha were more willing to conform to the curriculum and instructional decision instructed by the school administrators.

One of the study in the VIMP project, elicited at Taiwanese pre-service teachers' pedagogical values using six instruments (Chin, 2001). The first consisted of 25 statements on general values where respondents need to state their preference using a 5-point Likert scale. Respondents select five out of the 25 statements and rank their importance with reasons. The second questionnaire required respondents to rank the importance of 14 values in relation to their lesson planning and classroom teaching. The other four questionnaires address different for each of the four teaching topics. The sample consists of 42 in-service secondary mathematics teachers enrolled in a Master of Teaching Program in the National Taiwan Normal University and another group of 24 pre-service teachers' students who were in their third year of teaching education program. Two in–service and three pre-services teachers were selected using a questionnaire by Chin and Lin (1998) to identify views of mathematics and mathematics teaching.

Assessment of nature of mathematics. Perry, Howard, and Tracey (1999) performed a research with the objectives of identifying the nature of mathematics as a subject and mathematics education. This study is a part of a bigger study with a sample population of 939 secondary schools' mathematics teachers near Sydney, in which 233 were involved directly in this study. A three-point Likert scale instrument with 20 items represent teachers' beliefs about mathematics as a subject, mathematics learning, and mathematics teaching was constructed. Another set of data was obtained through interviews with only eight of the head master teachers. They were interviewed approximately 30 minutes each in which all interviews were audiotaped and transcribed. The research adopted survey design with 20 items on beliefs, six items on nature of mathematics, six items on teaching mathematics, and 8 items on mathematics learning. Sample of the study has 40 head mathematics teachers. The beliefs were being categorized as teachers' beliefs on the nature of mathematics, beliefs related to teaching and learning mathematics.

Another study which also dealt with teachers focuses on pre-service teachers studied the relationship between espoused beliefs and attitudes towards mathematics as a subject in relation towards their teaching and learning and their achievement on a simple mathematics examination designed for junior high school level (White, Perry, & Southwell, 2006). Unlike Perry et al. (1999), this study consumed three different instruments to measure attitudes, beliefs and achievement known to be necessary for their mathematics pedagogy units in their teacher education courses. A descriptive survey design was used and the three instruments were administered: (a) achievement test (23), (b) belief survey (18 items), and (c) attitude test (20 items). The sample for the belief survey were 83 Bachelor of Education students who are going to be primary school teachers and were taking the mathematics pedagogy subject. Among others, the results indicated that attitudes were an important element, however it is not sufficient to only have positive attitude. The findings also seemed to portray that belief was said to be influencing their attitude formation which they will bring to class through their beliefs and practices influencing their teaching culture. Furthermore, the understanding one's beliefs, attitude and practices by making these explicit and examine analysed them will help in improving their performance in class. Both studies done by Perry and White did not mention the theory in which they based their studies on. All instruments used by the two researchers are Likert scale self-report questionnaire.

In a study done by Boz (2008), 46 trainees were interviewed on their beliefs regarding the issues of teachers' training approaches, role of teachers, and interaction between students and teachers during class. The data portrays that the trainee teachers believe that teachers should be student-cantered, feel the ownership of learning, and class interaction should happen. Majority of the teachers portray their constructivist beliefs compared to traditional beliefs, however there are also trainees who subscribe to both beliefs. It was expected that majority of the students' teachers hold on to the constructivism beliefs as the classes that they attended were recently reformed towards constructivism. This confirms that university study and experiences as learners have direct influence on the shaping of students' teachers' beliefs.

Dede (2008) initiated to measure middle and high school students' values in mathematics education and its relation with their mathematics anxiety levels using the Mathematics Anxiety Questionnaire (MAQ) constructed by Durmus and Bicak (2006). The five-point Likert scale was piloted to 100 from middle and high school students and a total of 511 responded to the questionnaire which was distributed to 1015 students. The varimax rotation showed that the Mathematics Anxiety Questionnaire has four factors: peer anxiety, task anxiety, labelled individual anxiety, and labelled test anxiety using varimax rotation.

Assessment on views on mathematics as a subject. Another related study dealt with the mathematics teachers' values in relation to their grade level, gender and departments. The study was done on randomly selected 231 future primary and secondary mathematics teachers who were freshmen and senior college students from a university. The questionnaire used a five point Likert scale consisting of 34 items in which 14 of the items describe positivist values and the other 20 items describe the constructivist values in teaching and learning setting. The number of items in the questionnaire was reduced from 40 to 34 after a sequence of reliability processes. The mathematics teachers' values towards their teaching were categorized into the positivist and constructivist values. In the study, the positivist values refer to teachers' objectivity, control, mystery, accuracy, and clarity in their mathematics teaching. These values describe teachers' centeredness approach in a classroom setting. On the other hand, the constructivist values were made of rationalism, progress, openness, creativity, enjoyment, flexibility, and open mindedness to reflect the student centeredness and is based on behavioural, cognitive constructive approach as being suggested by Durmus and Bicak (2006). The Cronbach's alpha values for the instrument was recorded at a value of 0.73 for the whole instrument and 0.64 and 0.74 for positivist values and constructivist values respectively. The findings indicated that both the freshmen and the senior Turkish pre- service teachers held constructivist values.

Dede's (2009) study indicated that the freshmen and the senior students were more inclined towards constructivism rather than the positivist values in their mathematics teaching. Gender doesn't seem to have any significant effect on both constructivist and positivist values. The grade level and gender investigation on constructivist values of the female freshmen students was found to be statistically significant. Senior students were detected to score significantly high in constructivist values than the male freshmen mathematics students.

Teachers' beliefs and perception on students and mathematics were shown to have direct impact on the classroom practice (Beswick, 2004). Thus, a greater and clearer picture of teachers' beliefs about mathematics teaching will be beneficial to the discipline of mathematics education (Beswick, 2006).

A study done by Beswick (2005) in Australia had the objectives of investigating beliefs held by the teachers regarding: nature of math, teaching and learning of math, the extent student perceives their class to be constructivist, and the associations between teachers' beliefs and class environment perceived by students. He used survey questions, observation and interviews to collect data. A pilot study was done to 35 mathematics teachers where factor analysis was done to the 40 items of the beliefs survey to reduce it to 26 where 24 of the items were on mathematics teaching and 2 were on nature of mathematics. Some items were omitted either because they are not significantly related to either the constructivist or the traditionalist, or they are correlated approximately equally with both.

The reviewed instrument was sent to 25 students to investigate their views on teachers' beliefs their classroom practices. Here, classroom practices are defined as activities and practices in the classroom setting which could be categorized as constructivist. To tap on this, the five-point Likert scale Constructivist Learning Environment Survey (CLES) which consisted of 28 items is used in this study. The survey measures the extent to which the four aspects of classroom environments namely: autonomy, prior knowledge, negotiation, and student centeredness were perceived. The Constructivism Learning Environmental Survey (CLES) was distributed to the students of the respondents. The teachers were not Problem Solving view which is an indicator that they were not being consistent with the constructivism beliefs which they embarked on. Like their teachers, the students do not have the view of problem solving. Teachers tend to lean towards Platonist which was consistent with problem solving and student centeredness, a considerable number held traditionalist view, and very few could be classified as instrumentalist. Teachers are also found to have limited knowledge on constructivism which influenced the students, resulting in a classroom environment which is not consistent with the constructivist principles. The paper clearly highlighted the complexity of the relationship between what teachers perceive and beliefs with what they practice in classrooms.

Beswick (2004), in his six lessons observation study on a teacher found that the teacher had problem solving view of mathematics and in contrast they have constructivist view on learning mathematics. The study confirms that the teachers' belief is consistent with the recent reform of mathematics which is moving towards constructivism.

There were not many studies related to values in Malaysia. Wan Zah, Sharifah Kartini, Habsah, Ramlah, Mat Rofa, Mohd Majid, and Rohani (2005) explored teachers' understanding, perceptions and beliefs on mathematics values for four selected schools the state of Selangor and the Federal Territory. This is a qualitative descriptive study involving four mathematics teachers from Selangor and Wilayah Persekutuan. Participants went through a clinical interview several times until repeated ideas, concepts or elements become apparent. Data was recorded, transcribed verbatim and analysed using the inductive method. The teachers were found to have three perspectives on the meaning of mathematics values: noble values, intrinsic values and pragmatic values. The research concluded that teachers' mathematics values can be categorized as noble values, intrinsic mathematics values and values on the practicality of mathematics. The research concluded that there is still a lot to be done to increase the teachers' positive perceptions on values in teaching and learning mathematics. The participants were claimed to have logicism and formalism mathematical thinking. The study is based on the view that mathematics knowledge is rooted to the culture of the community in which the subject is being taught and developed.

Assessment on intended and inculcated values. Study by Lim and Ernest (1997) explore the relationship of planned curriculum values to the teachers' perceptions of what values are appropriate to be taught when teaching mathematics. They found that the intended values in the Malaysian curriculum are not mentioned by teachers in mathematics classrooms and the implementation aspect was not well structured. They focused on the 16 moral values emphasized in the Malaysian curriculum. Results demonstrated that pre-schools, primary and secondary teachers of mathematics have different prioritized values in mathematics education. The secondary teachers for example, emphasized on personal values followed by epistemological values and the kindergarten teachers stressed the epistemological values most followed by personal.

A group of researchers from Nigeria worked on building an instrument to measure how values are being inculcated within the teaching and learning mathematics environment (Liman, Ibrahim, & Johary, 2012; Liman, Ibrahim, & Yusuf, 2013). The five independent factors were ideological, attitudinal, sociological, computational and motivational mathematical values (Bishop, 1988). The self-developed survey questionnaire was used on a 509 out of 1145 using stratified random sampling technique. They were secondary schools' teachers coming from six different states of the Northern Eastern Region of Nigeria.

Project on development of values in mathematics and sciences. In 2007, a six-year project on development of values in mathematics and sciences was started at University of Malaya and led by Professor Dr. Nik Azis Nik Pa from the Faculty of Education. The project which was divided into six phases inclusive of efforts in (a) identifying critical issues, (b) analysis of the conceptions of teachers and students, (c) scrutinizing the conception and curriculum content, (d) producing learning modules, (e) carrying out the modules, and (f) developing a measurement instrument. Phase one were focused on researching on (a) related research for the past two decades locally and internationally, (b) what were the problem statements being researched, (c) what were the theories used in the studies, (d) what were the definitions used for the related construct, (d) what were the research design and methods used, (e) what were the findings from this research. A seminar was organized to exchange ideas, formed collaborations, and sharing of experience on development of values. The second phase was focused on studying various definitions of values and ethics across various cultures in the world. Amongst the analysis were (a) different definitions, (b) which philosophy, psychological, and sociological perspective were used as the base of studies, (c) strengths and weaknesses of the perspectives chosen, and (d) the implications towards the studies.

The third phase saw production of 21 studies related to the topics, including a comparison study of some mathematics textbooks in Singapore and Malaysia. All the studies were attempted to answer the questions related to (a) conceptions on values and values development in mathematics classrooms of teachers and students, (b) values in textbooks, (c) values in curriculum content, (d) values in examinations questions, (e) values being focused on homework, and (f) similarities and differences on exposure of values in the mathematics and sciences textbooks of Malaysia and Singapore. The fourth phase involved the constructions of learning modules for values development in several mathematics topics. The modules were later evaluated by teachers who were the potential users.

The studies were trying to answer questions related to (a) model for the modules, (b) content of modules, and (c) the clarity, representation, and relevancy of the model. This phase is followed by phase six which was the execution of the modules. The focus this time were on (a) teachers' understanding of values before and after using the modules, (b) the consistency of the teachers' understanding of values and the values they taught in class, (c) problems faced when using the modules, and (d) suggestions on ways to improve the modules. The last phase was on the assessment of values which involved instrument development and evaluation of the validity and reliability. The phase was focusing on (a) suitable model for instrument development process, (b) suitable content for the instrument, and (c) issues relating validity and reliability. This project is almost completed as phase six is currently in execution.

The literature study above revealed several important findings including (a) values in mathematics receive least attention although it is one of the most stable affective domains, (b) studies on mathematics values in classrooms executed in a non-collaborative manner, done in isolation and not being integrated especially into collection of relevant studies with suitable theory and theoretical framework, (c) the studies did not provide explicit definitions of the sub-constructs and dimensions leaving the reader to come up with their own conclusions on the definitions, (d) definitions of constructs and sub-constructs were found to be mainly based on the western education philosophy, (e) teachers' perceptions and beliefs are not parallel with their classrooms practices, f) teachers generally agree on the importance of values and the development in mathematics classrooms but were not exposed on teaching values in mathematics classrooms, g) studies were focused on pre-service and in service teachers teaching at various levels, but none involved those who are not directly from the teaching line such as academic administrators and policy makers, h) focus of research were more towards utilitarian rather than values development, i) the literature portray that there is still a big gap in knowledge concerning values development in mathematics education, j) the instruments available were designed mainly for the secular education, k) instruments were more inclined towards empiricism, separated control, openness, and absolute, and l) a small number of the studies shared their work on the validation and reliability processes involved.

Assessment on the academic achievement-related matters. Luttrell et al. (2010) developed a mathematics values inventory to study the perceived value of literacy of mathematics among the general education students at a university. The development process included literature survey, constructs conceptions, construction of large item pool, translation validity, face and content validity confirmation, construct validity, and a large-scale pilot study to evaluate the instrument. The model which is called the Mathematics Values Inventory (MVI), measures the individual differences of perceived value of mathematical in the context of their mathematical literacy. The inventory is based on Eccles, Adler, Futterman, Goff, Kaczala, and Mecee, (1983) which is a model of achievement-related choices focusing on related areas such as interest, general utility, need for high achievement, and personal cost. MVI started with 88 items which were reduced to 28 items since redundant items were eliminated. The inventory went through multi-steps of face, construct and content validity enhancement by getting advice from experts in the area and students. Items which were not following the normal distributions were eliminated and highly inter correlated items were checked for redundancy and those found to have redundancy in content were eliminated. An item inventory with 32 items was tried out to 1096 non-mathematics majors. A test re test study was also executed to 55 undergraduate students who are majoring in liberal arts. Initial study demonstrated that all the four subscales were correlated in which interest-utility have robust relationship. Interest, utility, and achievement were correlated positively with each other and inversely correlated with personal cost. The study also portrayed that gender-related difference were not statistically significant.

Assessment of values in curriculum. Research on students' values in Malaysia seems to indicate that the curriculum for Malaysian primary and secondary schools has yet to portray values and beliefs as one of the main entity with strong relationship with the cognitive domain. Even if there was any element of values in the textbooks, the values were not universally integrated (Ernest, 2007) in the teaching and learning. More systematically structured attempts on activities which could develop values in mathematics education is necessary to increase values development in mathematics education. (Butcher, Davies, & Highton, 2006). Mathematics educators need to furnish themselves with a clear understanding on the concepts of values and the process in values development (Prencipe & Helwig, 2002). A concerted effort is deemed necessary to transform from the current culture of inculcating or transforming values to building, constructing, and internalizing values. The universal integrated perspective is suggested as an alternative to behaviorism, cognitivism, and constructivism perspectives used in the current education system.

Generally, investigations and studies on values and values in mathematics among students from primary and secondary schools were found to be very limited especially on issues concerning: (a) immature conceptions of values in mathematics classrooms and the constructs to measure them, (b) awareness of the existence and importance of those values in teaching and learning mathematics among students, (c) absence of holistic curriculum which takes into consideration of values in mathematics classrooms, mathematics values students carry into their classes, (d) how students perceive values from teachers, and how these values relate to their success in learning the subject, I how students construct and develop values in mathematics classrooms, (f) values developed explicitly and implicitly in teachers' training programs, (g) unclear expected explicit and implicit values in the curriculum of primary and secondary schools, (h) explicit and implicit values implemented in classrooms, (i) values achieved by students in classrooms, (j) the relationship between the understanding of teachers on the National Education Policy and the relationship with values development, (k) influential factors towards developing these values, and (l) conceptions on values and development of values in mathematics classrooms. These studies also seemed to indicate that students were found not to have as much choice in terms of which values to subscribe to as compared to teachers. In other words, teachers who normally would have to make more decisions in teaching and learning mathematics and students on the other hand would normally follow or go along with their teachers' values.

Chapter 3 Research Design and Methodology

This chapter describes the research methodology used in the study in eight sub-topics. The eight subtopics are introduction, research design, population and sample, data collection techniques, instrumentations, pilot study, data analysis technique and summary. The introduction provides a summary for each sub-topic in the chapter. The research design section provides details on the four phases of the instrument development process, justifications for the design, the strength and the limitation of the design, and actions taken to lessen the impact of the weaknesses of the design. This is followed by the topic on population and sample of the study which explains the population, location of study, study sample, sampling technique, and justification on the why the sample was chosen.

The topic on data collection techniques explains the type of data collected at different phases of the instrument development processes, data collection techniques, justifications on technique selected, explanation on the weaknesses of the technique, and ways to improve them. Meanwhile, the topic on instrumentations discusses on the three instruments used during the analysis, design, development, and evaluation phases which includes the discussion on validity and reliability. Data analysis section contains the discussion on the techniques used to analyze the data collected at different stages of the instrument's development process, justifications of the techniques chosen, limitations of the techniques, and suggestions on how to overcome the limitations. Chapter Three is concluded with a summary of important ideas of the chapter, highlighting the appropriateness of the research design, data collection techniques, instruments used, data analysis techniques, and a brief introduction to Chapter Four.

Research Design

This study employs an instrument developmental method which involves quantitative research approach to develop and validate the instrument measuring values in mathematics classrooms. This section describes a set of standards which function as the scientific foundation and frameworks to organize and structure the process of development and evaluation of the instrument. The model used in this study is a modified version of the ADDIE model, a standard process usually used by instructional designers or training developers as a framework in planning and constructing educational and training materials and programs which is an acronym for analysis, design, develop, implement, and evaluate (Morrison, 2010). However, in this study the implementation state is not relevant since the instrument was still under development and was still in the assessment process. The assessment of the instrument was done at the development phase and the evaluation phase. The iterative processes focus on issues related to identification of current development, theory being used, design of scale, checking, and determining the validity and reliability of the instrument.

However, the model requires one to have some knowledge and skills as the depth and the intensity of the process in each phase depended a lot on the skill, understanding and effort of the researcher. The discussion on the research design in this chapter was followed the four phases, starting from analysis, design, development, and evaluation. Assumptions, limitations and strengths for activities at each phase were presented together with their justifications. There are three stages in the ADDIE model, the identification, generation, and confirmation. The first step in the identification stage is the analysis phase in which critical issues, purpose of studies, and research questions of the research area were being identified. During this stage, eight instruments will be analyzed thoroughly from the aspects of sub-constructs, theory, samples, validity, instrument design, and findings.

Table 3.1

The Activities in ADDIE Model

Stage	**Phase**	**Main focus**	**Activities**	**Types of Data**
Identification	(I)Analysis	Problems identification	Identifying problem through literature review Formulation of the purpose and research objectives	Qualitative
		Construction of conceptual framework	Clarification on theoretical framework for scale development Defining constructs, sub constructs, dimensions and value indicator values.	Qualitative
Generation	(II)Design	Design of scale	Determining format for scaling and the instrument Creating item pool Calculation of scores Writing instructions for respondents	Qualitative
	(III)Development	Checking	Focus group to evaluate, critic the pool of items and the instrument Check and improve the item pool and instrument following feedback from the focus group	Qualitative
			Panel of experts to evaluate the revised pool of items and the instrument Re-checking and refining pool of items and instrument following feedback provided by the experts	Quantitative
Confirmation	(IV)Evaluation	Determining validity and reliability	Checking and improving items pool through pilot study Determine the instrument validity through field work.	Quantitative

It also involves the formulation of the theory in which the theoretical framework is being constructed and the conceptual definitions of the constructs were explained.

Relevant sub-constructs, dimensions, and values indicators are identified besides forming the logical clustering of items to each dimension and the logical clustering of dimensions to the three sub-constructs. Measuring hard to define and intangible concepts like values in mathematics classes requires the researcher to form a clear understanding on the problem to be researched and the construct to be measured. Table 3.1 detailed out the process following the stages, phases, focus, activities, and identification of types of data collected.

The construction or the generation stage of the instrument development consists of the design and developments phases. The design phase includes activities involving (a) decision on the format of the instrument, (b) creation of item pool, (c) forming of the formula for scaling, and (d) writing instructions for respondents. The focus is to have a clear conception on the format of the instrument and coming up with relevant items based on the values indicators. The format of the instrument must be designed so that it is suitable for measuring the values in mathematics classrooms and suitable for the respondents. Furthermore, choices of format and designs will influence the analysis options. Developing and validating new instrument requires careful and detail planning in the design stage since poor design will produce poor measurement which will inaccurately assess the construct, resulting in faulty conclusion (DeVellis, 2003).

In this study, deductive approach is used where items are created based on the conceptual and operational items of the construct, sub-constructs, dimensions and its suitability to the respondents. The small item pool is preferred over the large item pool since the final content validity is not easy to determine besides being costly and time consuming. Multi-items scales are preferred to avoid bias misinterpretation and reduce measurement error (Burns & Grove, 1997), since it is unusual to develop a questionnaire that relies upon a single-item response. As each item is written, it is important to make sure that it represents the respective dimension or sub-construct for which the item was created to measure, since this adds to the construct validity of the instrument. The researcher must anticipate possible problems such as high participant turnover or high difficulty level and design items to assess the prevalence of such problems.

The researcher needs to write clear instruction for the sample as wrongly instructed respondents will provide inaccurate responses, not helpful in answering the research questions. Explanation on the objectives of the survey will be on the questionnaire for the respondents to know the purpose of the instrument. The instructions were written in Bahasa Malaysia as it was thought that the lecturers would understand them better, but the items are presented both in English and Bahasa Malaysia.

The content validity is enhanced during this phase, where substantive items were finalized (Dillman, 2000) through focus group and panels of experts. The activities involved: (a) getting the focus group to assess and criticize the initial collection of items and the instrument being developed, (b) checking and improve the collection of items and the instrument following the feedback from the focus group, (c) getting panels of experts to assess the items and the instrument, and (d) checking and improving the collection of items and instrument following feedback from the panels of experts. The objective of this phase is to consider and evaluate the quality of the instrument and refine the instrument from the feedback and comments received from the focus group and the panels of experts. Panels of experts are professors, associate professors, and senior lecturers of private universities who specialized in fields such as mathematics, mathematics education, and measurement. The focus group were lecturers from the public universities who were etching the pre-university courses.

Focus group involves moderator-facilitated interviews among multiple participants, a technique which can be used to gather opinion and perceptions from several key informants on specific topic (Patton, 2002). During the group interview, there might be some participants who might be reluctant to trust others with sensitive or personal views or prefer to stay neutral all the time. This can be reduced by informing the participants of the objectives and that there is no wrong or right answer and any feedback is much appreciated to help improve the instrument being developed. The next step is to enhance the content validity of the instrument in which experts' opinions from the area of mathematics, mathematics education, and education are sought. The main goal of getting feedback from experts is to finalize the substantive content validity of the questionnaire for the researcher to proceed to the evaluation phase (Dillman, 2000). To avoid having long questionnaire for each expert, three different panels of experts were formed and consulted on three different aspects of content validity.

The evaluation phase is the final phase in which reliability and construct validity are established. Discussion in this section will be on the pilot study and real study focusing on evidence of reliability and validity of the instrument being developed using the Classical Test Theory (CTT) and the Item Respond Theory (IRT). Both the pilot and real studies were focused towards establishing the construct validity and reliability. The pilot study focuses on at least three aspects: (a) explanation on the execution of the pilot study, (b) presentation of the findings from the pilot study using tables and figures besides the narrative report, and (c) details on improvements to overcome the weaknesses. The findings from pilot study will assist the researcher to make necessary changes probably on data collection technique and analysis methods. It may also provide information to improve the logistic in distributing the questionnaire, estimate the actual time consumption and to decide on suitable statistical test to check on construct validity. Results from the pilot study may provide information on which items to be removed or improved.

The refined version of self-report questionnaire is distributed to the respondents who are mathematics lecturers form the matriculation college. The survey design is a practical means to obtain big of respondents as sample. Sample must be large enough, sufficient to use related statistically tests. The researcher makes necessary arrangement with the management of the college before executing the study. Representatives were appointed based on the recommendation of the college's management. The questionnaires were sent to the representatives using the Poslaju service, together with carefully some guidelines for the representatives to follow. Guidelines include time needed and how to return the answered questionnaires.

Population and Sample

The section on population and sample discusses five areas: (a) explanation on the population of the research, (b) explanation on the setting or location of study, (c) explanation on research respondents including unit analysis or unit sample, (d) explanation on sampling method, and (e) justification on participants or types of samples chosen. These five areas are discussed for each of the four phases of the developmental model. The population of the real study consists of 430 mathematics lecturers from 17 matriculation colleges in the country. However only 325 (76%) of the lecturers took part. Four colleges were unable to take part since the college did not have mathematics lecturers, the responses arrived after the researcher keyed in the responses, there was a technical error and the responds did not reach the researcher, and unable to get permission from the college director. The respondents are at different locations in Malaysia but they are all sharing the same education system and under the Department of Matriculations, Ministry of Education Malaysia. The researcher took the initiative to have different set of respondents for the pilot and real study and ensured to have more than 200 respondents for both studies to ameliorate problems in relation to choosing statistics tests which requires a minimum of 100-150 respondents

The unit samples of the analysis phase are the eight instruments which measure the human values and values in mathematics classrooms. These instruments are identified after the literature search on the internet for data from the last two decades. Only instruments with clear theoretical framework and provided some information on validity and reliability are being considered. The development phase which consists of the focus group interviews and panels of experts has different set of participants. The participants of the focus group are lecturers from a preparatory college and from a local university. Participants have similar backgrounds with the sample of the real study. The panels of experts are chosen using purposive sampling since the researcher needs to identify experts from the area of mathematics, mathematics education, values of mathematics, measurement, and education.

The evaluation phase consists of the pilot study where the construct validity and reliability of instrument is formed. Samples for the pilot study were made of mathematics lecturers of a local university with similar teaching experience, education background, and social background with the population of the real study. Purposeful sampling is used because the respondents must represent the characteristics of the targeted population of the study. Sample for pilot study were carefully chosen to provide assurance that they are representatives of the sample of the real study and the sample of the real study were representatives of the populations allowing results to be generalized to the population.

Purposive sampling was chosen for the real study due to several reasons. Firstly, it is not easy to obtain a population which is easily accessible. This is the case with this study as respondents were only available when permission was granted by the institution of higher learning. Secondly, purposive sampling will ensure that appropriate people were selected and those who do not fit the requirements are eliminated. Random sampling is not used, as it might mean sacrificing for smaller samples due to selecting samples randomly and errors due to non-response bias (Burns, 2000). Based on the rationales discussed, the non-probability procedure of purposive sampling was chosen for this study. The lecturers who were randomly sampled could provide a rich data due to their diversity in geographical difference of their workplace, education background, age, gender, interest in mathematics, and number of years of experience. There are several purposive sampling techniques which can be adopted such as the maximum variations sampling, homogenous sampling, typical case sampling, extreme case sampling, critical case sampling, total population sampling and expert sampling (Patton, 2002).

This study used the maximum variation sampling since the objective is to be able to obtain all possible perspectives relating to values in mathematics classrooms. The researcher is searching for variation on perspectives, which includes those from the typical group to those that are more extreme in nature to obtain greater views into the latent trait. The purposive sampling may also provide the researcher with the justification to make theoretical, analytical or logical in nature generalizations from the sample that is being studied. However, this technique of sampling is open to researcher bias since judgment in selection of the samples, might not base on clear criteria. Since validity requires looking not just at the content of the survey but also how the survey is conducted, various data collection techniques are used at different phases of the development processes are discuss here. The discussion is focused on: (a) types of data collected, (b) data collection techniques, (c) justification on the technique selected, (d) the strength and weaknesses of the technique and ways to minimize the effect of its weaknesses. In addition, it is also crucial to discuss (a) duration of time for data collection, (b) tools used to collect data, (c) function of researcher during the data collection process, (d) consensus from the respondents. The discussion on the data collection technique will start with analysis of literature followed by the focus group, panels of experts, pilot study, and real study.

During the analysis and the design phases, qualitative data were collected from review of literature through journals, dissertations, and articles for the last two decades. This technique permits the researcher to study the trend and advancement of instrument development in the research area and obtained samples of instruments in the area. On top of that it is inexpensive as data is readily available. However not all data is easily accessible through journals and the electronic media, some might be incomplete, and there is also issue of confidentiality which limit the search efforts. The researcher prepares a document analysis protocol to guide areas to focus on for the literature search.

The development phase consists of the focus group interview and getting opinions from panels of experts. Focus group uses group interview technique to obtain qualitative data and survey method for quantitative data. The content validity of the instrument is investigated through survey technique. A closed and open ended questionnaire is prepared for three panels of experts to evaluate the instruments from three different aspects. A Likert scale with 5-point options is used for the experts to evaluate each item and experts are encouraged to write their suggestions, comments, and provide alternatives measures at the end of each item. The researcher will use the quantitative data to identify items with low average scores indicating the possibility to reconstruct these items. Qualitative data are collected and documented from the open-ended questions. The draft version of the instrument is sent using *SurveyMonkey*, which is an online survey tool for creating, sending and keeping track of the surveys and respondents. It allows immediate availability of the data since data is automatically stored electronically and making it possible to analyze it easier. Furthermore, data entry was avoided and this reduces the errors resulting from data entry (Rosenfeld et al., 1993). Researcher may detect bad deployment and return time almost immediately right after the instrument is sent. The respondents can have the flexibility of answering the questionnaire at their own preferred time without the feeling of being rushed by anyone. They can start at any one time, paused, and returned to it later and able to edit their responses. Respondents are free to respond to the online survey at their most comfortable place and time. During on line surveys, respondents will find that they are more willing to share their opinions or perspective as compared to personal interviews.

Getting respondents using *SurveyMonkey* has its own disadvantages. This is because there is a potential that respondents would just ignore the e mail. There is also a possibility that the respondents are not familiar with online surveys as they are with the traditional survey. This will discourage them from clicking the link or they may feel anxious just in case they make mistake in answering or submitting. The researcher will also need to ensure that the respondents have convenient access to internet as this could be a discouraging factor. The instrument will be send to their email addresses.

Table 3.2

Summary of Methodology for the Four Phases

Research Question	**Phases**	**Stages**	**Method of Data Collection**	**Instruments**	**Techniques of Data Analysis**
1	Analysis	Analysis	Review of Literature	Document Analysis Protocol	Qualitative Content Analysis
2	Design	Analysis	Review of Literature	Document Analysis Protocol	Qualitative Content Analysis
3	Development	Focus Group	Group Interview	Instrument for Focus Group (Survey and interview protocol for focus group)	Simple Descriptive Analysis Protocol Analysis
		Experts	Closed and Open Ended Survey	Survey	Simple Descriptive Analysis Protocol Analysis
4 & 5	Evaluation	Pilot	Survey	Self-report Questionnaire	Descriptive and Inferential Analysis
		Real	Survey	Self-report Questionnaire	Descriptive and Inferential Analysis

Once these permissions are granted, the researcher chooses mathematics lecturers from each branch campuses of the University for as participants for the pilot study and the Head of Mathematics Department of the matriculation college as the representative for each college. The representatives assist the researcher during the data collection process. To ensure that responds were maximized from each branch campus and each college, the researcher personally engage with the management of the Mathematics Department of the university and the Director of each Campus to obtain their full support and cooperation. The representatives are continuously in contact with the researcher to discuss any problems during the data collection process. The representatives are to mail the responds back to the researcher using a pre-paid Poslaju service. One of the advantages of using the survey method is the fact that it can be distributed to a big number of respondents without limitation on geographical boundaries or system interference in distributing the survey (Handwerk, Carson, & Blackwell, 2000). The representatives were informed that the respondents should be able to finish responding to the questionnaire in 20 minutes. However, more time can be allocated if needed by the respondents.

Instrumentation

The section on instrumentation discussed instruments used at different stages of the instrument development process, justification on why certain instruments were chosen, and issues on validity and reliability. Six instruments were used at different phases of the ADDIE model: (1) the document analysis protocol used during the analysis and design phases, (2) the protocol for group interview used for participants in the focus group, (3) survey question also used for participants from the focus group, (4) survey questions used for the panels of experts, (5) trial version of the self-report survey for the pilot study and (6) the self-report survey for the field work which are all in Appendix C. These instruments need to have certain level of validity and reliability since they directly contributed towards the validity and reliability of the instrument being developed (Streiner & Norman 2008).

The document analysis protocol used during the analysis and the design stages provide some parameters of the study area based on the theoretical framework. Besides ensuring that data collected are within the domain of the research area, the protocol serves as a guidance to ensure that enough literature for respective areas were searched. The protocol consists of guidelines for the literature search for each of the activities. In the design phase for example, under constructing a pool of item, there is a list which guides the researcher in finding the literature, for example: what is considered as good items, suitable number for an instrument, and samples from previous literature and instruments.

Table 3.3

Instruments and Validity at Different Stages

Phases	**Stages**	**Method of Data Collection**	**Instruments**	**Validity of Instrument**
Analysis	Analysis	Review of Literature	Document Analysis Protocol	Content validity: Expert's assessment
Design	Analysis	Review of Literature	Document Analysis Protocol	Content validity: Expert's assessment
Development	Focus Group	Group Interview	Instrument for Focus Group (Survey and interview protocol for focus group)	Content validity: Expert's assessment
	Experts	Closed and Open Ended Survey	Survey	Content validity: Expert's assessment
Evaluation	Pilot	Survey	Self-report Questionnaire	Content and Construct validity
	Real	Survey	Self-report Questionnaire	Content and Construct validity

To obtain the qualitative and quantitative data from the focus group, survey method and group interview protocol were used (see Appendix C). The survey questionnaire requires participants to evaluate the items per their clarity, relevancy, language and understanding using a five-point Likert scale. The protocol for group interview provides additional qualitative data to further support the available data. The protocol was shown to an expert to confirm the content validity. Focus group interview was used by Rokeach (1973), Schwartz, (1992), and Lutrell (2010) as a procedure to improve content validation. The combination of the survey and the interview methods complement each other to provide a more holistic picture of what the participants think of the items from the aspect of clarity, relevancy, language and understanding. Examples of questions for the protocol group interview were: is this item clear enough, is there any vague terminologies, how do you suggest the rephrasing of items should be, does the item represent the said values, do you have suggestions on words/phrases to replace the current ones, and does the item represent the said value.

The next instruments are the three instruments used for the three panels of experts. Survey questionnaires consisting of five-point Likert scale were used to get feedback from three different panels of experts. Feedback from an expert was sought for the three instruments to confirm their validity. Luttrel et al. (2010, 2011) and Liman et al. (2013) demonstrated that the experts' contributions could enhance the content validity. To serve this purpose, an online survey consisted of rating and open ended questionnaire were used. One of the panels need to evaluate the items from the aspects of relevancy, representation of values, quality of the translation and whether the collection of items represents the dimension of the sub construct. The next panel evaluates the items on the difficulty, clarity, and readability levels of the items and the third is on the format, presentation, allowance of time, general presentation and suitability of the instrument.

The initial instrument built is used for the pilot study and later being revised for the real study. As discussed previously, values in mathematics classrooms are multi dimensions latent trait which generally is defined operationally as personal inclination or preference can be documented using a self-report survey. Earlier research on values in mathematics education by Bishop, Beswick (2005), Dede (2009), Luttrel (2010), Nik Azis (2014) and Liman (2013) suggested that survey design can assist in collecting data on the perceptions on values. Items for this instrument were developed by referring to the VAMP study (Bishop (2002); Bishop and Seah (2007)) and Nik Azis (2012, 2014) besides looking through from other researchers such as McClure (2002), Kajander (2007), and Mazlini (2010).

Once the instrument has been revised from the feedback provided by participants of the focus group and panels of experts, the trial version of the measurement instrument was pilot tested before administering it for the field study. The instrument consists of two parts, the demographic and a list of values items for the respondents to rate. Instructions for the candidates include the objectives of the instrument, and explanation on the rating scale. The instrument was shown to experts for validation purposes before being used during the pilot study. Findings from the statistical analysis provides validity and reliability thresholds to produce the version for the real study.

There are assumptions required for statistical test for example a test might require a certain type of data, types of variables, impact of outliers, the need for independent of observations, normality, homogeneity of variances, or sphericity. It is typical that the data fails to fulfill the assumption or the study ignores outliers and run the statistical test even if the data violates certain data. The researcher will not transform the data to make it normal, instead an alternative statistical test will be chosen. Chapter Four will deal on how these assumptions are met before a certain test is used or how certain violations of the assumptions were dealt with. The assumption for normality for example was tested using the skewness, kurtosis, and Kolmogorov-Smirnov test. In certain cases, the researcher uses nonparametric test such as the Kruskal-Wallis test to rank several populations.

Data Analysis Techniques

The analysis of the data is presented in three segments starting with the analysis, development and evaluation phase and focusing on: (a) data analysis techniques used, (b) justification for its usage, (c) weakness in the analysis technique used, and (d) actions taken to minimize the weaknesses.

Analysis technique during the analysis phase. Qualitative content analysis is used during the analysis phase. The analysis stage consists of qualitative data related to the current issues, trend of research, answered and unanswered problems, conceptions of constructs, common theoretical framework, objectives of current research, and findings of the research. The analysis includes investigation on eight instruments related to values assessment from the literature. The instruments were reviewed on ten (10) relevant aspects, namely: (a) area or disciplines in which the instrument is designed for; (b) founder and user of the instrument; (c) purpose and objectives of the scale; (d) theory or theoretical framework; (e) factor structure includes conceptions and definitions of values and its sub-constructs; (f) target group; (g) scope of scale; (h) design, format, item pool, example of items, scaling formulas, number of items, chronology and rational review; (i) validity and reliability; and (j) strength and weaknesses of the scale. A summary table for each instrument discussed on important elements of the instruments such as values conception, sub-construct, instrument design, and validity is presented.

Analysis technique during design phase. The design phase focuses on matters like formats for the instruments, the scale, formation of pool of items, formula for scaling, and instruction for the respondents. Qualitative content analysis is used in which the researcher study related literature for the past two decades to assists in designing the instrument. The focus of the search would be the format used by other researchers, conceptions of the constructs, items used, the formula for scaling values and samples of instruments related to values in mathematics classrooms.

Analysis technique during development process. The analysis on the development stage consisted of analysis of data collected from the focus group survey and interview and content validation by the three different panels of experts, and the improvement done by the researcher to the instrument.

Analysis technique for the focus group. The quantitative data is obtained from the survey questionnaire where the participants evaluate the items from the aspects of clarity, relevancy, language and understanding. The average scores for each item on the different aspects are presented. The researcher also presents histograms for each of the dimensions on the agreement of the respondents on how well the group of items represent relevant dimension. The qualitative data was obtained from the verbal and the written comments provided by the participants of the focus group in providing sufficient information in explaining their opinion on the clarity, relevancy, language and understanding of the items. These data were organized to make them easier to work with such as categorize the comments under various variables or identification of pattern and spotting of trends. The researcher will also pick up the verbal comments by the participants and document them. Although the comments and feedback provided by the participants involved will demonstrate divergence opinions of them, these are valuable information to the researcher in making decisions of inclusion or exclusions of items to the instrument. Nonetheless, all these comments digested and interpreted will be influenced by the researcher's background knowledge and how she views a situation.

Analysis technique for panels of experts. To create a valid instrument of an underlying latent construct, it is very crucial that the instrument is thoroughly critiques by experts, evaluated, and pilot tested before it is administered to the targeted sample. The analysis was quantitatively and qualitatively done. Data from Panel A is analyzed on whether the initial pool of items represent the respective sub-constructs, whether the English and Bahasa Malaysia versions are comparable and whether the collection of items represent the respective values. Analysis for panel B is focused on whether the item is understandable, clear, and readable. Lastly, Panel C analysis is on whether the layout is appropriate, whether it looks professional and whether it suits the targets. The mean score of each item on several aspects being evaluated is used to determine whether an item is having a problem or not. Items with high mean value are items with least problem and do not need too much attention as items with low mean scores. This could help in identifying for example an item with high mean in difficulty level of clarity which is a signal that the item was found not clear by the experts.

The qualitative data obtained from the open-ended questions posted by the researcher after each dimension provides supportive data and often complement the findings from the quantitative data. It will provide the researcher with richer data, as more explanation is provided to enhance certain points. The data is collected and grouped per similar theme for analysis. Items which receive excellent mean for the criteria and do not receive any negative feedback will be traced and reported.

Analysis technique during evaluation phase. The quantitative data collected for the pilot and real study are both focusing on the construct validity. Each specific item in the instrument may be analyzed separately, or in some cases have it added with other items representing the same family of values to create a score for sub-constructs or dimensions. The values of general education for example are measured by the summated rating scale of sixteen items from: basic values, core values, main values and expanded values. The summated score of values in mathematics education values will be measured from both the dimensions of teaching and learning. The items under the learning dimension will be analyzed separately to determine the psychological inclination of the matriculation lecturers towards values in mathematics classrooms. The values in mathematics will be measured as summated sum from the ideological values, sentimental values and sociological values. However, the analysis of each item for the ideological dimension is done to study the philosophical inclination of the perceptions of respondents on values in mathematics classrooms.

The Classical Theoretical Test (CTT) and the Item Response Test (IRT) were used to study and enhance the validity and reliability of the latent trait which is the values in mathematics classrooms. There are three differences between the two theories, firstly, CTT would provide just one score, it may be the sum of the scores of items in a scale, where in IRT, the trait scores are made available at the item level as well. Secondly CTT generally assumes and provides one reliability indicator, for example the internal consistency or one standard error value for all levels of the scores obtained. Thirdly, within CTT, the psychometric properties, such as reliability, item total correlation, and standard error are sample dependent.

The key idea in CTT is that true score is equal to the estimated value plus error, in which the errors may come from many directions: uncontrolled testing conditions (e.g., distractions and differing context) and probably from the random fluctuations in individual performance. Assumptions for the CTT can be described in four points: (a) the errors are normally distributed; (b) the errors have no systematic pattern to explain scores fluctuation; (c) the errors are unrelated to the true score (it can take positive or negative), and (d) the mean of the distribution of errors over an infinite number of trials is zero since the errors have a normal distribution (Hambleton & Jones, 1993). CTT can explain the difficulty of items, provides insights into the reliability of test scores, and helps us toward coming up with an assessment of how to improve the test by maintaining and developing a pool of "good" items.

Data are keyed into Bond & Fox Step for it to be analyzed using the Item Response Theory (IRT) or the Rasch Model statistical computer software program, Winstep 3.68.2 (Bond et al., 2007). The same data is transferred to Statistical Package for the Social Science (IBM SPSS version 23) for the descriptive and inference analysis.

The analysis of the pilot and the real study started with the descriptive analysis of samples following to the variables of demographic profile such as age, academic qualifications and number of years of experience. Descriptive procedures also address instances of missing data. Normality checks was done by analyzing the skewness and the kurtosis values besides looking at the results of the Shapiro-Wilk test. Skewness measure is used as indicator of asymmetry and deviation from a normal distribution, while kurtosis measure is used to indicate the flatness of the data graphs in which peaked graphs is indicated by positive values and flat graphs by negative values. Assessment of the normality of data is a requirement for several statistical tests since normality is an assumption in parametric testing.

Reliability coefficient provides information on how much measurement error there is and where the sources of error came from. Researcher would want to minimize error so that the only difference capture in the scores is the differences in true respondent ability. The reliability estimates reflect the degree of the homogeneity of the items within each scale of the inventory. Cronbach's Alpha can be computed using SPSS and is used to check reliability of construct, sub-constructs, dimensions, and items (Cronbach, 1951). This will demonstrate the repeatability, stability, or internal consistency of the instrument.

Further item analysis is done by computing the inter-item correlation, item-total correlation, Cronbach's alpha when item is deleted, unidimensional, and factor structure. In this study, Pearson's correlation is used to study the correlation between items and item-total correlation. Inter-item correlation is used to determine whether constituent items are measuring the same sub-construct (Bowling, 1997). The item-total correlation represents the Pearson correlation of an item with the total scores of all other items (Garson, 2007). In this study is done separately for the three sub-constructs of the instrument. Item-total correlations help demonstrate whether the items belonging to a sub-construct are measuring the same underlying sub-construct. If they do all of them should correlate with the total score from the instrument or the sub-constructs. Low item-total correlation is an indication that the item is not strongly correlated with the overall scale, which is a sign that the item needs to consider to be dropped. Correlation study is done to investigate the connections between two or more variables and how the change in one variable effect on other variables. This may shed some lights on any issue and probably potential causes of an issue for the researcher to pave ways for further intervention.

The unidimensional test is done to the data to check that the instrument is measuring the latent trait in one direction. Unidimensional study provides information on whether the collection of items for a specific sub-construct measure the same traits that they are supposed to measure and whether all items in the instrument measure the same trait that that the instrument is supposed to measure and is local independent in which the response to a given item is independent from the responses to the other items in the questionnaire.

The chi-square test is used to indicate whether results of a cross tabulations are statistically significant, although it does not provide information on the nature of the differences. The four assumptions for chi-square procedures needed to be fulfilled for the real study data before using it. First, selection of sample for the real study was not biased and is independent of observations because a respond by a participant provided no information about another person's response. All responds were mutually exclusive where there are no overlapping responds. Lastly, no expected frequency should have expected value (count) less than 0, and no more than 20% of the cells have expected values (counts) less than 5 because this will make the probability to be less reliable.

For the real study, mean differences between groups which belongs to the demographic profile is included in the analysis. Kruskal Wallis was conducted to study whether the differences in values in mathematics classrooms among matriculation teachers vary significantly per gender, age, education background, teaching experience, and interest in mathematics. The researcher also analyzes the inclination of the respondents towards the teaching psychology and the philosophical view on the nature of mathematics. Difference between or among two groups of more is to identify factors contributing towards the score of values in mathematics classrooms. Although it may not say much about the cause of the situation, it may contribute towards the profiling of mathematics lecturers at Matriculation College.

In this study, the Rasch Model is used parallel the Classical Theory Test (CTT) focusing on item responses pattern as a decision making of item retention or deletion. It is worth noting that problematic items may also be identified due to high levels of non-response. Rasch analysis provides useful information to be used for checking whether the data fit the model using measures such as Point Measure Correlation (PtMea Corr), Outfit

Mean Square (MNSQ), and z-standard Test (Fisher, 2007). However, the analysis in this section will also cover the Infit and Outfir Mean Square (MNSQ), item separation reliability, person separation reliability. The item separation reliability is investigated to see how well the items are consistent and would be reproduced with another sample of respondents in terms of the relative order of item difficulty. The person separation reliability on the other hand will provide the information on how well the test is successful spreading out and identifying differences among respondents.

This study uses confirmatory factor analysis (CFA) to test the conceptual theoretical framework chosen. Factor analyses are performed by investigating the pattern of correlations (or covariance) between the observed measures. The objective of confirmatory factor analysis in this study is to determine the ability of a predefined factor model to fit an observed set of data, to test whether a set of factors are correlated or uncorrelated, and establish the validity of a single factor model. It will test the hypotheses about a factor structure, the relationship between the items (values indicators) and underlying dimensions and sub-constructs as suggested by the universal integrated approach. The study focuses on the fit index such as the Tucker Lewis Index (TLI), Confirmatory Fix Index (CFI), root mean square error (RMSEA), root mean square residual (SRMR), and AIC. Response category is also analyzed to check whether there is a need to collapse or expand the categories of analysis.

Summary

The objective of the study is to develop a valid instrument with psychometric characteristics. It involves four different sets of research respondents throughout the development process: (a) lecturers teaching mathematics preparatory subjects (focus group), (b) experts in mathematics, mathematics education, values in mathematics education, and measurement (panels of experts), (c) lecturers for the faculty of mathematics of a local university (pilot study), and (d) mathematics lecturers at Matriculation colleges (real study).

Chapter Three has established that the ADDIE model is appropriate in building a self-report instrument to measure values in mathematics classrooms through the analysis, design development and evaluation phases. This theory driven model is a preplanned method to guide the development and the establishment of the reliability and validity of the instrument. The model requires the researcher to be creative and innovative in making decisions and deciding on suitable activities and statistical test at each stage. It was required of the researcher to understand the universal integrated perspective, understand the conceptual definitions of values proposed by the theory, understanding the framework of the ADDIE model, skillful in addressing tasks like items constructions, interview sessions, communicating with people, performing validity and reliability tests, analyzing the findings and reporting.

Validity and reliability are the objectives of the research, which are vigorously considered, to ensure that the scale is measuring values in mathematics classrooms. The qualitative and quantitative data obtain from this model provides richness in data and enhance data quality. The systematic development procedure can reduce measurement errors which possibly occur from the instrument content, instrument design, instrument format, and the respondents.

The instrument is a 36-items self-report questionnaire which uses five-point Likert scale. Data are collected and analyze via several techniques: (a) the analysis phase uses documents from the literature and the themes of the variables are grouped and analyzed resulting in qualitative data, (b) rating of items, interviews, and open ended questions are used for the focus group where the average scores are taken for each items and all verbal and written comment being documented, grouped, and analyzed, (c) rating of items and open ended questions are used for the panels of experts in which the average mean is calculated and the open ended questions being grouped, documented, and interpret, (d) refined version of self-report survey is used for the both the pilot and real study where the descriptive and inferential statistics are used. The focus of the inferential statistics includes internal consistencies of items, dimensions, sub-constructs, and constructs, correlation test, uni-dimensionality test, and rating scales analysis. The researcher investigates the contributing factors of the values and the inclination of the teaching psychology and mathematical views of the respondents. Chapter Four will further demonstrate the analysis of the data obtained from each of four phases: analysis, design, development, and evaluation.

Chapter 4 Research Findings

This chapter discusses the results for the development and assessment of a newly developed instrument. The development and validation processes were in large part focused on reducing error in the measurement process during five sequential steps involved. The main focuses were on: analysis of documents, construction of the conceptual framework, design of instrument, review of instrument, and determination of validity and reliability. The development model was adapted from ADDIE which is a popular instructional design framework to build instructional course material. The study followed the phases in the model which were analysis, design, development, and evaluation with I=implementation phase being dropped out. It was a systematic iterative step, served as guideline for the instrument's development.

The discussion began with the data obtained from the Analysis phase where thorough study of relevant literature is done with the objectives: to further understand the current situation of research on development and assessment of values in mathematics classes; identify related problems and issues associated with instrument developments, formulation of theoretical framework suitable to conceptualize the construct, and confirming the purpose of this study and research questions. Discussion on the Design phase was targeted on identifying: format of instrument; types of items; generation of initial items; calculation of scores; and instructions for respondents. The Development phase on the other hand, involved activities to confirm content validity through interviews done during the focus group discussions and sorting feedbacks from three panels of experts of the area. Feedbacks from these two activities were used to improve the initial set of items and the questionnaire. Evaluation phase is focused on construct validity and reliability through the pilot and real study. This chapter ended with synthesis of the results, integrating all the theoretical and empirical evidence sources.

Analysis of Documents

The Analysis phase involved collecting and reviewing literature pertinent to the development of instrument to assess values in mathematics classrooms. The search included studies on problem statements, research questions, relevant theories, conceptions of construct, related instruments, sub-constructs, dimension, formats of instruments, items constructions, data collection, data analysis, scoring scale, sampling, related issues, validity and reliability. Thorough exploration of relevant information of reliable sources from books, journals, online journals, and proceedings were done by the researcher for materials from the last two decades. A thorough understanding and having a critical view of the relevant issues and problems through literature search provided better preparation and understanding on the subject matter for the foundation of the study. Data gathered during this phase is in the form of qualitative data.

The section presented the analysis on eight instruments related to assessment of human values and values in mathematics education. The selected instruments were known to assess values from several aspects such as human and personal values (Rokeach, 1973 & Schwartz, 1992), mathematics education values (Bishop et al., 2005, Bicak & Durmus, 2006, and Dede, 2011), beliefs in mathematics education and mathematics (Beswick, 2005b), motivation in learning mathematics (Luttrell, 2010) and mathematical values inculcation in mathematics content delivery (Liman et al., 2013).

Review of these instruments were focused on ten relevant aspects, namely: (a) area or disciplines in which the instrument is designed for; (b) founder and user of the instrument; (c) purpose and objectives of the scale; (d) theory or theoretical framework; (e) factor structure includes conceptions and definitions of values and its sub-constructs; (f) target group; (g) scope of scale; (h) design, format, item pool, example of items, scaling formulas, number of items, chronology and rational review; (i) validity and reliability; and (j) strength and weaknesses of the scale. Discussion started with the review on two instruments on human values followed by one instrument on belief system and five instruments on values in mathematics education.

Rokeach values survey (RVS). The most frequently cited definition of basic human values acceptable in all cultures was the one coined by Rokeach (1973) and widely used for inter cultural studies. The theoretical perspective on the nature of values from the social psychology aspect received widespread attention from researchers of various backgrounds. It was defined as a lasting and continuous belief that the specific manner of behaviour or is a personal or communally preferable as compared to the opposite manner of conduct.

In this context, Rokeach (1973) defined values as standards or criteria of personal and human values to guide actions, judgment, choice, attitude, evaluation, argument, exhortation, rationalization and attributions of casualties related to individuals and the community. He further distinguished human values into the instrumental and the terminal values. Terminal value is the preferred system of one's priority in representing their primary goals in current society. Terminal values included equality, salvation, wisdoms, world of beauty, an exciting life, and a comfortable life. The instrumental values, in contrast, represented the prioritization of an individual's preferences with respect to the means employed to achieve preferred end-states. They included values such as capable, self-controlled, logical, independent, and forgiving. Rokeach Value Survey (RVS) was one of the very few instruments which were based on a well-articulated conceptualization of values and was known to involve a multitude of cross-cultural samples (Schwartz & Sagiv, 1995). It remained a popular instrument until today and was confirmed to be able to discriminate people in terms of their race, sex, religion, occupation, and political ideology.

The instrument required respondents to rank 18 terminal values followed by 18 instrumental values, in the order of importance of the function of the values as guidance in life. Hundreds of literatures on values and peoples' personal experiences from 100 American city populaces and a sample of graduate students were implored before finalizing the 36 values. With the relatively high test-retest reliability coefficients the instrument had been used by hundreds of studies across a wide spectrum of areas including multi-cultural studies (Bond, 1988 & Wynd & Mager, 1989), value inclination of the Americans (Rokeach, 1973; Kahle, 1983; Pottick, 1983), changes of values in individuals (Ball-Rokeach, 1985), relationship of individual's and organizational values (Rokeach, 1979; Connor and Becker, 1979), how values is used in the evaluation of product attributes (Scott & Lamont, 1974), products' inclination (Vinson, 1977), spouses decision making (Weber, 1973), and market dissection (Vinson & Munson, 1976).

Reliability was quite low for the test-retest check done with students in college and high schools. The college students' reliability coefficients were between .78 and .80, and between .70 and .72 for terminal and instrumental respectively. The 7th and 9th graders' reliability scores were between .53 and .61 for instrumental between and .62 and .63 for terminal values. Table 4.1 sums up the discussion from the objectives, aspects of theory, values definition, sub-construct, instrument design, validity attempt, target group, and strength and weaknesses.

Table 4.1

Summary of Rokeach Value Survey - RVS (Rokeach, 1973)

Objectives	To measure personal values to provide information on how society operates.
Theory	Human Value Theory
Values Conception	Enduring belief that a specific mode of conduct or end-state of existence is personally or socially preferable to an opposite or converse mode of conduct or end-state of existence. Values served as standards or criteria of personal and human values to guide actions.
Sub-Constructs	Sentimental values and Terminal values
Instrument Design	18 Sentimental Items; 18 Terminal Items; Ranking per importance to one's value system. Later rating with 7-Likert point is used.
Validity Attempts	Focus group. Terminal values were from his compilation of several hundred from the values literature. Relatively high test-retest reliability coefficients over three week intervals. Instrument was improved from ranking to rating scale.
Target Group	Adults from a wide spectrum of areas in social science
Strength/weakness	Economical, broad spectrum of human values, well-articulated conceptualization, various applications across cultures. Forcing subjects to rank a value at the expense of another was not accurate and differences between the instrumental and final values were not made clear

Despite its popularity, RVS has its limitation. Forcing subjects to rank a value at the expense of another was not considered as accurate, as both values might be equally important to a subject. Furthermore, in measuring the scale, RVS preclude the possibility of using the wide variety of statistical analysis available. Researchers like Braithwaite (1982), Braithwaite and Law (1985) and Feather (1988) were involved in attempts to improve the instrument's validity and reliability. Format was suggested to be changed from ranking to rating using the 7-point Likert scale and multi items representation of a values were used instead of unidimensional (Miethe 1985). Ratings was proven to supply a more reliable data (Feather, 1988). His definition however was criticized to be too general since most of the time values were not objective and often they were related to individuals and community. Differences between the instrumental and terminal values were also not made clear. For example, forgiving can be an instrumental as well as the final values.

Schwartz's Value Survey (SVS). Schwartz (1994) was inspired by how priorities held by individuals influenced their behaviour and choices they made daily and how these values influenced the philosophies, attitudes, politics, religion, and the environment.

His work represented an intercultural exploration with the other 50 collaborators all around the world. He discarded 11 of the 36 Rokeach's values which did not represent the criterion of cross-cultural stability in the meaning of the values such as courage and salvation, and instead replace them with the values power and tradition. The values of all world-religions and items from cultural-specific questionnaires from other continentals such as Africa and Asia were taken into consideration. More than 60000 individuals from 64 nations on all continents contributed towards the effort on enhancing the validity of the instrument.

SVS is based on the Theory of Basic Human Values, in which values such security, independence, wisdom, success, kindness, and pleasure as were regarded as an important element in lives. They were contextualized as anticipated goals which varies significantly in people's lives and depended on the type of motivational individuals have.

Ten motivationally distinct values orientations acceptable and recognized by all cultures were characterized by its central motivational goal such as self-direction, stimulation, hedonism, achievement, power, security, conformity, tradition, benevolence, and universalism. These values were implicitly accepted and grounded in universal requirements. In one of his work, Schwartz attempted to include the “spiritually” values but were found that it was not recognized by all cultures (Spini, 2003).

The ten values map exactly onto four dimensions such as: opposing self-transcendence (universalism, benevolence), self enhancement (power, achievement), opposing conservation (tradition, conformity, and security), from openness to change (self-direction stimulation) as proposed by Lawrence and Nohria (2002). These distinct types of values were organized in a circular structural demonstrating the compatibility and the dissimilarities between the values.

The Schwartz’s Value Survey were used extensively in a cross-cultural study on young adolescent from Uganda, Germany, Chile, Portugal, Australia, Singapore, the Philippines, and Indonesia with different number items (Bubeck & Bilsky, 2004; Liem, & McInerney, 2010). Respondents were to rate on how important each value item as a guiding principle of one’s life on a 7-point scale. The non-symmetrical scale is heavier at the upper end and condensed at the bottom to be able to map on how people do their thinking on values. The scale also enabled respondents to report opposition to values that they tried to avoid expressing or promoting, especially necessary for cross-cultural studies as people in one culture may not agree with values from other cultures.

Another study to test a partially new structure for how human values can be categorized through studies on areas such as: Behavioural prediction (Bardi & Schwartz, 2003), faith in organization (Devos, Spini& Schwartz, 2002), faith between groups (Schwartz, Struch, & Bilsky, 1990), comparing values between various cultures (Schwartz, 1992), values and its correlation to political views (Schwartz, 1996), and values and its correlation across differing religions (Saroglou & Dupuis, 2006). The

Schwartz Value Survey (SVS) has evolved since it was first tested on 60,000 adolescents and adult in 64 nations on all continents. It has been translated into 50 languages.

The instrument caught the attention of many researchers and several attempts were done to improve the instrument to suits the sample and for shorter time consumption. Since SVS was found to be inapplicable for the youngsters, the older generations and those who were not educated in Western schools that emphasized abstract and free thinking.

Table 4.2

Summary of Schwartz Value System – SVS (Schwartz, 1992)

Objectives	To measure the personal values that are important to individuals
Theory	Basic Human Value Theory
Values Conception	Values were contextualized as desired goals varying in its significance in people's lives depending on the type of motivational goal they express.
Sub-Constructs	Ten distinct types of values: Power, Achievement, Hedonism, Stimulation, Self-direction, Universalism, Benevolence, Tradition, Conformity, Security
Research Design	Survey 56 items (1988); 57 items (1994); 7-point Likert scale, non-symmetry
Validity Attempts	Focus group and alpha reliabilities of the 10 values average .68, ranging from .61 for tradition to .75 for universalism
Target Group	60,000 adolescents in 64 nations on all continents
Strength/weakness	Strong and sound instrument that have been tested at a large scale around the world, translated into 47 languages, try adding universal value 'spirituality' as a universal value Inapplicable for the youngsters, elderly and persons not educated in Western schools

Each portrait described individual's goal, ambitions, wishes which indirectly would point to the importance of a certain values. For example, if the statement of thinking up for new ideas is very important, that would be an indication that he prefers to do things in his own way and will point to the values of self-directed.

For each portrait, respondents indicate how much they like the person from a three- point rating scale and compare the portrait to themselves instead of the other way around. The summary of the discussion on the instrument is given in Table 4.1.2.

Mathematics Values Instrument (Bishop). The developments in culture and mathematics such as Bishop's (1988) research on enculturation, gave birth to the first definition of values pertaining to mathematics education which was proposed by Bishop (1996). Seah and Bishop (2000) recognized that culture plays a big role in values in mathematics education, implying that different countries, cities, and school types will uphold different values in the teaching and learning of mathematics. Values in mathematics education were defined by Bishop as the innate affective characteristics and qualities which the education system should aim to instil through the teaching and learning of mathematics. These values whether positive or negative endure longer in one's memories as compared to the conceptual and procedural knowledge related to the learning of mathematics which are likely to fade if not being refreshed often as discussed by Bishop (1996; 1998; 2001). Bishop viewed mathematics as a cultural phenomenon in which values significant to a societal development will influenced the way mathematics was received, taught and learned.

It was fundamental to understand the role of mathematics education in the socio-cultural perspective since the people, and the institutions involved were responsible in placing the values on mathematical symbols, class activities, and outcome of a lesson. However, these values needed to be made explicit for mathematic to make more sense. Bishop (1988) suggested that they were not which values might be, or should be embedded or focused on in mathematics education, but rather on how the mathematics subject were development throughout the Western history. The western views suggested that the source of arguments was mainly from logic and empiricism experiences, in which pragmatism and realism philosophical were used bases of the theories. His views were inclined towards the information theory, social constructivism and symbolic instructivism. To Bishop the values in mathematics' education were formed in the cognitive and operationalized in the cognitive-affective domain in line with the physical and mental strengths of human where these values were absorbed and accepted by individuals.

He categorized values in mathematics education into three categories of interest which were the general educational, mathematics educational and mathematics values. Although Bishop developed definitions for the values in mathematics and mathematics education, he did not pay much attention to general education values. Bishop (1988) viewed values in mathematics as three complementary pairs of values to be balanced in the ideological, sentimental and sociological aspects.

He adopted White's (1959) ideological, sentimental, and sociological component analysis for mathematical views in nature. The ideological component were philosophies involved in interpreting symbols and philosophies, sentimental (attitudinal) component dealt with attitudes towards the subject, feelings attached to people who dealt with the teaching and learning of mathematics, and sociological component which involved the community, customs, institutions, rules and relational behaviour. The values indicators for ideology were known as the complementary pair rationalism versus empiricism, the sentimental value indicator was control versus progress, and the sociological values were known as openness versus mystery sociologically. Mathematics Educational values were related to general societal values, mathematical values were related to the scientific discipline of mathematics and mathematics educational values are related to pedagogy of mathematics, that is, to practices and norms emerging from mathematics instruction (Seah & Bishop, 1999; Atweh & Seah, 2008).

The expansion of the study related area of values in mathematics education were done on values in mathematics textbooks by Seah (1999). In that study, mathematics education values were viewed as five (5) complementary pairs where: formalistic versus activist view of mathematics learning (Dormolen, 1986), instrumental versus relational understanding and learning (Skemp, 1979), relevant versus theoretical nature of mathematics teaching and learning, accessibility versus specialism of mathematics knowledge, and utilizing mathematical skills as part of a process versus as a tool.

The study on comparison of values between primary and secondary mathematics and science teachers used Bishop's (2008) instrument. In the early stage of the study, 2 mathematics teachers and 2 science teachers were in involved in an interview to come up with the framework for similarities and differences of values held by educators of mathematics and sciences (Corrigan et al., 2004). In the study, participants were required to rate the activities for the first two questions based on the importance and emphasis in both the science and mathematics teachers. The scale used was 4 (always), 3 (Often), 2 (Sometimes), and 1 (Rarely).

The items in these questions were designed to explore aspects of rationalism, empiricism, control, progress, openness, and mystery. Question 1 and 2 consisted of 18 questions where each of the six values from mathematics as knowledge was represented by three questions. For example, "mystery", was represented by how frequent do teachers stimulate students' mathematics imagination with pictures and artworks. Participants were also asked to decide how frequent they used the listed activities in their classes using the same Likert scale. Examples of the activities were mathematical artwork, puzzles, and using mathematical paradoxes.

Questions 3 and 4 were related to the teachers' preferences for the six mathematics values. Each mathematical value is represented by one statement, for example the statement "It emphasizes argument, reasoning and logical analysis" was related to rationalism. Questions 3 and 4 required the respondents to rank the six statements in each question following the scale where '1' indicates your first choice, '2' your second choice, '3' your third choice, etc. The respondents could have the same ranking value for more than one statement. The paper however did not discuss on evidence of validity and reliability.

Bishop's definition on values in mathematics education was widely accepted by researchers like Chin, (2006) and Chin and Lin (2001) from Taiwan and Liman (2011) from Nigeria. Researchers from Turkey, Durmus and Bicak (2006) and Dede (2009 & 2010) constructed their instruments measuring values involved in the teaching and learning mathematics using Bishop's conceptual definition. The only study which was done on values towards a specific content in mathematics was done by Dede (2006b) which was specifically related to the content towards function concept.

Although Bishop provided a conceptual definition for the mathematics education and mathematics values, the instrument which he developed was mainly focused on mathematics values. Table 4.3 sums up the discussion from the aspects of objectives, theory, values definition, sub-construct, research design, validity attempt, target group, strength and weakness.

Table 4.3

Summary of Mathematics Values Instrument (Bishop, 2008)

Objectives	To investigate teachers' preferences and practices regarding values in teaching mathematics and science.
Theory	Social-cultural perspective, symbolic interactionism, and social constructionism.
Values Definition	Define values as the deep affective quality nurtured through mathematics education limited to classroom setting, personal, institution and community
Sub-Constructs	Mathematical values: Rationalism-Empiricism, Openness-Mystery and Progress-Control
Research Design	Case study; 3 point Likert scale; 18 ranking questions on values emphasized. 18 ranking questions on frequency of activities; 12 value items rank for preferences.
Validity Attempts	None were discussed
Target Group	13 primary and 17 secondary teachers
Results	Values in mathematics and science for the two groups of teachers show interesting differences, reflecting their concerns with the curriculum and teaching at their respective levels.
Strength/weakness	Includes implicit and explicit values. Mixture of rating and ranking. General education values were not detailed out. Do not include meta-physical aspects. Limited discussion on validity and reliability. Ranking values maybe difficult.

Study by Bishop showed that the secondary teachers, favoured rationalism for mathematics and empiricism for science, while the primary teachers, preferred empiricism over rationalism for both science and mathematics. For the sentimental dimension, the secondary and primary teachers preferred progress values as compared to control. Mathematics primary teachers favoured openness while science teachers preferred mystery. The stand-out value here is that of Control, is not a preferable value for the teachers, it often ranked low in teachers' preferences however it was ranked high in practice. On the other hand, the teachers mostly were inclined towards the value of empiricism, but in practice they were more inclined towards rationalism with control indicating some contradiction between beliefs and practice. Both the science and mathematics teachers' values on the practical values were almost the same. The research concluded that teachers' values in the classroom were very much influenced by the respective subject as they perceived it. Thus, changing perceptions of teachers and their perceptions towards the subject may influence the set of values which they may want to adopt in their classes.

Mathematics Value Scale (Durmus and Bicak). Durmus and Bicak (2006) from Turkey constructed Mathematical Values Scale with the intent of distinguishing the positivist and constructivist among the pre-service mathematics teacher from the elementary and high schools using the definition of mathematics values developed by Bishop. The study was mainly based on behavioural and cognitive constructive approach. The positivist values refer to teachers' objectivity, control, mystery, accuracy, and clarity in their mathematics teaching. On the other hand, the constructivists valued rationalism, progress, openness, creativeness, enjoyment, flexibility, and open mindedness reflecting the student centred approach. Definitions were directly taken from Seah and Bishop (2002) five pairs of mathematics education values and Bishop's three pairs of the mathematical values Bishop (1988, 2004). Being in the western education system, researchers from Turkey were holding to the secularism philosophy which implied that the divine guidance, worship of God, and obedience to Him should be confined to individuals' personal life. Other worldly affairs should be disassociated from the influence of God, since God has nothing to do with this world.

Durmus and Bicak (2006) used a 5-point Likert scale with 34 items which were distributed to 231 primary and secondary mathematics student teachers. The Likert scale ranged from "I agree absolutely" to "I absolutely don't agree" with scores ranging from 1 to 5. The face and construct validity were confirmed by three subjects' specialists. Their feedbacks were used to reconstruct the items. Principal component factor analysis identified two main factors namely the constructivist and the positivist mathematics for mathematics education values. Twenty (20) of the items were loaded to the sub-category of constructivist and fourteen (14) were loaded to the sub-category of positivist. The number of items in the questionnaire was reduced from 40 to 34 after a sequence factor analysis was executed in which six (6) items were with item-test correlation below 0.30 were removed.

The positivists items are indicators items on the principle of mathematics learning which was to learn the logic behind mathematics and knowledge, the fact that students not only learn from the correct solutions but also from the mistakes they made, Mathematics can be an activity which needs creativity, and school mathematics must have a sense of joy and appreciation towards the subject. Some of the samples of the constructivists values indicators were: searching for the right solution should be the focus in teaching mathematics, new topics in mathematics cannot be learned unless the previous knowledge was made known, students must try and understand the explanation provided by the teacher instead of trying to make sense of the concepts and relations on their own, and the main source of knowledge in teaching mathematics would be teachers.

Cronbach alpha was used to measure the reliability of positivist (0.64), constructivist (0.74) and the overall (0.73). The Pearson correlation coefficient between the two sub-categories was 0.20. Table 4.4 summarized the discussion from the aspects of theory, values definition, sub-construct, research design, validity attempt, target group, strength and weaknesses.

Table 4.4

Summary of Mathematics Values Scale (Durmus & Bicak, 2006)

Objectives	To investigate Turkish preservice mathematics teachers' mathematical values.
Theory	Behavioural, cognitive constructivist approach
Values Definition	Sub constructs are mathematics education values (Seah & Bishop, 2000) and mathematics values (Bishop, 1988)
Sub-Constructs	positivist values: teachers' objectivity, control, mystery, accuracy, and clarity in their mathematics teaching constructivist values: rationalism, progress, openness, creativity, enjoyment, flexibility, and open mindedness reflect the student centred approach
Research Design	Descriptive survey research; 14 positivist items and 20 constructivist items, 5 point Likert scale
Validity Attempts	Face and content validity – subject specialist construct validity - Principal component factor analysis – identified two main factors (positivist and constructivists) Cronbach Alpha - measure the internal consistency coefficients (2 factors and overall) Reliability – Items further reduced from 40 to 34
Target Group	231 Pre-service primary and secondary mathematics teacher
Results	Preservice primary and secondary mathematics teachers seemed to adopt constructivist values rather than positivist values in their mathematics teaching.
Strength/weakness	Economical instrument. Western view of mathematics, discussion on validity and reliability effort available, although not comprehensive.

The instrument was used in the study done by Dede (2009), with the objective of exploring the pre-service teachers' mathematical and mathematical education values and how these values differ within department of studies, grade levels of students and gender. The findings contributed towards the investigation on weather teachers and students may demonstrate the environment where construction of knowledge was expected to be done through active participating, reflection and abstractions. The study revealed that teachers from both the preservice primary and secondary schools were more inclined towards the constructivist values rather than positivist values in their teaching. Similar study using the same instrument were done by Yacizi et al., (2011) to investigate the relationship between mathematical values of pre-service teachers with their teaching anxieties in mathematics. Teachers with mathematical constructivist teaching values were found to be more prone to develop mathematics teaching anxiety as compared to those positive teaching philosophies.

Mathematics Education Values Questionnaire (Dede). The mathematics educational values were a survey questionnaire by Dede (2011). The study categorized mathematical values into three pairs of complementary indicators of values related to the Western Culture where the knowledge was being developed (Bishop, 1998). On the other hand, mathematical education values were categorized into five pairs of complementary mathematics educational values indicators as being conceptualized by Seah and Bishop (2000). The Mathematics Education Values (MEV) instrument however was not obtainable for further investigation.

The instrument was used to investigate the mathematics education and pedagogical values uphold by teachers. The findings were used as indicators whether the teachers' values were parallel with the education reform implemented in Turkey, which was based on the constructivism philosophy. The development process started with items selection or constructions which were mainly based on the Values and Mathematics Project (VAMP) study done in Australia. Out of fifty-two (52) items, twenty-nine (29) were positively phrased and twenty-three (23) were negatively phrased.

Table 4.5

Summary of Mathematics Education Value Questionnaire - MEVQ (Dede, 2011)

Objectives	To measure mathematics educational values
Theory	Constructivism, Social Cultural perspective
Values Definition	Mathematics education values (Seah& Bishop, 2000) and mathematics values (Bishop)
Sub-Constructs	Mathematical values: Rationalism-Empiricism, Openness-Mystery and Progress-Control Mathematical educational values: Formalistic-activist, relevance-theoretical knowledge, accessibility-special, evaluating-reasoning
Research Design	52 items, 5 points Likert scale

Validity Attempts	Items selection – From VAMP Language validity – two language experts, to translate and back-translate Content validity - three experts in mathematics education, educational measurement and evaluation Understandability and language - Pilot tested Construct validity - Exploratory factor analysis (factors identification) Predictive validity – Item analysis; explore that individual items measured contributed to the total measure; and items and sub-scales were sensitive to expected differences Second item analysis; compared the difference between upper and lower performance groups and the sensitivity of the instrument (ANOVA)
Target Group	107 pre-service primary mathematics teachers
Strength/weakness	Different number of items representing the dimensions may result in problems in analysis, western view of mathematics Economical instrument, quite comprehensive validity effort

The mathematical values examined in the questionnaire were the three pairs of values defined by Bishop (1988). Each value consists of different number of items: rationalism (3) – objectivism (3); control (5) – progress (6); and openness (3) – mystery (4). The five pairs of continuum values of mathematics education values by Bishop (2005) were used in the instrument. They were: formalistic view (4) – activist view (4); instrumental understanding (1) – relational understanding (4); relevance (2) – theoretical knowledge (4); accessibility (2) – special (2); and evaluating (1) – reasoning (4).

A translation process to achieve language validity was done by two academicians who were fluent in both languages. These academicians were experts in mathematics education, English language and literature all of them had doctoral degree. The experts in language translated the items from Turkish to English and a different expert translated them back into Turkish. The initial draft of the scale was evaluated by three experts in mathematics education, educational measurement and evaluation to confirm the content validity. The items were revised based on the inputs provided by the experts where some items needed to be rewritten but no items were deleted.

The trial version was pilot tested to 30 pre-service mathematics teachers where some items were identified as not easily being understood. The trial version was edited to produce the edited version called the Mathematical Educational Values Questionnaire (MEVQ) and was distributed to 107 pre-service teachers. The data were used to examine the structural and predictive validities. Item analysis was used to enhance the instrument's predictive validity; study the how the individual items contributed to the total measure; and analyse the differences of items and sub-scales.

Teachers' Beliefs Survey (Beswick). Beswick from Australia used beliefs as the construct to define values in mathematics education. The sub-constructs were beliefs in teaching and learning mathematics and the nature of mathematics subject. She defined beliefs generally to be anything that an individual regard as true and was likely to maintain among one's most central such as the nature of mathematics, teaching mathematics and learning mathematics (Ernest, 1989a).

The first subconstruct was categorize into Platonist and problem solving (Ernest, 1989b); the second sub-construct was categorized into content focused emphasizing on performance, content focused with emphasis on understanding and learner focused (Van Zoest et al., 1994), and the last sub-construct was categorized into skill mastery with inactive respond towards knowledge, action taken towards forming understanding, and self-directed exploration of own interest (Ernest, 1989a). These various categories were connected (Beswick, 2005b); for example, if a teacher was an instrumentalist, he/she would be a content focused person besides emphasizing on performance and believed in skill mastery, passive reception of knowledge. A Platonist teacher will be content oriented focusing on active construction of understanding. Lastly, a problem-solving teacher will be a learner focused person and appreciate autonomous exploration of own skills.

Out of the four studies done by Beswick a professor from the University of Tasmania, only one used a survey questionnaire and the rest used open ended questions, interviews and class observation. The 40-item instrument in which 35 items on beliefs about mathematics teaching were created by 'Van Zoest et al., (1994) and five (5) items related to nature of mathematics were adopted from a survey by Howard, Perry, and Lindsay (1997). This 40 items questionnaire was first tried to 35 mathematics secondary school teachers who were not the actual participants in the study. Participants responded using the 5 point Likert scale.

Table 4.6

Summary of Beliefs Survey (Beswick 2005)

Objective	To investigate the connection between beliefs held by teachers and their classrooms practices.
Theory	Constructivism
Values Definition	Beliefs as anything that an individual regard as true and are likely maintained among one's most central
Sub-Constructs	Beliefs Survey Nature of mathematics: Instrumentalist, Platonist, & problem solving Beliefs about mathematics teaching: Content focused – performance, content focused – understanding, Learner focused. Beliefs about learning mathematics: Skill mastery, active construction of understanding, autonomous exploration of own interest CLES Autonomy Negotiation Student Centeredness Prior Knowledge

Research Design	Interviews; Observation; Survey; (26 items, 5 point Likert Scale) CLES (28 items, 5 point Likert Scale)
Validity Attempts	Did not discuss on how the content validity Construct validity. Factor analysis - revealed two factors: instrumentalist and problem solving Reliability - Cronbach Alpha
Target Group	25 mathematics secondary teachers
Strength/weaknesses	No content validity of questionnaire. Can be tedious with so many ways in collecting data. Able to connect the values of problem solving approach with values in constructivism. Consider implicit and explicit values.

The factor analysis revealed two factors related to views on mathematics teaching which were the instrumentalist's view and problem solving views. Items with low correlational values (<0.3) or correlated approximately equal with both factors were omitted. Thus, the survey was reduced to 26 items after eliminating 14 items, where twenty-four (24) items were from 'Van Zoest et al., (1994) and two were from Howard, Perry, and Lindsay (1997). The reliability coefficients were 0.78 for instrumentalists and 0.77 for problem solving view. Beswick did not discuss on how the content of the items were being validated. Her focus was merely on the construct validity which was not extensively discussed in his paper.

The Constructivist Learning Environment Survey (CLES) survey was conducted together with the instrument to measure the four aspects of classroom environments namely: autonomy, prior knowledge, negotiation, and student centeredness following the constructivism theory.

Mathematics Values Inventory (Luttrell). The research by Luttrell (2010), intended to develop a self-perceived inventory on value of mathematical literacy for students from the general education using the expectancy-value theory of achievement motivation (Eccles, Adler, & Meece, 1984; Wigfield & Eccles, 2000). This theory advocated that students' choices, tenacity, and performance were very much influenced by the belief system they have on how well they will succeed and the degree to which they appreciated that activity. Mathematics value aspects were defined as values that bear directly on a person's inspiration for engaging, persevering, and excelling in mathematics.

The researchers conceptualized interest value, utility value, and attainment value as beliefs that could increase the value which students positioned to become someone who so mathematically literate (Feather, 1988) and conceptualized personal cost with respect to beliefs was something which may lead students to devalue the mathematical literacy. The only work which presented detailed process of instrument' development relating to values in mathematics education can be found in Luttrell et al. (2010).

Their main purpose of study was to identify the most important aspects of math-related prizing, to construct suitable items to tap those aspects, and to offer proofs in enhancing the content validity of the instrument. However, his work focused only on mathematics values from the non-science based students' perspectives. The Mathematics Values Inventory (MVI) measured the individual differences perceived value of mathematical in the context of their mathematical literacy. Initial stage of the study was to obtain the most important facets (construct) from literature related to math valuing. The researchers concluded that the constructs can be categorized as interest, utility, attainment and personal cost.

The inventory went through multistep processes of face, construct and content validity by experts in the area and students to further enhance the reliability and validity of the instruments. Five experts were identified to assess the 88 items reflecting the four constructs using the Likert-type response format. Experts were welcome to offer their recommendations for additional facets which they thought were important but did not surface during the literature review. The next step involved item sorting where experts were asked to designate the items to one of the four constructs which they think is most suitable. Items which did not fit into any of the four constructs were categorized as others. Experts may also offer new additional items for any of the four constructs. Four items which did not receive enough votes from the experts were taken out and one item was added to the pool.

Table 4.7

Summary of Mathematics Values Inventory - MVI (Luttrell et al, 2010)

Objectives	To develop a self-report inventory which can measure individual differences in the perceived value of mathematical literacy for the students from the general education.
Theory	Expectancy-value theory of achievement motivation
Values Definition	Mathematics value aspects as covering those values that bear directly on a person's motivation for engaging, persisting, and excelling in mathematics
Sub-Constructs	Interest, General Utility, Need for high, Achievement, Personal Cost
Instrument Design	28 items, 5 point Likert Scale
Validity Attempts	Facet validity – clarity (Five experts) Content Validity Item sorting – into one of the four constructs Language – clarity, meaning, whether it reflect the construct done by 38 students. Normality test – (tried on 944 math majors) skewness, kurtosis and interim correlation Principal components analysis – Factor structure Factor analysis – 27 items to four factors Cronbach alpha coefficients – for all the four constructs Factor analysis – to show factor inter correlations (naming of the factors were revised) Gender-related differences Temporal stability: A test re-test over a 2-week period (55 undergraduate study) Discriminate validity: Marlowe-Crowne Social Desirability Scale
Target Group	Pilot study 944 non-mathematics students Trial Study 1096 non-mathematics students
Results	Scores for MVI did not differ by gender Those with higher MVI scores had completed more mathematics course Scores for MVI were not related to scores on a measure of social desirability
Strength/weakness	Took a lot of time for verification Clear conceptual framework. Instrument went through rigorous processes of validity and reliability.

Once the process was completed, clarity and meaning of the items were reviewed by the same experts. Response options ranged from not at all clear to extremely clear using a five-point Likert scale. Items were also evaluated on whether they reflect the construct that they are supposed to represent. Fourteen items were eliminated when found to be like others, no additional item was added, and leaving 73 items in the pool.

A graduate measurement class consisting of thirty-eight students were asked to participate in rating the wording of each item. They were encouraged to provide recommendations revisions and may offer additional items. However, they did not propose new items but three items were excluded, leaving only 70 items. The 70 item-instrument were tried to 944 non-mathematics majors. Items which demonstrate far from normal distribution were eliminated and those with higher inter correlated items (Pearson's $r \geq .70$) were checked, in which four items with redundancy in content were eliminated.

The factor structure was examined by the principal components analysis and to add to the scree test and Kaiser-Guttmann criterion, parallel analysis was done. During this process four items succeed in meeting the extraction criteria where the item content matched the aspects of interest, utility, achievement, and personal cost. The Cronbach alphas coefficients were all found to be above the recommended minimum. Five new items were added before conducted the second try out to avoid inappropriate of item representation. The 32-item inventory was tried out to 1096 non-mathematics majors.

The MVI scores of students not majoring in mathematics were not differ by gender. However, students with higher scores of MVI seemed to complete more mathematics courses while those with low scores have taken less mathematics courses (Luthrell, 2010).

Values inculcation in mathematical contents delivery (Liman et al., 2013). The study by Liman et al., (2013) was done on values in relation to the mathematics teaching in Nigeria. The initial study (Liman, et al. 2012) was focused on the exploration of the meaningful covariance relationship among the sub-constructs for values inculcation in mathematics teaching and learning and whether the data fit the model for values inculcation in mathematics teaching and learning. The next study was executed and aimed at exploring the latent traits for the values inculcation in mathematics teaching and learning among mathematics teachers. The targeted samples for both studies (Liman et al., 2012 & 2013) were secondary mathematics teachers teaching. A self-developed survey instrument was distributed to a population of 1145 randomly sampled mathematics teachers from the states of Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe. The researchers received 599 feedbacks and only 509 data were used after considering the null and void responses and the outliers.

A qualitative study was done to initially analyze the existing conceptions of related values in mathematics teaching and learning. The dimensions and conceptualizations of mathematical values from Bishop (1988) and Clarkson and Bishop (1999) were extended to develop a new conceptual framework for mathematical values inculcation. The independent variables or the sub-constructs of the Mathematical values inculcation model were hypothesized as ideological, attitudinal, sociological, computational and motivational mathematical values where the first three were adopted from Bishop (1988).

The computational mathematical values had seven items and motivational mathematical values had nine items. Principal Component Analysis and Varimax were used for extraction and the rotation method, structural equation modeling technique and confirmatory factor analysis (CFA) test showed that there was a significant covariant relationship among the latent constructs indicating that they were linearly inter-dependent (Liman et al., 2012). The instrument received a high value of above 0.7 for Cronbach's Alpha indicating good internal consistency of the items. Evidence of constructs validity were detected from the percentage of variance explained of each construct which were all found at the threshold of 40 and above.

Table 4.8

Summary of Mathematics Values Inculcation Instrument (Liman, et al. 2013)

Objectives	To investigate and understand the underlying factors of values inculcation in mathematics teaching and learning among mathematics teachers.
Theory	Social-cultural perspective
Values Conception	Adopts and extends Bishops conception of Mathematics Values
Sub-Constructs	Ideological, Attitudinal, Sociological, Computational and Motivational Mathematical Values
Instrument Design	Quantitative data, 43 items, 7 point Likert scale
Validity Attempts	Construct validity: Structural Equation Modeling, Confirmatory Analysis, Confirmatory Factor Analysis, Goodness-of-fit measures
Target Group	Secondary schools' mathematics teachers (509)
Strength/weakness	A simple questionnaire, easy to handle, validity and reliability checks were done. Based on western education system.

Goodness-of-fit of the data to the model were judged from selected diagnostic measures for factorial validation such as degree of freedom, Normed Chi-square for Hypothesized Model, Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), Goodness of Fit Index (GFI), Tucker-Lewis Coefficient Index

(TLI), Incremental Fit Index (IFI), Standardized Root Mean Square Residual (SRMR) of five factor structure. The values indicated a good fitting model for the sample. Five factors were finally revealed as factors for the values inculcation in mathematics teaching and learning. To conclude, values inculcation in mathematics teaching and learning may use the five factor dimensions. In addition, out of the 52 items proposed only 43 items hypothesized the five dimensions.

Summary of the eight instruments. The summary of the eight instruments investigated were given in Table 4.1.9. Instruments were found to be based on various psychological and sociological theories, providing different structures of sub-constructs, several instrument designs, varying its validity and reliability techniques, and aiming at various sample targets. The eight instruments have several similarities and differences from the aspects of objectives, theory, construct and sub-constructs, design of instrument, validation, and target group which were being analysed in this section which will be discussed here.

In summary, the conception of values in mathematics education used in all the instruments were not compatible to the National Philosophy of Malaysian Education (NPME) which was based on belief in God as the first principle stated in the Rukun Negara (National Principles). At present, the only conception which based on spiritual and faith is the one proposed by Nik Azis (2009). He viewed values in mathematics education as subjective from a holistic perspective where both the physics and the spiritual elements were being addressed. His idea is mainly based on the work by Al-Ghazali (1990) and Syed Muhammad Naquib (1995). This is opposite to Bishop since he regarded all values as relative and subjective and values are determined by human rational thinking or the society norm without any standard reference besides ignoring the metaphysics aspects.

Table 4.9

Summary of the Eight Instruments Analysed

Instrument	Theory	Sub-constructs	Instrument designs	Validity	Target
Rokeach Value Survey – RVS (1973)	*Social psychology, Human Value Theory*	*Sentimental values and Terminal values*	*Rank importance of values to one's value system. Later changed to 7-point Likert scale rating*	*Content validity Test retest reliability*	*Adults from a wide spectrum of areas in social science*
Schwartz Value Survey – SVS (1992)	*Social psychology Basic Human Values*	*Power, Achievement, Hedonism, Conformity Stimulation, Self-direction, Universalism, Benevolence, Tradition, Security*	*nonsymmetrical Survey 9-point Likert scale*	*Content validity Construct validity*	*60,000 adolescents in 64 nations on all continents*
Bishop's Mathematics Values Instrument	*Social-cultural, Social constructivism Symbolic instructivism,*	*Mathematics Education Mathematical values*	*Rating Survey: 3 point Likert scale Ranking, frequency of activities*	*Content validity*	*13 primary and 17 secondary mathematics teachers*
Mathematics Values Scale (Durmus & Bicak, 2006)	*Behavioral, cognitive constructivist approaches*	*positivist values constructivist value*	*Survey: 5 points Likert scale*	*Face validity Construct validity*	*231 pre-service primary and secondary mathematics teacher*
Mathematics Education Value Questionnaire (MEVQ) (Dede 2010)	*Social Constructivism*	*Mathematical values Mathematical educational values*	*Survey: 5 points Likert scale*	*Language validity Content validity Construct validity Predictive validity*	*107 pre-service primary mathematics teachers*
Beliefs Survey (Beswick 2005)	*Cognitivism*	*Nature of mathematics Beliefs about mathematics teaching Beliefs about learning mathematics*	*Survey: 5 points Likert scale*	*Construct validity*	*25 math secondary teachers*
Mathematics Values Inventory (Luttrell et al. 2010)	*Expectancy-value theory of achievement motivation*	*Interest General Utility Need for high Achievement Personal Cost*	*Survey: 5 points Likert scale*	*Facet validity Content Construct validity Test-retest validity*	*1096 non-mathematics students*
Values Inculcation in mathematics Content Delivery	*Social-cultural*	*Ideological Attitudinal Communication Motivation*	*Survey: 7 points Likert scale*	*Facet validity Content validity Construct validity*	*509 secondary school mathematics teachers*

Discussion on the theoretical framework. An explicit, theoretical based definition of the values in mathematics classrooms was essential prior to the attempt of measuring them. The study adopted Nik Azis's conceptual structure of values in mathematics education based on the integrated approach a shorter term for universal integrated approach (Nik Azis, 2009). This theory proposed values as conceptions and beliefs of a person with regards to the significance of something which turn into guidance of their behaviours (Nik Azis 2009, Jeyasingam & Nik Azis, 2014).

In the context of classroom settings, value in mathematics education was categorized into three sub-constructs: the general educational values, mathematical education values and mathematics values (Nik Azis, 2009a, Jeyasingam & Nik Azis, 2014). The framework of the Hierarchy Categories of Values Model proposed that the sub-construct of general education values is related to four dimensions of factors which are the fundamental, core, main and expanded values, where the fundamental is the most basic values need to guide one's life. The next dimension was the core values which were values necessary for one to live a harmonious life. The next dimension was the main value, representing values within an individual which portrayed his/her value system. The last dimension which was the expanded values where individuals have one or more combination of values from the earlier dimensions which may develop an individual into a better being. Faith or believing in God was the indicator for the fundamental values. The core had excellent characteristics, brave, wisdom, and justice as the indicators (Nik Azis, 2009; Al-Ghazali 1992). On the other hand, the main has integrity, cooperation, diligent and proactive as the sample values and the expanded values was related to values in honouring time, enjoy working, internalization of knowledge and lifelong learning as values indicators.

The mathematics education was divided into two dimensions, the values in teaching and values in learning in which teaching and learning were further divided into the values in the purpose and roles of teaching and learning (Nik Azis, 2012). The purpose of teaching has four indicators related to it: theorist, utilitarian, functional, and civilization and the roles of teachers has four values indicators namely: knowledge disseminator, solution guider, construction assistant, and civilisation developer. Literature had shown that there was a link between mathematics philosophies and one's belief systems with classroom practices. All pedagogies used in mathematics class, even if it is scarcely coherent can be linked on a philosophy of mathematics (Thompson, 2002).

In defining the sub-construct of mathematics values, the researcher adopted the most explicit structure in the field of values in mathematics education proposed by Bishop (1999). He distinguished the three levels of individual's values towards mathematics which were values towards mathematics, termed as ideology, values towards individuals as learners of mathematics, known as sentimental and values towards society in relation to mathematics education which is known as the sociological values (White, 1959). He suggested technological, ideological, sentimental (or attitudinal), and sociological, where technology was the motivator for the rest of the values indicators. Bishop (1988) argued that technological component of culture be represented by mathematics itself since the subject could be thought as a symbolic technology. Instead of viewing the ideology as consisting two complementary values rationalism and empiricism as suggested by Bishop, the researcher followed Nik Azis idea where values in ideology is seen to contain values related to the rationalism, empiricism, pragmatism and integrated approaches. The second dimension which was the sentimental value has control and progress as two values indicators. The two indicators came from Bishop except it was not placed as complementary values anymore. The last dimension was the sociological value which consisted of value indicators mystery and openness (as inputs). Nik Azis added image of mathematics as indicator which consisted of separated and related values. Separated values emphasized on rules, atomism and object-centeredness, which were values associated with a view of mathematics as a product, a body of knowledge where the role of humans being minimized. Connected values on the other hand emphasized associations, holism and human-centeredness. These values were the role of human activity in mathematics. In total, there were ten indicators for the mathematics values.

Table 4.10

Sub-Constructs, Dimensions and Values Indicators for Universal Integrated Approach

Sub constructs	Dimensions of Values	Values indicators
General Education Values	*Basic values	Religious and faithful
	*Core values	Good characteristics, courageous, wisdom, and justice
	*Main Values	Disciplined, working together, accountability, and innovative
	*Extended values	Worth of knowledge, success of perseverance, importance of quality, virtue of precision, power of integrity
Mathematics Education Values	Teaching values	Theoretical, utilitarian, functional, *internalization
	Learning Values	Mastering skills, information technology, construction of Knowledge, *knowledge acquisition
Mathematics Values	Ideological values	Rationalism, empiricism, pragmatism, *integrated approach
	Sentimental values	Control, development, *civilization
	Sociological values	Mystery, openness, *integrated

* added by Nik Azis (2012) from universal integrated approach perspective

The integrated approach did not discuss values in mathematics education and values in mathematics as complementary pairs which were to be balanced. Instead the values were discussed in holistic, appropriate and integrated manner. The model of the constructs, sub-constructs, dimensions and samples of values for values in mathematics classrooms followed the integrated approach is in Table 4.1.10. Definitions of sub-constructs and dimensions were discussed in Chapter One and the tables can be found in Appendix A.

Instrument Design

The design phase was focused on the format of the instrument, generating of items pool, formulating the scoring formula and writing instructions for the respondents. The discussion in this section followed the following sequence: format of scales and instrument, items pool generation, forming the formulas for scaling, instructions for the respondents, focus group and experts' evaluation.

Instrument format. Deciding on the response format and instrument format was a critical step during the generating stage (DeVellis, 2003), since it determined the data to be obtained and analysed, more importantly it influenced the validity and reliability of the findings. Selection of measurement scales, its layout, formatting, font size, data collection method and proposed data analysis were discussed here. Consideration on scaling should be made before planning for data analysis so that research questions can be answered using the appropriate statistical method chosen. Measurement rules were applied to types of scaling, methods to quantify demographic data were identified and summated rating scales were used to decrease the error component of true scores.

The scale was a cluster of value items that belonged to a single domain of dimensions. It also referred to the cluster of dimensions which tapped into a single domain of the sub-constructs belonging to the latent trait being assessed which was the values in mathematics classrooms. This suggested that the sub-constructs and dimensions should be uni-dimensional means the set of items uniquely measured a specific trait or ability.

Complex concepts such as values in mathematics education was measured with scales and not by single value items indicators. Careful scale formatting was the key component to construct validity.

Researchers can use several response scales which are commonly used in the study of values, although they differed in terms of its complexities and the amount of effort and labour needed to execute them. The decision of the nature of response scale had an impact on the statistical analysis of the data (Welman & Kuger, 2001). It is conventional and accepted for researchers to treat the ordinal data as interval or higher. The nominal level measurement was not suitable as it could only measure categories, rank and order. On the other hand, a ratio scale which was the top level of measurement was not often available in social research since it required having a true zero point.

Since the values statements were constructed with the assumption that the values that the researcher wanted to measure is one-dimensional in nature, it is possible to use the Likert-scale. The Likert scale was among the popular scale when compared to the other scales used by researchers when using self-reported on perspectives of latent constructs. The scale measurement used in this study was the ordinal scale where the response format used a 5-point Likert scale, providing the opportunity for the respondents to provide intensity of their responses. It provided continuing and variations which was more suitable to measure latent traits like values. Weight were given for each of the responses, for example in this study a five-point scale was used where strongly disagree is equal to one and strongly agree is equal to 5. If the value items were all positive, there was no need to convert the score of negative statements.

The strength and intensity of experiences was made to be linear on a continuum from strongly disagree to strongly agree. The researcher avoided having even points, this was because an even number options created the scenario which forced the respondents to fall on one side of the fence or another. It was also not advisable to increase the number of points (1 - 7 or 1 - 9) as responses will tend to cluster at the top (ceiling) or bottom (floor) of any scale. Respondents were asked to rate each item and tick the corresponding number which best described their feelings towards the value. Higher scores indicated greater agreement on the value item which described one of the dimensions of the sub-constructs while lower score indicated less agreement with the statement. In other words, higher scores indicated stronger perceptions on the respective value item.

Calculation of scores for construct and sub-constructs. The 5-point Likert scale followed the weighted rating scale such that strongly disagree is equivalent to one and strongly agree was equivalent to five. The rating average was obtained by dividing the sum of the weights by the sum of the number of responses. If there were 10 respondents, a respond mean for an item might look like the following:

$$2*(1) + 0*(2) + 3*(3) + 3*(4) + 2*(5)] / (2 + 0 + 3 + 3 + 2) = 32 / 10 = 3.2$$

The respondents' totals of those that picked the ratings was (2 + 0 + 3 + 3 + 2) = 10. A response rating of 3.2 indicated that it was at the weaker part of the not sure category. The scoring of the construct is divided into three mutually exclusive categories which were general education, mathematics education and mathematics values, to ascertain the common values items that are believed to measure similar traits. The sum score of the responses to the items in each category and on the total, were the estimator of the position of the respondents on the continuum. Aggregating scores in this manner helps increase the reliability of the measure. To obtain individual's total score, sums of the weights of all the items in the instruments were taken. Summated scale is used in this study to obtain the score of each person's scale by adding up the multiple items scores. A summed rating scale is a collection of rated statements which, when added together, produce a single score which measure a dimension or sub-construct. Here the numerical values for each question were simply added to produce a single scale score.

The general education value score was obtained by summing up the scores of 17 items, in which four items are from the category of basic values, four values items from the core values, four items from the main values and five values items from the expanded values. The mathematics education value is represented by four value items from the teaching and learning dimensions respectively. On the other hand, four items represent the ideology dimension, three items represented the sentimental dimension, and three items represent the sociology dimension.

The general education values have 17 values items describing the 4 dimensions. In this category scores ranged from a low 17 ($17 \times 1 = 17$) to a high of 85 (17×5). The score of mathematics education values ranges from 8 ($8 \times 1 = 8$) to 40 ($8 \times 5 = 40$). The mathematics values' scores ranges from the lowest 10 ($10 \times 1 = 10$) to 50 ($10 \times 5 = 50$) representing 10 values items of 4 sub-constructs. Score for the values of values in mathematics classrooms consists of the scores of all the values indicators of the three sub-constructs. Thus, the total score ranges from 35 ($35 \times 1 = 35$) to 175 (35×5). Since the value items were all positively phrased there is no need to reverse the response values.

The instrument has a demographic information section consisting independent variables thought to be associated with the construct. Age, gender, academic backgrounds, social backgrounds, duration of service, and interest in mathematics are among the information being collected. This information was important in the utility study to analyse the relationship between these independent variables with the construct. Often a total score of the instrument, the sub-constructs or dimensions were takes as an interval scale which would allow more statistical analysis to be used.

Generating pool of items. This section provided an explanation on the process of items generation following the structure of the sub-construct detailed in the previous section and the operational definition provided in Chapter One. Some of the items generated were based from other researchers as well. The report on how items were developed was done in accordance to the three categories of values in mathematics classrooms which were the general education values, mathematics education values and mathematics values.

All the items being generated were positively stated. The researcher needed to consider that the instrument did not consist too many items as the length could affect responses (Roznowski, 1989). Instruments with too many items can create fatigue problems among respondents besides requiring more time to develop and to administer and process the findings. Although ensuring that the instrument was short was an effective measure of minimizing responses biasness (Schriesheim & Eisenbach, 1990), however, too few items may lack content and construct validity, internal consistency and test-retest reliability (Nunnally & Bernstein, 1994). When generating the items, the researcher took into consideration on the language used. As much as possible items should avoid using abbreviation or usage of vaguely worded items, avoid slang and colloquial expressions, avoid technical terminology, avoid intensifier notes, avoid value judgment, and avoid hidden meaning items. Other concerns would be whether an item was easy to understand, whether it made sense and most important of all whether it represented the value it was supposed to represent. Below is the discussion on how the items for each of the sub-construct were developed. Table 2.1, 2.2, 2.3, and 2.4 in Appendix A contain definitions of all the definitions of values belonging to all the dimensions in the respective sub-constructs.

Generating general education values items. For this sub-construct of values in mathematics classrooms, the researcher referred mainly to Rokeach (1973 and Schwartz (1996) whose studies were on human values, Ingersoll (1997) who wrote a spiritual wellness inventory, Smith and Liva (2008) who researched on multi faith, Scerenko (1997) who focused on general values, and Nik Azis (2009) who viewed values in mathematics education from the perspective of integrated approach. Samples of dimensions and items for the basic, core, main and expanded values from several researchers were listed in Table 4.2.1 which could be found in Appendix A.

For example, "fairness" maybe thought as the core values (Scerenko, 1997) was explained by "Freedom from favouritism and self-interest". On the other hand, Nik, Azis (2009) described it as "Formed and developed to satisfy psychological and life needs". Internalizing knowledge which can be a dimension for the expanded values were written as "Broad minded and being tolerant of different ideas and beliefs" (Shwartz, 1996) and "Intellectual, intelligent and reflective" (Rokeach, 1973). Items from other instruments assisted the researcher in creating three indicators to represent each value sample. Thus, there were 12 sample items representing the four dimensions of the general education values. There were some values samples for example internalization of knowledge and lifelong learning which cannot directly be found from other researchers.

However, the researcher found that there were elements such as broadminded (tolerant of different ideas and beliefs), intellectual (intelligent and reflective), curious (interested in everything, exploring), and knowledge, and learning, understanding and awareness which were related to importance and appreciation of knowledge.

Table 4.11 *Samples of Value Items for the General Education Values in Two Languages*

Dimensions	Sample of values-items
Basic Value	Believe in God and following all commands by God and refrain from what He forbade is very important to me. *Percaya kepada Tuhan dan mematuhi segala suruhannya dan meninggalkan segala yang dilarangnya amat penting bagi saya.* Believing in the existence of God and emphasizing on spiritual matter than material is very important to me. *Percaya dengan kewujudan Tuhan dan menekkan perkara spiritual dan bukan perkara keduniaan adalah amat penting bagi saya.* Believing in God and following my religion conscientiously is important to me. *Percaya dengan Tuhan dan mengikui segala suruhan agama adalah amat penting bagi saya.*
Core Values Wisdom	Have a total insight and sound judgment to place things where they belong is important to me. *Memiliki ilmu yang membolehkan seseorang mengetahui untuk meletakkan sesuatu pada tempat yang sewajarnya adalah amat penting bagi saya.* Have the knowledge which could guide one to understand life is very important to me. *Ilmu yang boleh membimbing seseorang untuk memahami kehidupan adalah amat penting bagi saya.*
	Have the knowledge which could fulfil the emotional, social, self achievement, self purification and spiritual needs. *Mempunyai ilmu yang memenuhi keperluan emosi, social, pencapaian dan penyucian diri serta keperluan rohani.*
Main Value Integrity	Being truthful and sincere through my words, actions and relationships is very important to me. *Menjadi seorang yang jujur dan ikhlas di segi percakapan, perbuatan serta hubungan sesame manusia am penting bagi saya.* It is important to be honest a*at*nd sincere, as it will guide me to act and do the right things and tell the truth. *Adalah penting bagi saya untuk jujur dan ikhlas kerana ia akan membantu saya untuk bertindak* To do things according to the moral, ethics and law is important to me *Melakukan sesuatu berdasarkan prinsip moral, etika, dan undang-undang adalah amat penting bagi saya.*

Expanded Values Internalizing of knowledge	To be able to use knowledge to improve life and civilization is very important to me. *Berupaya menggunakan pengetahun untuk kehidupan dan meningkatkan peradaban adalah amat penting bagi saya.* Able to use knowledge to improve life and civilization in the effort of fulfilling responsibilities to God, nature, socity and oneself is very important to me. *Berupaya menggunakan pengetahuan untuk memperbaik kehidupan dan peradaban dalama konteks memenuhi tanggungjawab terhadap Tuhan, alam sekitar, masyarakat dan diri sendiri adalah amat penting bagi saya.* Able to use knowledge to solve everyday life is important to me. *Berupaya menggunakan pengetahuan untuk menyelesaikan permasalahan harian amat penting bagi saya.*

Sample values such as creativity (uniqueness, imagination), daring (seeking adventure, risk), logical (consistent and rational), imaginative (daring and creative), and creativity: exhibiting an entrepreneurial spirit inventiveness characteristics related to lifelong learning. Table 4.2.2 provided samples of the items in both English and Bahasa Malaysia. The researcher was considering of providing the respondents with both languages to consider the various abilities of both languages of the respondents.

Generating mathematics education values items. Mathematics education values may be discussed as eight types of values related to classroom situations such as learning approaches, types of understanding, learning elements, types of knowledge, purpose of questioning, types of participation, objectives of education and technology usage (Nik Azis, 2009a). Learning approach can be categorized as behaviourism, cognitivism, constructivism, and integrated approach. The four types of understanding were the instrumental, relational, logical and meaningful understanding (Nik Azis, 2009a). In terms of the characteristics of learning, the universal integrated approach divides it into six characteristics. The simplest being memorization followed by representation, communication, relational learning, logical, and meaningful. Elements of learning included representation, communication, relation, problem solving, and reasoning. Another mathematics education value was related to the types of knowledge which was categorized as facts and linguistic, procedural knowledge, conceptual knowledge, strategic knowledge ethical knowledge, and spiritual knowledge. However not all the samples of items were obtainable. Questioning in classroom had six objectives, which were to check the ability of students to recall, to clarify the ideas, to apply the knowledge, to analyse, to evaluate, and to innovate during the process of learning.

Table 4.12

Samples of Value Items for the Mathematical Education Values in Two Languages

Values Samples	Sample of values-items
Teaching Theorist	Mathematics is taught for students to learn and understand higher level mathematics through activities which emphasizes on analytical, computational, axiomatic, reasoning, and evidence is important in the mathematics classroom. *Mengajar matematik supaya pelajar dapat mempelajari dan memahami matematik yang lebih tinggi dengan menekankan aktiviti berbentuk analisis, pengiraan, aksiomatik, penaakulan, dan pembuktian adalah amat penting di dalam bilik darjah/kuliah matematik.*
Utilitarian	Teaching mathematics with emphasis on applications, where computation and problem solving are very important in the context of teaching mathematics *Mengajar matematik untuk tujuan aplikasi dengan menekankan aktiviti seperti aplikasi, pengiraan dan penyelesaian masalah adalah nilai penting dalam konteks mengajar matematik.*
Functional	Teaching mathematics with the intention of constructing sophisticated viable knowledge through problem solving, representation, connection, communication, and reasoning is important in mathematics classrooms. *Mengajar matematik dengan tujuan pembinaan pengetahuan matematik yang sofistikated dan berdaya maju melalui penyelesaian masalah, perwakilan, hubungan, komunikasi, dan penaakulan adalah amat penting dalam bilik darjah matematik*
Internalization	Teaching mathematics through the process of introduction, understanading, constructing, enhancing, evaluating, and using mathematics to fulfill responsibilities to God, oneself, society, and the nature is very important in mathematics classrooms. *Mengajar matematik melalui proses pengenalan, pemahaman, pembentukan, pengukuhan, penilaian, dan penggunaan matematik untuk melaksanakan tanggungjawab kepada tuhan, diri sendiri, masyarakat, dan persekitaran adalah amat penting dalam pengajaran matematik.*
Learning Behaviorism	Penumpuan kepada kemahiran matematik melalui aktiviti berkaitan kecepatan, ketepatan, latihan, latih tubi, hafalan, dan kaedah masteri adalah penting dalam bilik darjah/kelas matematik. Focusing on mathematics skills through activities related to speed, accuracy, exercises, drills, memorizing, and mastery learning when learning mathematics is important in mathematics classrooms
Information processing	Processing mathematical information which involved collection, processing, storage, reproduction, and usage of mathematical information is very important in learning mathematics in the classrooms. *Pemprosesan maklumat matematik yang melibatkan pengumpulan, pemprosesan, penyimpanan, pengeluaran semula, dan penggunaan maklumat matematik adalah amat penting dalam melaksanakan aktiviti matematik di dalam bilik darjah matematik.*
Constructivism	Constructive learning which involved construction of schemes or sophisticated mathematical knowledge involving active participation, reflection, abstraction, problem solving, representation, communication, relationships, and reasoning is very important in learning mathematics. *Pembelajaran konstruktif yang bertumpu kepada pembinaan skim atau pengetahuan matematik yang sofistikated melibatkan penglibatan aktif, refleksi, abstraksi, penyelesaian masalah, perwakilan, komunikasi, hubungan, dan penaakulan adalah amat penting dalam proses pembelajaran matematik.*

Obtaining Knowledge	Emphasis on the acquisition of mathematical knowledge through intuition, inspiration, abstraction, reflection, active engagement, problem solving, representation, communication, relationships, reasoning, and mastery is very important when learning mathematics in the classroom. *Penekanan terhadap pemerolehan ilmu matematik melalui intuisi, ilham, pengabstrakan, refleksi, penglibatan aktif, penyelesaian masalah, perwakilan, komunikasi, hubungan, penaalukan, dan kaedah masteri adalah amat penting semasa pembelajaran matematik di dalam bilik darjah.*

Participations in learning mathematics was divided into three forms of mathematics participation, the elite group, the majority group, and pupils. The three objectives of mathematics education are mathematics for mathematics, mathematics for utility, and mathematics for internalization. The last value in mathematics education was on technology in the teaching and learning which are: communication, representation, exploration, internalization of mathematical knowledge. Table 4.2.4 contains some sample values of mathematics education proposed by the researcher which are given in both English and Bahasa Malaysia.

Samples of value items for the mathematics education values from other researchers can be found in Table 4.2.3 in Appendix A. Samples of items on some of the values above were obtained from researchers such as Philippou and Christou (1999), Bruce and McClure (2002), Dede (2007, 2009), Kajander (2007), Beswick (2005), and Pierce, Stacey and Barkatsas (2007).

Generating mathematics values items. The pool of item for this sub-construct, was constructed by referring to Seah and Bishop (2002), Beswick (2005), Dede (2009), and Bishop (2008) worked on values in mathematics education. Table 4.2.5 in Appendix A demonstrated samples of values items from other sources.

Table 4.13

Samples of Value Items Generated for the Mathematics Values in Two Languages

Values Samples	Sample of values-items
Ideology Empiricism	Values of mathematics which emphasis on concrete material, use of diagrams, inventing symbols, create new terminologies, concrete representations of mathematics ideas and manipulation of objects are very important to me when I am teaching. *Nilai matematik yang membabitkan penekanan kepada bahan konkrit, penggunaan rajah, mencipta simbol, mencipta terminologi sendiri, perwakilan konkrit bagi mengambarkan ide matematik, dan menggunakan manipulasi objek adalah amat penting bagi pengajaran saya.*
Islamic philosophy	Encouraging students to involved themselves with empirical and rational mathematical activities and relates the activities to spiritual development and knowledge internalization is very important to me. *Menggalakan pelajar melaksanakan aktiviti empiris dan rasional dalam pembelajaran matematik serta mengaitkan aktiviti tersebut dengan pembangunan rohani dan penghayatan ilmu adalah amat penting bagi saya.*
Sentimental Control	Encouraging students to analyze and understand why some routines and algorithm will lead to correct answers besides stressing on the importance of getting the correct answer are important to me. *Menggalakkan pelajar untuk menganalisis dan memahami mengapa hanya sesuatu rutin dan algoritma menghasilkan jawapan yang betul disamping menekankan kepentingan mendapat jawapan yang betul adalah amat penting bagi saya.*
Integrated	Enhancing on the power of mathematics knowledge, usage, and its development while integrating mathematics knowledge with religion is important to me. *Memberi penekanan terhadap kuasa pengetahuan, kebergunaan dan perkembangan matematik serta penyepaduan ilmu matematik dan agama adalah amat penting bagi saya.*
Sociology Openness	Encouraging student in the democracy of generating and inventing new ideas while able to defend and justify answers using various media are important values for me. *Menggalakkan pelajar dalam pendemokrasian menjana dan mencipta idea serta mempertahanakan dan menjustifikasikan jawapan dengan pelbagai media adalah nilai yang amat penting bagi saya.*
Ownership	Encouraging students to understand that knowledge of mathematics is owned by God and is given to and obtain them through the process of development is important to me. *Menggalakkan murid memahami bahawa pengetahuan matematik adalah milik Tuhan dan manusia memperolehinya melalui proses pembinaan adalah nilai amat penting bagi saya.*

The definitions for this sub-construct and its dimensions were provided in Chapter One under the topic of Definitions of Terms. Since there were ten values samples representing the four dimensions the researcher constructed thirty (30) indicators. Table 4.2.6 portrayed some of value-items constructed by the researcher for the mathematics values categories written in two languages.

After studying the definitions of values and the value items by other researchers in the field of values and mathematics values, the researcher decided to have 17 items in the general education values, seven (7) items in mathematics education values, and 12 items in mathematics values in the instrument to be discussed and assessed by the focus group.

Instructions for the respondents. In general, the instructions were located at the top of the page with other information such as the purpose of the study and brief description on values in mathematics classrooms, followed by the rating format and options, and finally the items. The response choice which was a 1-5 scale is placed in a column next to each item. The explanation on the rating options were repeated on each page. The objective was to consider a layout that will make it easy for the respondents to quickly see item and score them clearly and for the researcher to quickly locate the responds and enter data for analysis. The respondents were also informed of the objective of the survey which was a requirement to complete a doctoral study together with some information and contact number of the researcher. Participants were also informed that there were no correct or wrong answer and the researcher is looking honest respond from them. A brief explanation was given on the four sections of the instrument. Respondents were also informed of the meaning of each of the rating scale. A copy of the instrument with the full instruction can be obtained from Appendix C.

Development Phase

Content and face validity were enhanced during this phase where initial pool of items and the instrument were evaluated by a focus group and later re-evaluated by three panels of experts. Feedbacks were analysed using both qualitative and quantitative data analysis. The researcher reviewed the instrument using the feedbacks provided by the focus group and further refined the items using feedbacks provided by the three panels of experts. Findings of this section were in the form of qualitative and quantitative data. The discussion starts with findings from the focus group followed by findings from the experts. The instrument for the focus group was made available in Appendix C.

Focus Group. Focus group allowed the researcher to obtain qualitative and quantitative data on feedbacks on the items, which was a crucial step in assuring the face and content validity. The discussion on focus group covered topics on selection of participants, data collection methods and data analysis.

Participant selection. Seven lecturers from a preparatory college in Selangor and two lecturers from a local university volunteered to be a participant in the focus group. The lecturers were between the ages of 30 and 52 where five of them were female and two were male. The lecturers have about the same level of education backgrounds and teaching preparatory level which is the same level of mathematics courses at the matriculation colleges. All the participants have Master degree and have been teaching mathematics between 3 – 25 years. Convenience sampling was utilized, since the researcher deliberately selected the participants who were easily accessible and agree to participate.

Potential participants were contacted personally by the researcher. Official invitations were sent through e-mail to the eight lecturers who agreed to participate, but one lecturer was unable to participate due to other commitments. The invitation included information on the purpose the focus group and how they contributed towards the development of the instrument. Participants were told of the suggested date, time, duration and venue of the session and confirmation was made one week before the meeting.

Site selection. The researcher followed suggestion by several researchers that focus groups discussions should be held in comfortable, conducive and reachable place with minimal disruptions (Robinson, 1999; Stewart & Shamdasani, 1990). A meeting room at the researcher's workplace was chosen since there was an oblong table, enough to seat all the participants. The room was also well-equipped with LCD projector. Participants were seated in such a way that each participant have eye contact with the members of the group.

Function of moderator. The researcher acted as the group moderator for the focus group. The researcher briefed the objectives of the session followed by how the group discussion will be conducted. They were briefed that all opinions were appreciated, and everyone had the right to voice out their opinion and the discussion was done in an informal way. Definitions of each of the sub-constructs, dimensions and the values indicators were projected using the LCD and the moderator took some time to explain the meaning of the values when requested by the participants. The moderator conducted a focused discussion, created a permissive environment which encouraged different points of view without pressure and encouraged participants to respond to one another's ideas. The researcher wrote down important facts voiced out by the participants.

Data collection. To create a welcoming atmosphere, snacks and beverages were provided during the focus groups. The first ten minutes of the interview session was used as introduction session where a brief overview of the background and purposes of the session were given as suggested by Krueger (1998). They were informed that they were evaluating a newly developed survey instrument on values in mathematics classrooms targeted for matriculation teachers of the country. The remaining time was devoted to discussing the consent letter, conceptual framework, and the evaluation process. All participants completed a consent form and the participants spent approximately two hours with the researcher to evaluate the items. Participants were also informed that their identity will remain confidential and their feedbacks will only be used for the research purpose.

The evaluation of the items started with the researcher reading the item and the participants evaluated the items quantitatively. The participants rated each of the value items for its clarity, understanding, relevancy and tone of language using a five-point Likert scale. They were invited to identify items that were ambiguous, confusing or difficult to understand, gave reasons for their claims and provided alternative if they could.

Short clinical interviews were done following the Protocol for Group Interview which could be found in Appendix C. Interview questions on clarity include questions on whether the items were clear and whether there were vague terminologies. On the other hand, questions on understanding needed participants to determine whether there were vague words or phrases used and whether there were difficult words or phrases used. The researcher asks questions related to whether there were unsuitable words or phrases within item, whether there was grammatical error, and whether there was any problematic sentence structure. Questions on relevancy of items included whether items represented the values and items did not represent the sub-construct. Respondents were encouraged to provide suggestions for items improvement by providing suggestions on replacement of terminologies, rephrasing of sentence, replacing of words, shortening the items, or possibility of replacing items.

Coding. The items were coded by the researcher to ease the data analysis. The code consists of six alphanumeric characters where the first two represent the three sub-constructs which are the general education value (NU), mathematics education values (PM) and mathematics values (NM). This is followed by an alphabet which indicates the dimensions under respective sub-constructs and a number representing the values indicators. The last alphabet represents whether the item is written in Bahasa Malaysia or English. For example, the item PMB1M is an item from the mathematics education (PM) sub-construct, it is an item under the dimension of learning (B) and 1M indicates that it is the first value indicator in this sub construct and the item is written in Bahasa Malaysia (M).

Qualitative analysis. The group spent some of the time during the session giving their verbal and written feedbacks on how the items can be rephrased to avoid misunderstanding or confusion among the respondents. The researcher take note of the comments made. Discussion was prolonged especially for long items, difficult terminologies, and items which are difficult to comprehend. The participants gave several suggestions to improve these items although there were times when they could not unanimously agree on certain decision.

Most of the times the participants managed to agree on better terminologies to replace the existing ones. For example, all participants were uncomfortable with the word classrooms which appeared in almost all items, which they would like it to be replaced by the word classes. In another occurrence, they unanimously suggested the word “faith” in item NUA1M to be replaced by the word “believe in God", the phrase “to please God” were suggested to replace the phrase “to be closer to God”. In item NUA4M the phrase “to cleanse one’s heart” was suggested to be replaced by “fear God”. The word “knowledge” was suggested to be replaced the word “ilm” in item NUK1M. Other suggestions included the term “mystic” to be replaced by “miraculous”. The participants also corrected six misspelled words including typo errors done by the researcher. Table 4.14 listed suggestions on terms and phrases given by participants of the focus group.

Table 4.14

Original and Suggested Terms and Phrases

Item	Original phrases / terminologies	Suggested phrase / terminologies
NUA1M	Beriman	Kepercayaan kepada Tuhan
NUA3M	..untuk mendekatkan diri dengan Tuhan…	…untuk mendapat keredhaan Tuhan
NUA4M	Menyucikan hati	Takut kepada Tuhan
NUK1M	Nilai ketinggian ilmu	Nilai ketinggian pengetahuan
NUK3M	…petunjuk prestasi realistik…	…Objektif yang jelas…
NMI1M	…logical…	…mantik…
NMS1M	..keobjektifan…	…sangat objektif…
	..kemistikan…	…keajaiban…
NUT3E	Having the knowledge from God	Believing that knowledge is from God
NUK3E	Concern about quality in work	Priorities on quality in work
NMS1M	… a sense of security and stability…	…provides a sense of confidence…
NMS2E	…and the questioning of existing ideas…	..and enquiring of existing ideas…
NMG1E	…as something full of astonishment..	…as something full of wonders…

Items NUU3M, NUU4M, NPA1M NUK1M, and NMI4M were specially mentioned and agreed to be too long. However, for the two items NUU3M and NMI4M which are the main values (general education values) and value of integrated approach (mathematics values), participants thought the item should remained as they are quite easy to comprehend although they were long. Participants suggested that some of the examples of the values in the items to be put inside brackets to avoid confusion.

Table 4.15

Long Items with Revised Version

Item code	Initial and revised versions of the items
NMI4M	matematik milik Tuhan yang diberi kepada individu melalui proses pembinaan dan hanya bertukar menjadi ilmu apabila individu memperolehi makna melalui proses intuisi atau ilham adalah penting di dalam bilik darjah matematik. Pengetahuan matematik adalah kurniaan dari Tuhan kepada individu, melalui proses pembinaan pengetahuan dan hanya bertukar menjadi ilmu apabila individu memperolehi makna melalui proses intuisi atau ilham adalah penting di dalam bilik darjah matematik.
NUU3M	Melaksanakan tugas dengan penuh tanggungjawab berpandukan prinsip, berupaya memberi justifikasi terhadap tindakan dan prestasi, bertanggungjawab terhadap keputusan yang telah diambil, dan memenuhi matlamat dan harapan adalah amat penting dalam konteks bilik darjah/kelas matematik. Melaksanakan tugas dengan penuh tanggungjawab berpandukan prinsip, berupaya memberi justifikasi terhadap tindakan dan prestasi, (bertanggungjawab terhadap keputusan yang telah diambil, dan memenuhi matlamat dan harapan) adalah amat penting dalam kelas matematik
NUU4M	Berupaya memperkenalkan sesuatu yang baru, berani mencuba idea baru, menjadi perintis dalam bidang yang diceburi, sentiasa berada dalam cabaran untuk membuat perubahan, dan tidak takut menghadapi kegagalan adalah amat penting dalam bilik darjah/kuliah matematik. Berupaya mencuba dan memperkenalkan sesuatu yang baru adalah amat penting dalam kelas matematik.
NPA1M	Mengajar matematik supaya pelajar dapat mempelajari dan memahami matematik yang lebih tinggi dengan menekankan aktiviti berbentuk analisis, pengiraan, aksiomatik, penaakulan, dan pembuktian adalah amat penting di dalam bilik darjah/kuliah matematik. Mengajar matematik supaya pelajar dapat mempelajari dan memahami konsep matematik yang lebih tinggi kelas matematik.
NUK1M	Mencintai ilmu yang bermanfaat, menlandaskan pemikiran, keputusan dan tindakan pada ilmu, sentiasa berusaha melengkapkan diri dengan pengetahuan terkini, dan berada dalam cabaran intelektual sepanjang hayat adalah nilai penting semasa melaksanakan aktiviti matematik di dalam bilik darjah/kuliah. Mencintai ilmu yang bermanfaat, menlandaskan pemikiran, keputusan dan tindakan pada ilmu, dan sentiasa berusaha melengkapkan diri dengan pengetahuan terkini, adalah nilai penting semasa melaksanakan aktiviti matematik di dalam bilik darjah/kuliah.

Table 4.15 listed the original items and the revised version done by the researcher based on feedbacks from participants. Out of seven participants, six of them commented that they understood the items better after reading the English version. They mentioned

that when they had problem understanding the item in Bahasa Malaysia, they would refer to the English version and found them to be easier to comprehend. They suggested that the questionnaire should be written in both English and Bahasa Malaysia.

The term “functional value” under the mathematics value, was thought unanimously as misleading. To the participant, the first thing which crossed their minds when reading the term is the functions as defined in mathematics. However, since it is a terminology accepted by the mathematics educators the term remained in the item. All the participants unanimously agreed that the physical look of the instrument portrayed that it is a value measurement instrument. This confirmed the face validity of the instrument. The rest of the section reported on the quantitative feedback provided by the participants.

Quantitative data. Score for clarity, understanding, language and relevancy given by the participants for each item were keyed in into Excel to find their means. The mean for the clarity of groups of items for each dimension and each sub-construct are given in Table 4.3.3 for both languages. For the Bahasa Malaysia, items representing the mathematics education values have means of 4 and above. The mean for the dimensions and sub-constructs for the understanding are all higher for the English version. It was a similar finding for the mean for the language. All values for the average of the sub-constructs for understanding were all more than 4.0 except for the mathematics education values. Just like the other category, all the means for the English version of the dimensions and sub-constructs were higher than the Bahasa Malaysia. The means for language assessment of the nine dimensions were all more than 3.5. The means for the items written in English were all higher than the means for the items written in Bahasa Malaysia, except for the “basic” dimension. The lowest mean was 3.52381 which was the language mean for the sentimental dimension. The mean for language for all items written in Bahasa

Malaysia in GEV was the least when compared to the mean for MEV and MV. The mean for the relevancy for all sub-constructs in both languages were all very high when compared to the mean for language, understanding and clarity. Mean for the English items for the sub-constructs were all more than the Bahasa Malaysia except for the mathematics education values.

Table 4.16

Mean for Language, Clarity, Relevancy, and Understanding

		Language		Clarity		Relevancy		Understanding	
		Bahasa Malaysia	English	Bahasa Malaysia	English	Bahasa Malaysia	English	Bahasa Malaysia	English
GEV	Basic	3.8928	3.8571	3.8928	3.8928	4.5	4.3571	4	4.2142
	Core	3.6785	3.8571	3.2857	3.5	4.3214	4.3571	3.4285	3.6071
	Main	3.8214	4	4.1428	4.2857	4.5	4.6785	4.1785	4.1785
	Expanded	3.7714	4.1428	3.9714	4.2	4.3428	4.6285	3.8690	4.1714
	Total Average	3.7910	3.9642	3.8232	3.9696	4.4160	4.5053	3.8690	4.0428
MEV	Teaching	3.7142	4.1785	3.9285	4.2142	4.5	4.5357	3.8214	4.1428
	Learning	4.3571	4.4642	4.0714	4.2142	4.6785	4.5357	4.2142	4.25
	Total Average	4.0357	4.3214	4	4.2142	4.5892	4.5357	4.0178	4.1964
MV	Ideology	3.7142	4.1071	3.8928	4.1071	4.4642	4.5714	3.7857	4.1785
	Sentimental	3.5238	4.2857	3.80952	4.4285	4.6190	4.6666	3.9047	4.3809
	Sociology	4.2380	4.3809	4.1428	4.1904	4.6666	4.6666	4.3809	4.3333
	Total Average	3.8253	4.2579	3.94841	4.2420	4.58333	4.6349	4.0238	4.2976

Next, the mean score of clarity, understanding, language and relevancy were calculated and histogram graphs were plotted for each item. Since there are thirty-six (36) items and each was evaluated for four factors in two languages, resulting in a huge data. This section sampled only four dimensions belonging to the general education values (basic, core, main, and expanded) and one dimension (sentimental) belonging to the mathematics values.

Figure 4. 1 demonstrated the mean scores for the basic values, which consisted of four items. The last few items received several scores which were less than 3.5. Three of the low scores came from clarity, understanding, and language (Bahasa Malaysia version) and the score on clarity for the English version. The item "Cleansing the heart from sins and distant oneself from indulging in things that God forbids and abstaining from unsuitability things in life are important in mathematics classrooms" seemed to be very confusing to the participants.

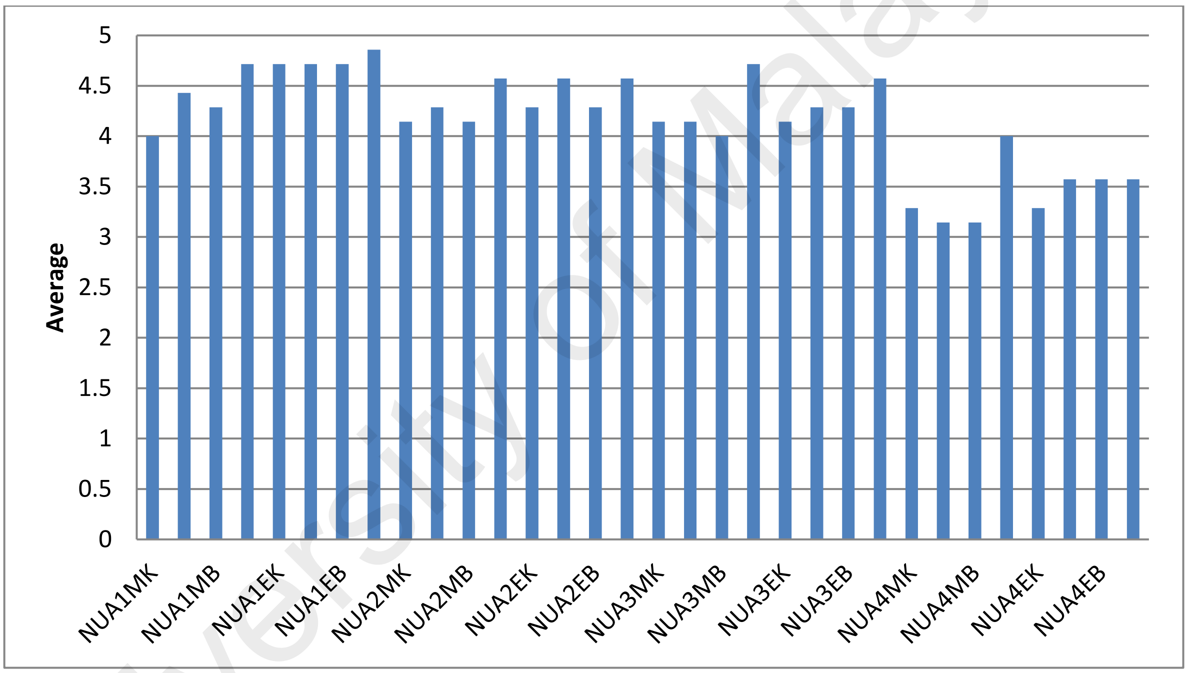


Figure 4.1 Mean scores for items under the basic values

The core value as depicted in Figure 4.3.2 had the highest number of mean below 3.5 as compared to all the dimensions. There were ten scores below 3.5 and six of them were from item number three (three Bahasa Malaysia and three English versions).

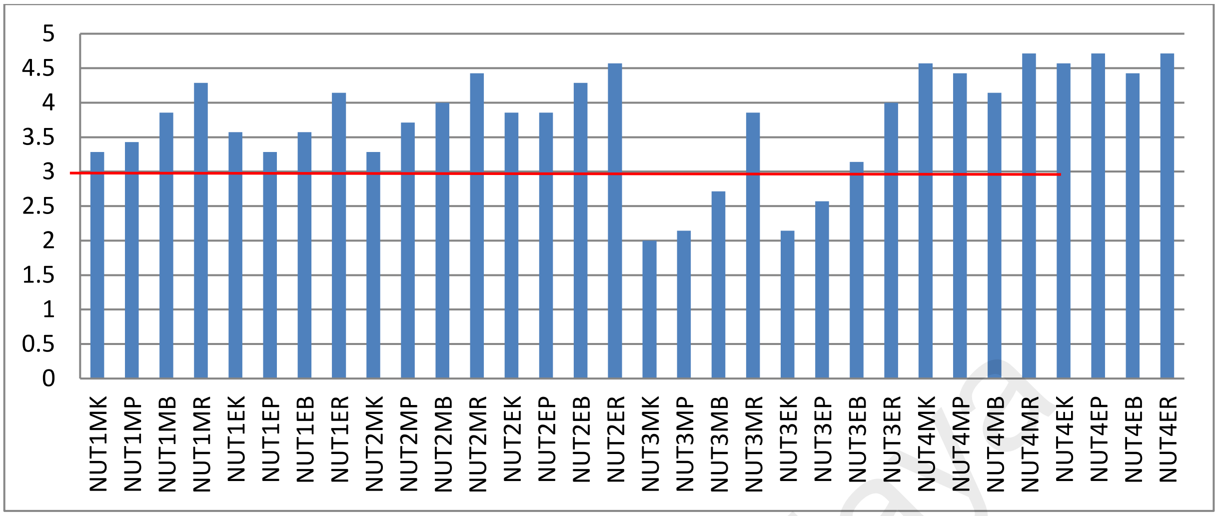


Figure 4.2 Mean scores for items under core values

The item is on the value of wisdom. The Bahasa Malaysia item is "Memiliki ilmu dari Tuhan yang membantu untuk membuat pertimbangan benar tentang tempat yang wajar bagi sesuatu perkara adalah amat penting dalam konteks bilik darjah matematik" and the English version was "Having the knowledge from God to assist in making sound judgment in placing things where they belong wwas very important in the contexts of mathematics in classrooms".

The main values received only two scores which was less than 3.5 indicating that most of the items in that dimension were comprehensible, and the participants were comfortable when reading them.

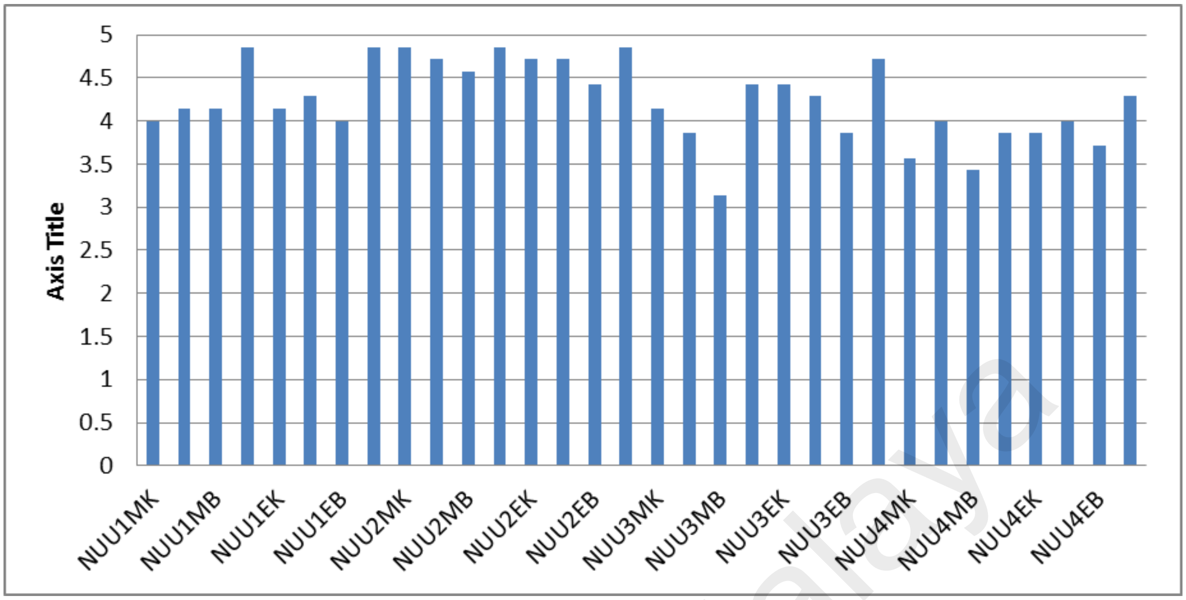


Figure 4.3 Mean scores for items under main values

The expanded value has eight (8) scores below 3.5 and majority (six) of them came from item one. Item one which is on the value of knowledge was found not to be well accepted by the participants in both languages. The Bahasa Malaysia version is "Mencintai ilmu yang bermanafaat, menlandaskan pemikiran, keputusan dna tindakan kepada ilmu, sentiasa berusaha melengkapkan diri dengan pengetahuan terkini, dan berada dalam cabaran intelektual sepanjang hayat adalah nilai penting semasa melakukan aktiviti matematik dalam bilik darjah/kuliah" and the English version is "Love of knowledge where thoughts, decisions and actions were in accordance with knowledge, always in the process of getting updated knowledge, and always being challenged inteelectually, are important values in performaing mathematics activities in the classrooms".

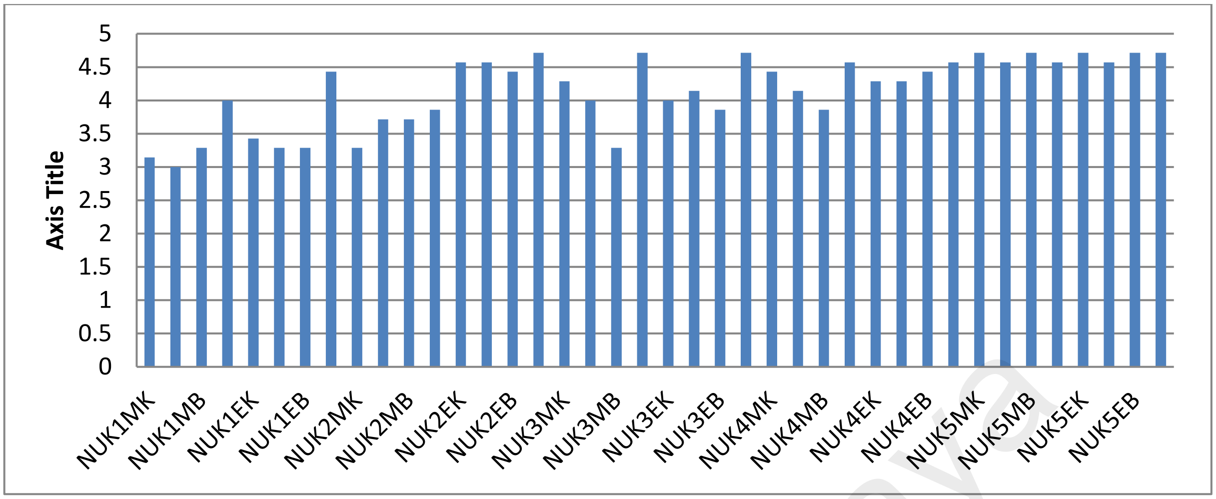


Figure 4.4 Mean scores for items under expanded values

Figure 4.5 demonstrated the average scores for the items under the sentimental values which is one of the dimensions for mathematics education values. This dimension consisted of three values items. The participants evaluated each item for clarity, understanding, language and relevancy for the Bahasa Malaysia and English version separately. Thus, this dimension consisted of 24 scores. The item "Nilai yang bertumpu kepada discipline rohani, akal dan jasmani yang membolehkan individu mengenal dan meletakkan matematik pada tempatnya yang betul sehingga menimbulkan keharmonian, dan keadilan dalam diri, masyarakat dalam alam meterialistik dan spiritualistik adalah penting dalam bilik darjah matematik" which is an item on civilization and written in Bahasa Malaysia, received the lowest score of 2.86. Item number one in Bahasa Malaysia, "Nilai dalam matematik yang membekalkan rasa selamat dan stabil semasa menyelesaikan masalah persekitaran sosial kerana adanya pengetahuan, peraturan, ramalan dan masteri adalah penting dalam bilik darjah matematik" received score of 3.14 for clarity, 3.43 for understanding and 3.14 for language. This item describes the value indicator of "control" under the dimension of sentimental values in mathematics education. However, there were also items which received high score of 4.71. For example, the English version of item number one and two for relevancy, the Bahasa Malaysia version of item number two for clarity, understanding, and relevancy received a high score of 4.71.

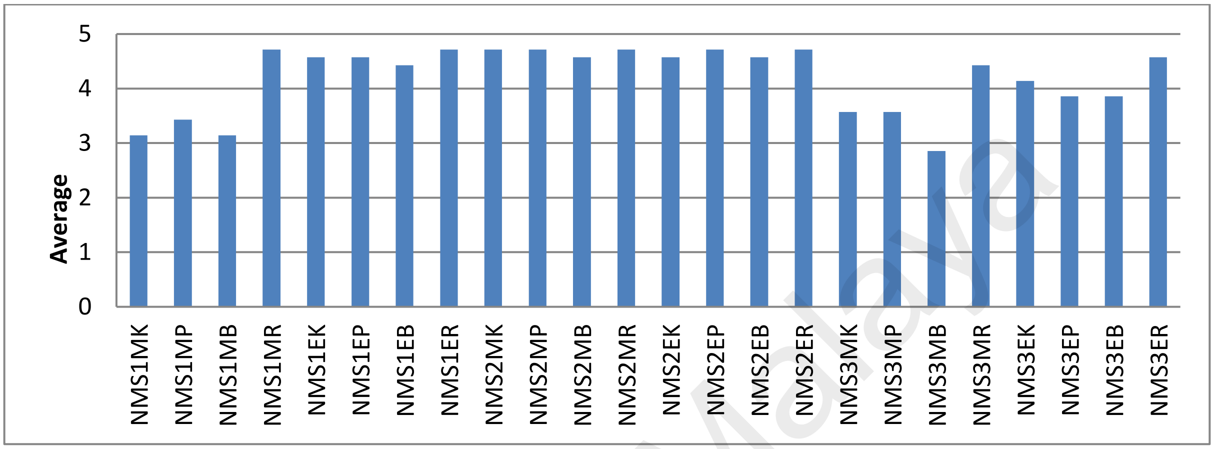


Figure 4.5 Mean scores for items under the sentimental values

The researcher investigates the mean for all the four categories clarity, understanding, language and relevancy for the general education, mathematics education, and mathematics values which are less than 3.5.

Table 4.17

Percentage of Data in General Education Values with less than 3.5

General Education Values	Number of data less than 3.5
Basic (4 items x 8 = 32 data)	4 out of 32
Core (4 items x 8 = 32 data)	10 out of 32
Main (4 items x 8 = 32 data)	2 out of 32
Expanded (5 items x 8 = 40 data)	8 out of 40
Total percentage of data having less than 3.5	24/136 ~ 17.6%

Table 4.17 indicated that the participants were having more difficulties in terms of clarity, understanding, language and relevancy for items in the sub-construct of general

education values as compared to the other categories. The category of general education values has the highest percentage (17.6%) for items below 3.5. Both Table 4.18 and Table 4.19 portrayed that items from the mathematics education and mathematics values have 0.07% and 0.08% of items below than 3.5, an indication that most items in these two categories are clear, understandable, clear in language and relevant to the said values.

Table 4.18

Percentage of Data in Mathematics Education Values with less than 3.5

Mathematics Education Values	Number of data less than 3.5
Teaching (3 items x 8 = 24 data)	3 out of 24
Learning (4 items x 8 = 32 data)	1 out of 32
Total percentage of data having less than 3.5	4/56 ~0.07%

Percetage of Data in Mathematics Education Values with less than 3.5

Table 4.19

Percentage of Data in Mathematics Values with less than 3.5

Mathematics Values	Number of data less than 3.5
Ideology (4 items x 8 = 32 data)	4 out of 32
Sentimental (4 items x 8 = 32 data)	4 out of 32
Sociology (4 items x 8 = 32 data)	0 out of 32
Total percentage of data having less than 3.5	8/96~0.08%

4.3.1.8 ***Revising the Items.*** The feedbacks provided by the participants of the focus group were used to revise and improve the initial collection of the items. Table 4.3.7 in consisted of items with mean less than 3.5 and its revised version. The first column is the coding used for the items together with the score for

Revising the items. The feedbacks provided by the participants of the focus group were used to revise and improve the initial collection of the items. Table 4.20 in consisted of items with mean less than 3.5 and its revised version. The first column is the coding used for the items together with the score for clarity, understanding, language and relevancy, second column is the original item and the column next to it consists of the reviewed items using feedback from the participants of the focus group.

There were also items which the participants did not give suggestion for improvement. Some were suggested to be revised although the items did not receive any scores below 3.5 for clarity, understanding, language and relevancy. The participants gave some suggestions on what to be revised, however the corrections suggested by the participants were minimal for each of these items if compared with the items in the table above.

Table 4.20

Revised Version of Items with Means less than 3.5

Items	Initial Items	Revised
NUU1M	Mematuhi peraturan, disiplin, norma atau kod tingkahlaku yang telah ditetapkan adalah amat penting semasa melaksanakan aktiviti matematik dalam bilik darjah/kelas.	Mematuhi peraturan dan berdisiplin, adalah amat penting semasa melaksanakan aktiviti matematik dalam bilik darjah/kelas
NUK4M	Amalan mengutamakan ketepatan dalam janji, masa, membuat keputusan, pemikiran, pengetahuan, penjelasan, dan pertimbangan adalah amat penting dalam bilik darjah/kuliah matematik.	Mengutamakan ketepatan dalam janji, masa, membuat pertimbangan dan keputusan, adalah amat penting dalam kelas matematik
PMA2M	Mengajar matematik untuk tujuan aplikasi dengan menekankan aktiviti seperti aplikasi, pengiraan dan penyelesaian masalah adalah nilai penting semasa mengajar matematik.	Mengajar matematik untuk tujuan aplikasi dan penyelesaian masalah adalah nilai penting semasa mengajar matematik.

NUK3E	Concern about quality in work, have clear standards, creating a system of accountability, have a realistic performance indicator, and have own initiatives is very important when doing activities in mathematics classrooms.	Priorities on quality in work, have clear standards, creating a system of accountability, have a realistic goal, and own initiatives is very important when doing activities in mathematics classrooms.
NMS1E	Values in mathematics which provides a sense of security and stability when solving problems in the social environment due to the existence of knowledge, rules, prediction and mastery of mathematics is important in the mathematics classrooms.	Values in mathematics which provides a sense of confidence when solving problems in the social environment due to the existence of knowledge, rules, prediction and mastery of mathematics is important in the mathematics classrooms.
NMG1E	Viewing mathematics knowledge as something full of astonishment, admiration, mysticism, abstract, and objective where human involvement is minimal is important in the context of the mathematics classroom.	Viewing mathematics knowledge as something full of wonders, admiration, mystery, abstract, and objective where human involvement is minimal is important in the context of the mathematics classroom.

They agreed that the items should remain as it is although not all of them gave a perfect score for these items in terms of clarity, understanding, language and relevancy. Samples of such items were given below in Table 4.21.

Table 4.21

Items Suggested to be Retained

Item	Initial item to be retained
NUT4M	Bertindak dan mengaplikasi perkara yang bersesuaian pada masa yang tepat, tempat yang betul dan adab yang betul adalah amat penting dalam kelas matematik.
NUK2M	Kegigihan, komitmen yang tinggi, berkeyakinan diri, tabah menghadapai cabaran dan sanggup berkorban adalah amat penting dalam melaksanakan aktiviti dalam bilik darjah/kuliah matematik.
PMA4M	Mengajar matematik melalui proses pengenalan, pemahaman, pembentukan, pengukuhan, penilaian, dan penggunaan matematik untuk melaksanakan

	tanggungjawab kepada tuhan, diri sendiri, masyarakat, dan persekitaran adalah amat penting dalam pengajaran matematik.
NUT4E	To act and apply what is appropriate at the right time, in the right place and in the right manner is important in mathematics classrooms.
NUU3E	Perform duties with full responsibilities, able to justify one's actions and performance, responsible for the decisions taken, and meeting the goals, are very important in the context of mathematics classrooms.
NUK4M	Prioritizing the virtue of precision in promises, time, decision making, thinking, knowledge, explanation, and judgment is very important in mathematics classrooms.

The feedbacks were analysed closely and the items were revised following the given feedbacks. The revised version which is now the instrument used for the experts to evaluate can be found in Appendix C and is now ready to be sent to experts for content validity.

Evaluation by experts. Once the items were improved following the suggestions made by the members of the focus group, the instrument was sent to experts to enhance the face and content validity. Experts' judges, rating and feedbacks on the degree of match between items and the conceptual definition of the construct definition is a crucial phase in instrument construction. To reduce the number of tasks done by each expert, the researcher divided the evaluation into three different areas. The first area was evaluation on relevancy, representation of values, quality of the translation and whether the collection of items represents the dimension of the sub construct. The second area was on the difficulty, clarity, and readability level of the items and the third was on the format, presentation, allowance of time, general presentation and suitability of the instrument. This section discussed on how selection of experts was made, the evaluation process which took place, and the feedback obtained from the three groups of experts on three different areas. It also included the improvements made by the researcher on the items and the instrument based on the feedbacks received.

Selection for panels of experts. The first step in evaluation by panel of experts involved identifying the members of the panel of experts whose consensus opinions were to be sought. Potential experts were identified from names of lecturers listed under the faculty of education from several local public universities' websites. The lists were filtered to focus on academicians with mathematics and mathematics education backgrounds only. Those with research backgrounds of beliefs, values, anxiety, and performance, in mathematics were also considered as potential experts. Invitations through e-mails were sent out to fifty (50) candidates, enquiring whether they are interested to volunteer as one of the panel of experts. Out of fifty (50), only thirty-three (33) responded their willingness to participate in the evaluation process. They were divided into three groups: panel experts A, B, and C with ten respondents in each group.

Unfortunately for panel expert A, six out of twelve responded. Six out of eleven responded in panel B and seven out of nine responded in panel C. This is unexpected because they personally have agreed to participate in the evaluation process when contacted by the researcher earlier. Another possibility is they are uncomfortable answering using the Surveymonkey which is an internet based programme.

Table 4.22

Details of Experts and the Areas Evaluated

Panels		**Senior Lecturers**	**Associate Professor**	**Professor**	**Recipient of instruments**	**Did not respond**	**Responded**
Panel A	Relevancy, representation of values,	**1**	**1**	**4**	**12**	**6**	**6**

	quality of the translation and whether the collection of items represents the dimension of the sub construct.						
Panel B	difficulty, clarity, and readability level	**2**	**3**	**1**	**11**	**5**	**6**
Panel C	format, presentation, allowance of time, general presentation and suitability of the instrument	**8**	**1**	**0**	**9**	**2**	**7**

Selection process. The thirty-two (32) respondents who indicated their willingness to participate were given approximately four weeks to complete the survey which was sent through e-mails. However only nineteen (19) responded back. The link provided to the respondents brought the respondents to Surveymonkey the form where instructions could be found. In the instruction section, the researcher: do self-introduction, thank the participants for their willingness to participate, briefed on the sub-constructs and dimensions, provided the objectives of the survey, briefed the experts on the tasks that they must perform, and gave deadline for the survey. Since there were three groups of experts, the objectives differ from one group to another. The researcher provided contact numbers and e-mail addresses for further communications.

Feedback from panel of experts group A. Panel A consists of six participants who evaluated the relevancy, representation of values, quality of the translation and representations the dimension of the sub construct.

Table 4.23

Items Getting Less than 3.5 and Above 4.5 for Relevancy of Item

Indicators and items	Areas of evaluation	scores on relevancy
(4) Wisdom *Menerima ilmu dari Tuhan yang membolehkan pertimbangan wajar dibuat bagi sesuatu perkara adalah amat penting dalam konteks kelas matematik.* Receiving the knowledge from God will assist in making sound judgment to place things where they belong is very important in the contexts of mathematics classrooms.	Item is very relevant to the values indicator The English and the Bahasa Malaysia versions are at par with each other	3.33 3.0
(34) Values of development Nilai perkembangan idea matematik melalui teori alternatif, pembentukan kaedah baru, membuat generalisasi dan penyoalan terhadap idea sedia ada adalah penting dalam bilik darjah matematik. Value in development of mathematical ideas through alternative theory, formation of the new method, and enquires of existing ideas are important values in mathematics.	Item is very relevant to the values indicators The English and the Bahasa Malaysia versions are at par with each other	3.25 3.0
(18) Theoretical Mengajar matematik supaya pelajar dapat mempelajari dan memahami konsep matematik yang lebih tinggi adalah amat penting di dalam kelas matematik. Teaching mathematics for students to learn and understand higher level mathematics is important in a mathematics classroom.	Item is very relevant to the values indicators The English and the Bahasa Malaysia versions are at par with each other	4.75 4.5

There were four professors, one associate professors and one senior lecturer in this group. The experts evaluated using a 5-point Likerts scale to indicate how much they agree to the items. The experts were given space for suggestions on ways to improve the items or suggested items to be edited, replaced or removed. All the thirty-six items received a mean score of relevancy above 3.5 except for item 4 and 34. Item 18 received the highest score which was 4.75

Table 4.24

Loaded Items according to Experts

Value Indicators	Value Item
(7) Indikator nilai: Nilai berdisiplin / Disciplined	Mematuhi peraturan dan berdisiplin, norma dan kod tingkahlaku adalah amat penting semasa melaksanakan aktiviti matematik dalam kelas. Abiding rules, discipline, norms, or codes of conduct are important in performing activities in mathematics classrooms.
(9) Indikator nilai: Nilai akauntabiliti / Accountability	Melaksanakan tugas dengan penuh tanggungjawab berpandukan prinsip, berupaya memberi justifikasi terhadap tindakan dan prestasi, bertanggungjawab terhadap keputusan yang telah diambil, dan memenuhi matlamat dan harapan adalah amat penting dalam kelas matematik Performing duties with full responsibilities, justifying one's action and performance, taking responsibilities.
(10) Indikator nilai: Nilai Inovasi / Innovative	Berupaya mencuba dan memperkenalkan sesuatu yang baru, berani mencuba idea baru dan menjadi perintis dalam bidang adalah nilai penting dalam kelas matematik. Able to try and introduce new ways of doing something, bold enough to try new ideas, and being a pioneer in one's own field, are important values in mathematics classrooms.
(11) Indikator nilai: Nilai ketinggian ilmu / The worth of ilm	Mencintai ilmu yang bermanfaat, menlandaskan pemikiran, keputusan dan tindakan pada ilmu, dan sentiasa berusaha melengkapkan diri dengan pengetahuan terkini, adalah nilai penting semasa melaksanakan aktiviti matematik di dalam bilik darjah/kuliah. Love of knowledge where thoughts, decisions and actions were in accordance with knowledge, always in the process of getting updated knowledge, and always being challenged intellectually are important values in performing mathematics activities in the classrooms.'
(12) Indikator nilai: Nilai kejayaan ketekunan / The success of perseverance	Kegigihan, komitmen yang tinggi, berkeyakinan diri, tabah menghadapai cabaran dan sanggup berkorban adalah amat penting dalam melaksanakan aktiviti dalam bilik darjah/kuliah matematik. Persistence, high commitment, self-confidence, tenacity to face challenges and willing to sacrifice are essentials values in mathematics classrooms
(13) Indikator nilai: Nilai kepentingan kualiti /The importance of quality	Mementingkan kualiti dalam tugas, mempunyai piawaian yang jelas dan mempunyai petunjuk prestasi yang realistik adalah amat penting semasa menjalankan aktiviti dalam kelas matematik. Putting quality as a priority in work, having clear standards, creating a system of accountability, having a realistic goal, fulfilling one's initiatives are very important when doing activities in mathematics classrooms.
(14) Indikator nilai: Nilai keutamaan ketepatan / The virtue of precision	Mengutamakan ketepatan dalam janji, masa, membuat pertimbangan dan keputusan, adalah amat penting dalam kelas matematik. Prioritizing the virtue of precision in promises, time, decision making, thinking, knowledge, explanation, and judgment is very important in mathematics classrooms.
(15) Indikator nilai: Nilai kekuatan integriti/ The power of integrity	Bersikap amanah, cekap, jujur, konsisten, telus, pemikiran terbuka, dan boleh dipercayai adalah penting dalam konteks kelas matematik. Honesty, efficient, truthful, consistent, transparent, open mind, and trustworthy are important in the context of mathematics classroom.
(16) Indikator nilai: Nilai penguasaan kemahiran / Mastering the skills	Penumpuan kepada kemahiran matematik melalui aktiviti berkaitan kecepatan, ketepatan, latihan, latih tubi, hafalan, dan kaedah masteri adalah penting dalam kelas matematik. Focusing on mathematics skills through activities that are related to speed, accuracy, exercises, drills, memorizing, and mastery learning is important in mathematics classrooms.

(17) Nilai pembinaan pengetahuan / The value construction of knowledge	Pembelajaran konstruktif yang bertumpu kepada pembinaan pengetahuan matematik yang sofistikated, penglibatan aktif, refleksi, abstraksi, penyelesaian masalah, perwakilan, komunikasi, hubungan, dan penaakulan adalah amat penting dalam proses pembelajaran matematik Constructive learning, which involved construction of schemes or sophisticated mathematical knowledge involving active participation, reflection, abstraction, problem solving, representation, communication, relationships, and reasoning, is very important in learning mathematics.

The items and their average scores were given in Table 4.23. On another note, one of the respondents, who was a mathematics education professors suggested items 7, 9, 10, 11, 12, 13, 14, 15, 16, and 17 to be checked and see whether there was a need to break the items into two or three separate items under the same dimension since the item seemed to be loaded to him. The list of the items was demonstrated in Table 4.24.

Table 4.25 *Suggestions from Panel Expert Group A*

No	Items	Suggestions
12	Mencintai ilmu yang bermanfaat, menlandaskan pemikiran, keputusan dan tindakan pada ilmu, dan sentiasa berusaha melengkapkan diri dengan pengetahuan terkini, adalah nilai penting semasa melaksanakan aktiviti matematik di dalam bilik darjah/kuliah. Love of knowledge where thoughts, decisions and actions were in accordance with knowledge, always in the process of getting updated knowledge, and always being challenged intellectually are important values	the word "menlandaskan" in Bahasa Malaysia should not be translated as "in accordance".
21	Mengajar matematik melalui proses pengenalan, pemahaman, pembentukan, pengukuhan, penilaian, dan penggunaan matematik untuk melaksanakan tanggungjawab kepada tuhan, diri sendiri, masyarakat, dan persekitaran adalah amat penting dalam pengajaran matematik. Teaching mathematics through the process of introduction, understanding, constructing, enhancing, evaluating, and using mathematics to fulfill responsibilities to God, oneself, society, and the nature is very important in mathematics education.	"pengukuhan" is more appropriate for "reinforcement"
25	Constructive learning, which involved construction of schemes or sophisticated mathematical knowledge involving active participation, reflection, abstraction, problem solving, representation, communication, relationships, and reasoning, is very important in learning mathematics.	Item needed to be improved, as the word "involve" appeared twice.
31	Mathematics knowledge, inherited from God is given to man through construction of knowledge and only turned into ilmu when individuals acquire meaning through intuition or inspiration is important mathematics values. .	The word "ilmu" cannot be used as an English word The word "inherited" is not suitable to be used in the sentence.
34	Value in development of mathematical ideas through alternative theory, formation of the new method, and enquires of existing ideas are important values in mathematics.	Experts suggested the item to be rephrased.

Table 4.25 consisted of items with unsuitable words together with the comments from the experts. Other comments included a reminder from an expert that in item 23, under the values indicator - mastering the skills, the related values of the teachers will depend on the types of mathematics he or she is dealing with. The types of mathematics indicated the skills that one needed to master. Panel A was also asked to give their opinion

on whether the group of items represented the dimensions of the values. Figure 4.3.6 indicated that the means are all 3.5 above for general education values. For example, they agree that the four items representing the values indicators: disciplined, working together, accountability, and innovativeness represent the main value, a dimension in the general education value.

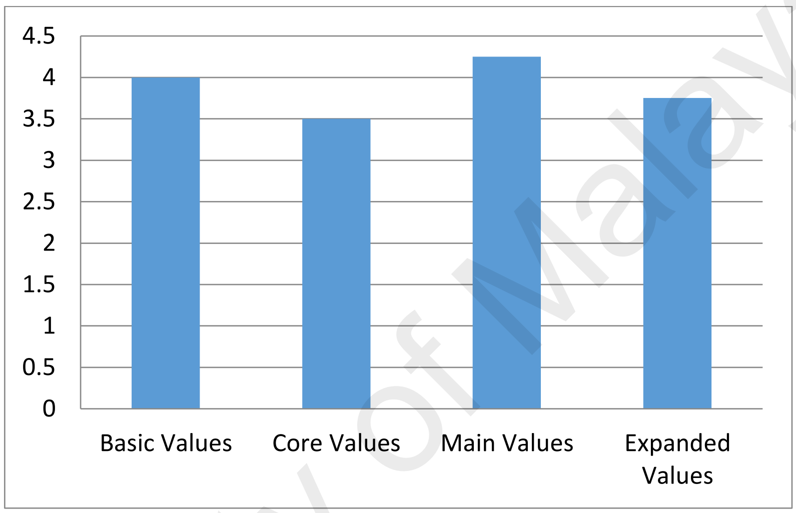


Figure 4.6 Representation of items for the dimensions in general education values

For the mathematics education sub-construct, the experts gave scores of 3.75 for both dimensions, indicating their level of agreeness that the items represented the dimensions teaching and learning as demonstrated in Figure 4.3.7.

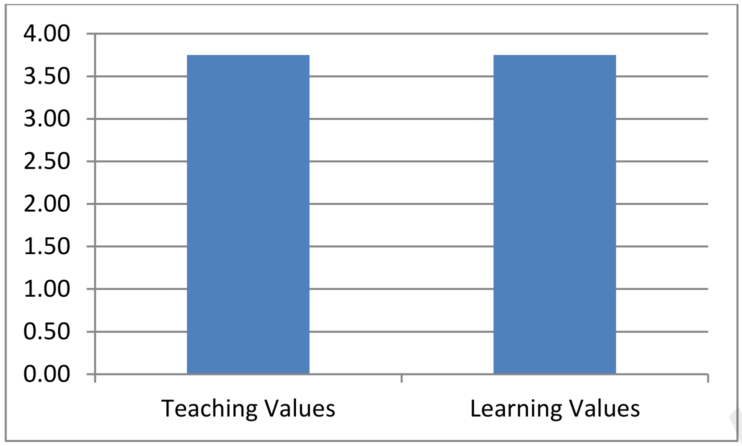


Figure 4.7 Representation of items for dimensions of mathematics education values.

The mathematics values gained scores between 3.75 and 4.00 indicating that the level of agreeness of the experts that the items represented the respective dimensions such as ideology, sentimental, sociology and integrated values.

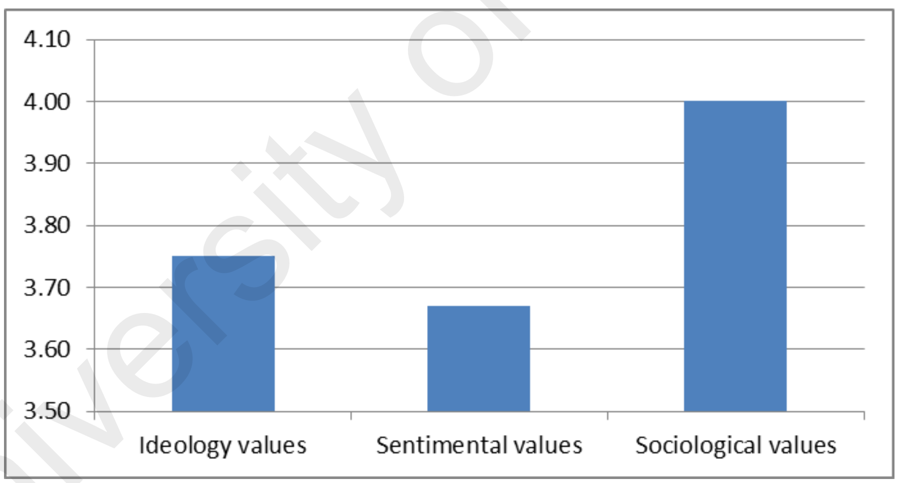


Figure 4.8 Representation of items for the dimensions of mathematics values.

All the dimensions received scores above 3.5 and the maximum value is 4.25 (main values). Out of the nine dimensions, only three dimensions from the general education values received scores above four.

Feedback from panel of experts group B. The panels in this group consisted of one professor, three associate professors and two senior lecturers. They evaluated the items on the difficulty, clarity, and readability level. The experts evaluated using a 5-point Likerts scale where 1= extremely do not agree, 2 = do not agree, 3 = don't know, 4 = agree, and 5 = extremely agree and provided suggestions for improvements. Table 4.26 indicated that the average score of each category is 3.55 (difficulty), 3.48 (clarity), and 3.57 (readability).

Table 4.26

Mean of Items according to Assessment Criteria

	Item	Difficulty	Clarity	Readability	All mean less than 3.5
GEV	1	3.50	3.17	3.50	
	2	4.00	4.00	4.33	
	3	3.83	3.83	4.00	
	4	3.00	3.17	3.33	√
	5	3.50	3.50	3.67	
	6	3.83	3.83	3.83	
	7	4.17	3.83	3.83	
	8	2.83	2.83	2.83	√
	9	4.00	3.67	3.80	
	10	2.83	2.83	2.83	√
	11	3.83	3.50	3.83	
	12	3.67	3.33	3.33	
	13	3.67	3.67	3.67	
	14	3.33	3.33	3.33	√
	15	4.17	4.00	4.33	
	16	3.50	3.50	3.67	
MEV	17	3.50	3.17	3.50	
	18	2.83	2.83	2.83	
	19	3.50	3.67	3.67	√
	20	4.00	3.83	4.17	
	21	3.50	3.50	3.50	
	22	3.33	3.33	3.33	
	23	4.17	4.17	4.17	√
	24	3.83	3.83	3.83	
	25	3.33	3.33	3.33	
MV	26	3.33	3.33	3.33	
	27	3.33	3.33	3.33	√
	28	3.83	3.83	3.83	√
	29	3.33	3.33	3.33	√
	30	3.00	3.00	3.00	
	31	3.17	3.00	3.00	√
	32	4.00	3.83	3.83	√
	Mean	3.55	3.48	3.57	

Out of 32 items, 13 of them received mean less than 3.5 for either difficulty, clarity, or readability level where six were from general education values, three from mathematics education values, and nine from mathematics values. There are twelve items which obtained less than 3.5 for all the categories. The details of each of the twelve items can be found in Figure 4.3.9 in Appendix A. However, seventeen of the items received scores 3.5 and above for all the three categories where eight were from the general education values, five from the mathematics education values, and four were from the mathematics values.

Although these items received score of more than 3.5 for all the categories, the items may have other weaknesses highlighted by Panel A. The researcher needed to improve some of them as well. These findings indicated that the items were quite easy to read, to understand and the items were written concisely although the items may be either too long, have complicated sentence structure or there are difficult terminologies in them as pointed by panels of experts in group A. The two items which received a mixture of scores 3.5 and above and below 3.5 were presented in Figure 4.9.

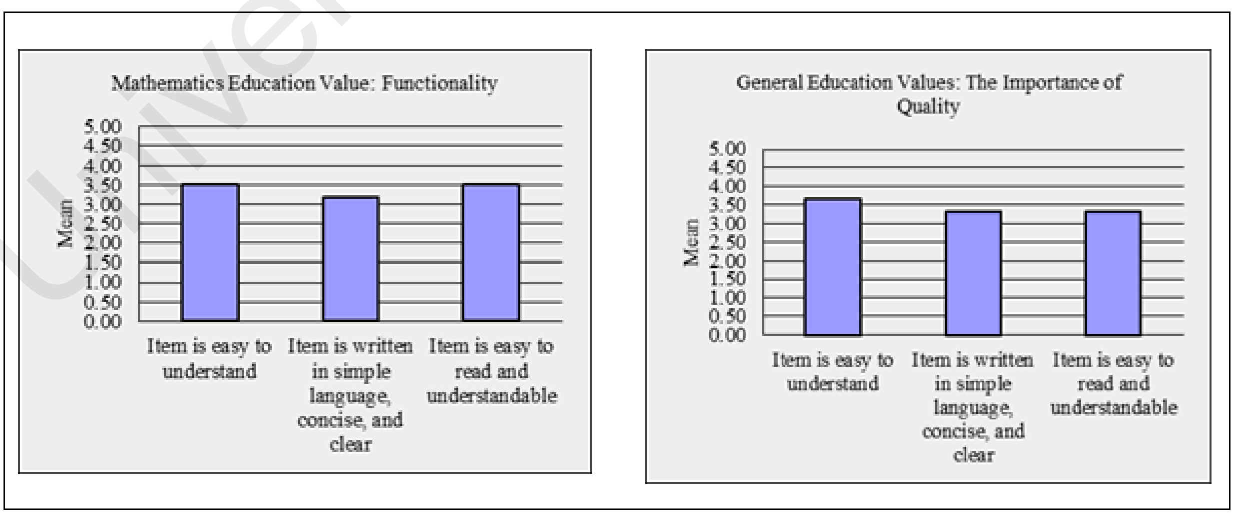


Figure 4.9 Items which received a mixture of scores 3.5 and above and below 3.5

Feedback from panel of experts Group C. The seven experts in panel C needed to evaluate the instrument, on five categories: the format or layout of the instrument, professional look of the instrument, whether the instrument look interesting, whether the survey demonstrated an overview of values in mathematics classrooms, and whether the instrument was reasonable to be given to mathematics teachers at matriculation colleges. The mean scores for the five categories were 3.85, 4, 4,4.29, and 3.24, an indication that the panels were quite unanimous in saying that the instrument is reasonable in terms of its layout, professional look, interesting look, instrument covers all aspect, and reasonable for matriculation colleges measuring values in mathematics classrooms. Figure 4.10 portrayed the mean score for each category of assessment.

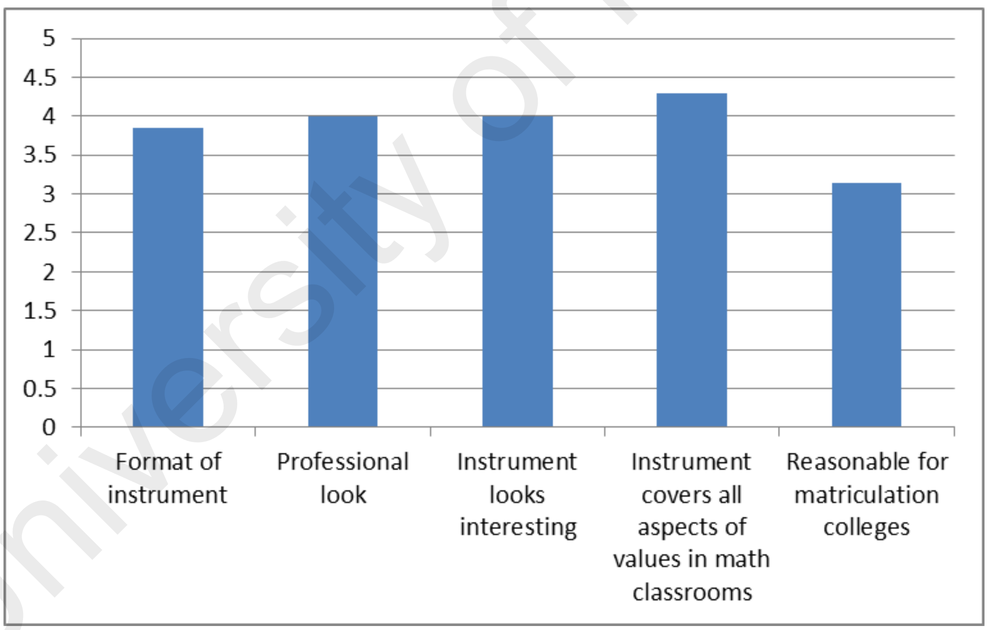


Figure 4.10 The means for the five categories of assessment

The feedback collected from the focus group and the three groups of panel experts assisted the researcher to study the content validity of the instrument. Each item was scrutinized and improvements were made if necessary following the feedback provided.

Table 4.3.15 which can be found in Appendix A, displays the initial items (both languages), corrected versions, and suggestions given by the experts. There were also items which did not receive any feedback from the experts and were remained.

4.3.2.6 *Reviewing the items*. The feedback from the focus group and the three panels of experts were used by the researcher to enhance the content validity of the instrument. However, there were also non-relevant feedbacks which were not taken into consideration by the researcher. Table 4.3.15 provided the suggestions by the experts, the items together with the corrected versions can be found in Appendix A. The comments received through the open-ended questions were categorized into eight categories and the details of the frequency are as follows: loaded items (3 items), suitability (2 items), conceptual (1), language (16), terminology (9), vague (15), translation (2), and no comment (4 items) which can be found in Table 4.27.

Table 4.27

Summary of Category of Open Ended Feedbacks

Category of Open Ended Feedbacks	Items	Frequency
LD=Loaded	10, 12, 21	3
S=Suitability	1, 21	2
C=Conceptual	24	1
L=Language	1, 2, 3, 6, 7, 8, 10, 11, 13, 14, 16, 19, 25, 27, 28, 31	16
TR=Terminology	4, 7, 10, 11, 18, 20, 27, 26, 29	9
V=Vague	1, 4, 5, 7, 12, 13, 14, 15, 17, 18, 19, 26, 28, 30, 31,	15
T=Translation	2, 3	2
NC=No comment	15 ,22, 23, 32,	4

It seemed that the value items constructed by the researcher were generally found to be vague and the experts were concerned on the language being used. Four items received no comments and remained as it is. Some of the items only required minor correction such as replacing a term and some required restructuring of sentences. There were some changes on the number of items in the general education values where two more items were added to the first dimension which is the basic values. The number of items in the other two sub-constructs remained the same, making the number of items now 34 instead of 32. Once the content validity was established, the instrument was piloted for estimation of validity and reliability of the items, dimensions, sub-constructs, and construct.

Evaluation Stage

The evaluation phase consists of the findings from the pilot and the real studies. Results from the pilot study were used to revise the instrument for the real study. The statistical tests executed in the pilot study were not necessarily done for the real study since the tests were found not to provide significant results.

Pilot study. The objective of the pilot study is to look at the construct validity of the instrument. Although pilot study may add to the time duration of the research, it provided an opportunity for the researcher to improve the research design if any problem was detected. Items that lacked clarity, not appropriate, and unable to discriminate between respondents were identified during the pilot study and decision to delete or improve any item was made following the results from the statistical analysis. The pilot study emulated the procedures, estimated timing of survey, review logistic and estimated cost involved during validation process (Dillman, 2000). This assisted the researcher to improve the logistics of distribution of the questionnaire at the right time and estimated the time needed for the respondents to comfortably respond to the instrument.

Background characteristics of the sample. The data of this study came from 241 mathematics lecturers who taught either at preparatory or diploma levels of a local university which was about the same level as the matriculation lecturers. The pilot version of the instrument was sent to 300 respondents after getting approval from the coordinator of the mathematics department of the university.

Table 4.28

Demographic Characteristics of the sample (N=241)

Age group	**Frequency**	**Percentage**
Below 25	23	9.5
26 - 35	127	52.7
36 – 45	29	12.0
46 and above	62	25.7
Gender		
Male	34	14.1
Female	207	85.9
Academic Status		
Degree	5	2.1
Masters	221	91.7
PhD	15	6.2
Teaching Experience		
Less than 5 years	113	46.9
6 – 15 years	56	23.2
16- 25 years	45	18.7
26 years and above	27	11.2
Total	**241**	**100**

On the other hand, the highest number of lecturers belonged to the group with less than five years of experience. There were 113 (46.9%) who were in this category, followed by 56 (23.2%) with 6 – 15 years of experience and 45 (18.7%) with 16 – 24 years of experience. Out of 241 lecturers only 27 (11.2%) had teaching experience of 26 years and above.

Items descriptive statistics. Item statistics provide data about responses to each value item to help judge its effectiveness. The descriptive statistics for all the 34 items were given in the table below. These sub-constructs were further categorized into several dimensions. There were 9 dimensions in total: four in the general education values, two in the mathematics values, and three in the mathematics values.

Table 4.29

Descriptive Statistics for 34 Items

	Minimum	Maximum	Mean	Std. Deviation
Terpisah	2	5	3.76	.813
Peradaban	2	5	3.83	.810
Berpadu	1	5	3.86	.843
Innovasi	2	5	3.98	.741
Empirisisme	2	5	4.00	.686
Bersepadu sejagat	1	5	4.02	.795
Perkembangan	2	5	4.13	.670
Teoretis	2	5	4.14	.687
Utilitarian	2	5	4.18	.632
Berani	2	5	4.20	.716
Berkaitan	2	5	4.21	.611
Pragmatism	2	5	4.23	.627
Rasionalisme	2	5	4.24	.682
Kawalan	2	5	4.32	.566
Fungsian	2	5	4.33	.574
Bijaksana	2	5	4.36	.694
Kecekapan Pemprosesan maklumat	2	5	4.37	.614
Pembinaan Pengetahuan	2	5	4.38	.558
Akauntabiliti	2	5	4.39	.643
Pemerolehan Ilmu	2	5	4.41	.571
Penghayatan	3	5	4.43	.629
Keadilan	2	5	4.43	.636
Amalkan Agama	2	5	4.44	.687
Integriti	2	5	4.44	.597

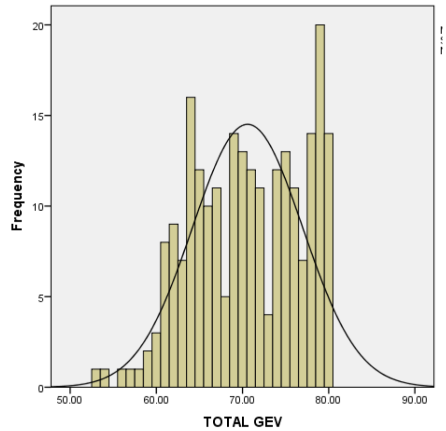
Penguasaan Kemahiran	2	5	4.44	.576
Kerjasama	2	5	4.47	.592
Keutamaan Ketepatan	2	5	4.48	.606
Baik peribadi	3	5	4.49	.571
Disiplin	3	5	4.49	.585
Prioroti Agama	1	5	4.52	.671
Kepentingan Kualiti	2	5	4.52	.548
Tahu Kep Agama	1	5	4.53	.652
Kejayaan Ketekunan	2	5	4.57	.544
Ketinggian Ilmu	2	5	4.58	.535

Table 4.29 recorded the minimum and the maximum values for each item together with the mean and the standard deviations. The mean of all items fall into the range of 3.60 and 5.00, which indicated that each item scored reasonably well.

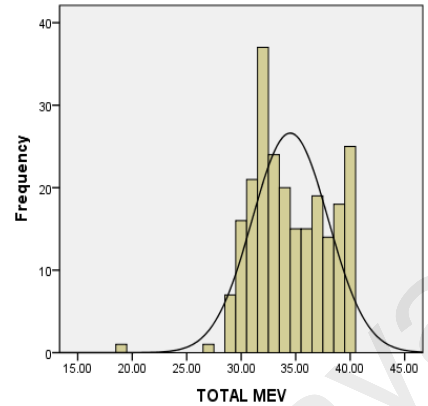
Normality test. Missing data possessed a serious problem to the integrity of the statistical results and claims (Kline, 2005). However, when the data was screened for missing data, it was detected that there were only six missing out of 8194 data. Since the number was very small 0.0007%), the missing responds were replaced by the value “3” on the Likert scale. The data were then checked for its normality.

Figure 4.11 demonstrated the frequency for the distribution of the scores for the general education values (GEV), mathematics education values (MEV), and mathematics values (MV). All the four charts did not represent perfect normal graphs through observation. More tests such as the kurtosis and skewness test were done to further investigate the normality of the graphs.

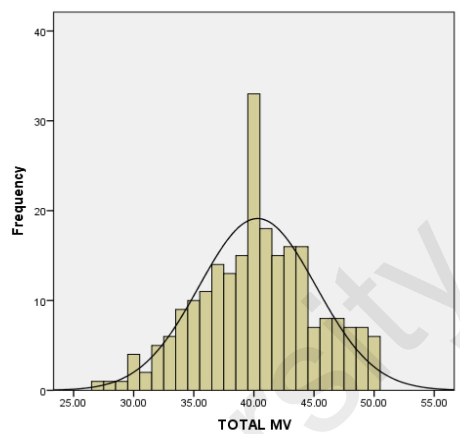
Frequency: General Education Values



Frequency: Mathematics Education Values



Frequency: Mathematics Values



Frequency: Values in Mathematics Classrooms

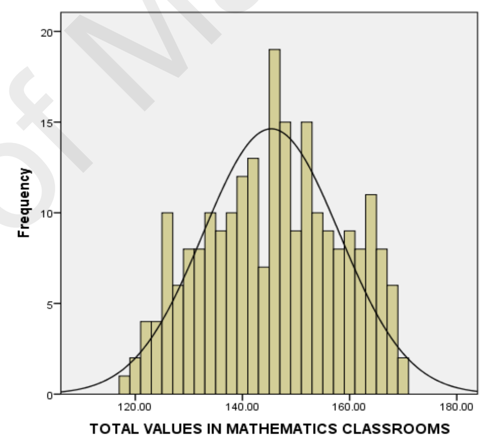


Figure 4.11 Frequency for sub-constructs and construct

Performing statistical test to check normality had an advantage over visual inspection. Table 4.30 confirmed that the distribution of the data of the four scores were not normal. They had negative values for skewness which indicated that it was skewed to the left, indicating that most values were concentrated on the right of the mean. Values greater than 1.0 or less than -1.0 can be said that the skewness would be substantial but the distribution was far from symmetrical. The kurtosis on the other hand quantifies the flattening of the data distribution. Since the data had a negative kurtosis where the kurtosis values ranged from -.889 to -.272, the distribution was expected to be flatter. A positive Kurtosis indicated that the distribution was more peaked than the Gaussian distribution. A Gaussian distribution would have a zero kurtosis.

The results indicated that the sub-scales and the scales were not perfectly normal, but having a sample size exceeding 200 cases which was a reasonably large sample may reduce the risk of problems associated with skewness and kurtosis in data sets (Tabachnick & Fidell, 2007).

Table 4.30

Descriptive Statistics: Sub-constructs and Construct

	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Deviation Statistic	Skewness		Kurtosis	
					Statistic	Std.Error	Statistic	Std.Error
Total GEV	53.00	80.00	70.5837	6.40468	-.227	.159	-.889	.318
Total MEV	19.00	40.00	34.4979	3.49152	-.160	.159	.286	.318
Total MV	27.00	50.00	40.3047	4.85983	-.118	.159	-.272	.318
Total MViC	118.00	170.00	145.3863	12.70712	-.082	.159	-.879	.318

Since the pilot study yields 241 responses, the risk was at minimum. This was because, large sample sizes of greater than 30 or 40, the risk was minimalized if the normality assumption was violated (Pallant, 2007). This would mean parametric procedures could be used even when the data were not normally distributed (Elliott & Woodward, 2007).

Reliability of construct, sub-construct, and dimensions. Chronbach's alpha values were used to measure reliabilities of construct, sub-constructs, and dimensions.

Reliability measure was one of the indication factors for accuracy of measuring procedure. The Cronbach's alpha values for the three sub-constructs, general education values (GEV), mathematics education values (MEV), and mathematics values (MV), and mathematics values in classrooms (MViC) were displayed in Table 4.4.4. All alpha coefficients were more than .70 which was the acceptable cut off in most social sciences research (Nunnaly, 1978).

The general education values consisted of 16 items, has α = .901, the mathematics education sub-construct consisted of 8 items with α = .870, the mathematics values sub-construct consisted of 10 items with α = .876, and the values in mathematics classrooms which has 34 items, has α = .939. This indicated that the level of consistency for GEV, MEV, MV, and MViC were quite high and the highest being the alpha value for the MViC (.939) which was the instrument's alpha value.

Table 4.31

Reliability Statistics for Three Sub-Constructs and Construct

	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
GEV	.901	.904	16
MEV	.870	.874	8
MV	.876	.879	10
MViC	.939	.942	34

The general education values had four dimensions, the basic, core, main and developed values, the mathematics education had the teaching and learning values, while the mathematics values had the theorists, sentimental, and sociological values. The alpha Cronbach of these nine dimensions were listed in Table 4.4.9, where majority of the values were found to be more than .7 which was good enough to show that the items within each dimension were measuring the said dimension. In Table 4.32, the only dimension with less than .70 for the alpha coefficient was the dimension of the main values under the general education values. The value .680 indicated that the item-item had low correlation in measuring the same dimension or the items were not measuring the same dimension.

However, it was important to note that number and item and number and samples played a role in determining the values of alpha. None of the dimension had alpha coefficient of more than .90. Although the three dimensions for the mathematical values which were the ideology, sentimental, and sociological had values of alpha below .80, the total of these three dimensions which was the mathematical values had a higher alpha of .876. This was also true for the dimensions of general education values, where the alpha coefficients of the dimensions were all less than the sub-construct they represented which had a higher alpha of .901.

Table 4.32

Reliability Statistics for the Nine Dimensions

Values	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
Basic	.872	.872	3
Core	.777	.780	4
Main	.680	.690	4
Developed	.849	.849	5
Teaching	.715	.720	4
Learning	.887	.888	4
Ideology	.786	.794	4

Sentimental	.720	.729	3
Sociological	.725	.727	3

Item-total statistics for the construct, sub-constructs, and dimensions. Item-total statistics provided more evidence of item consistency in measuring the said construct and sub-constructs. The item-total statistics such as the scale mean if item deleted, scale variance if item deleted, corrected item-total correlation, squared multiple correlation, and Cronbach's alpha if item deleted for all items in the sub-constructs, construct, and the dimensions were displayed below. However, the study will focus only on the corrected item-total correlation and Cronbach's alpha if item deleted.

The item-total correlations, correlates an item and a scale score (sub-constructs, construct, and dimensions) in the absence of the assessing how well one item's score was internally consistent with the rest of the items. A correlation of below .30 was considered as weak for item analysis purposes (de Vaus, 2004), probably need to be removed. The item-total correlation for all items in general education values were all more than .40, a sign of strong correlations with the scale.

Table 4.33

Item-Total Statistics for General Education Values

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Tahu Kepentingan Agama	66.07	37.038	.444	.563	.900
Prioriti Agama	66.08	35.972	.565	.700	.896
Amalkan Agama	66.16	36.051	.541	.606	.897
Baik peribadi	66.11	36.177	.655	.517	.893
Berani	66.41	35.208	.627	.531	.893
Bijaksana	66.24	35.841	.564	.386	.896
Keadilan	66.17	35.600	.658	.530	.892
Disiplin	66.11	36.729	.554	.405	.896
Kerjasama	66.13	36.354	.602	.501	.894
Akauntabiliti	66.22	35.973	.600	.426	.894
Inovasi	66.64	36.844	.410	.265	.902
Ketinggian Ilmu	66.02	37.163	.543	.422	.896
Kejayaan Ketekunan	66.03	36.952	.566	.575	.896
Kepentingan Kualiti	66.08	36.718	.600	.624	.895
Keutamaan Ketepatan	66.12	36.204	.607	.591	.894
Integriti	66.16	35.815	.677	.650	.892

Table 4.33 portrayed that the Cronbach's alpha value if any of the 16 items was deleted ranged from the lowest value of 0.892 to 0.902 which were all less than the Cronbach alpha for values in mathematics classrooms (.939). These values were all less than the Cronbach's alpha of the general education (.901) except for the 'inovasi' item which had a value of .902.

Table 4.34

Item-Total Statistics for Mathematics Education Values

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Teoretis	30.39	9.816	.449	.268	.875
Utilitarian	30.34	9.623	.562	.342	.861
Fungsian	30.19	9.570	.651	.449	.851
Penghayatan	30.09	9.746	.520	.329	.866
Penguasaan Kemahiran	30.07	9.309	.726	.570	.843
Kecekapan Pemprosesan maklumat	30.15	9.237	.692	.597	.846
Pembinaan Pengetahuan	30.14	9.389	.733	.667	.843

Pemerolehan Ilmu	30.11	9.367	.717	.605	.844

The mathematics education value had a Cronbach alpha of .870. Table 4.34 indicated that the Cronbach alpha ranged from .843 to .875 when an item was deleted. Only the 'teoretis' item was seen to have a slightly higher (.875) value than than the Cronbach's alpha of the mathematics education values (.870). None of the item-total correlation was below .30, an indication that the correlations between items and the mathematics education values were quite strong.

Table 4.35

Item-Total Statistics for Mathematics Values

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Rasionalisme	36.09	20.043	.513	.394	.870
Empirisisme	36.33	19.250	.664	.546	.859
Pragmatism	36.10	19.981	.585	.495	.865
Bersepadu sejagat	36.31	18.621	.644	.517	.860
Kawalan	36.00	20.185	.619	.434	.864
Perkembangan	36.20	19.472	.635	.475	.861
Peradaban	36.51	18.570	.642	.499	.860
Berkaitan	36.12	20.356	.530	.339	.869
Terpisah	36.59	18.657	.628	.488	.862
Berpadu	36.48	18.811	.569	.497	.867

Table 4.35 indicated the same pattern as the two tables above, where the changes of Cronbach alpha ranged from .859 to .870, which were all lower than the Cronbach's alpha value of the mathematics values (876). The corrected item-total correlations were all above than .30 and they were all positive values, portraying that items were internally consistent with the other items.

Three items were shown to have value of .939 which is the same reliability value for the instruments. The items were terpisah (separated), tahu kepentingan agama (know the importance of religion), and teoretis (Theoretist). The corrected item-total correlations in Table 4.36 were all bigger than .30, showing strong correlations between item and the scale. The instrument was reliable with a Cronbach's score of above .70 for the instrument, the three sub-constructs, and the dimensions. Items were all correlated, the instrument met the acceptable level of reliability and was determined suitable for use with the current study.

Table 4.36

Item-Total Statistics for Values in Mathematics Classrooms

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Delete
Rasionalisme	141.18	153.258	.462	.938
Empirisisme	141.42	152.029	.542	.937
Pragmatism	141.18	152.824	.538	.938
Bersepadu sejagat	141.39	149.981	.563	.937
Kawalan	141.09	152.251	.643	.937
Perkembangan	141.28	150.954	.620	.937
Peradaban	141.59	150.493	.529	.938
Berkaitan	141.20	153.446	.510	.938
*Terpisah**	141.67	151.696	.466	.939
Berpadu	141.56	150.782	.488	.938
*Tahu Kep Agama**	140.87	154.725	.386	.939
Prioroti Agama	140.88	152.508	.509	.938
Amalkan Agama	140.97	153.051	.465	.938
Baik peribadi	140.91	153.036	.572	.937
Berani	141.21	151.443	.543	.937
Bijaksana	141.05	152.183	.513	.938
Keadilan	140.97	151.594	.603	.937
Disiplin	140.91	153.881	.497	.938
Kerjasama	140.93	152.263	.604	.937
Akauntabiliti	141.02	152.357	.548	.937
Innovasi	141.44	152.024	.494	.938
Ketinggian Ilmu	140.82	154.200	.522	.938
Kejayaan Ketekunan	140.83	153.769	.545	.938
Kepentingan Kualiti	140.88	152.589	.631	.937
Keutamaan Ketepatan	140.93	152.008	.606	.937
Integriti	140.96	152.029	.616	.937
*Teoretis**	141.27	153.700	.434	.939
Utilitarian	141.23	153.231	.508	.938
Fungsian	141.08	152.894	.585	.937
Penghayatan	140.98	151.918	.589	.937
Penguasaan Kemahiran	140.96	152.167	.632	.937
Kecekapan Pemprosesan maklumat	141.03	152.180	.590	.937
Pembinaan Pengetahuan	141.03	152.219	.653	.937
Pemerolehan Ilmu	141.00	151.664	.676	.936

Table 4.37 demonstrated the item-total statistics for each dimension. The last column which represented the alpha Cronbach if the related item was deleted. All values in this column were less than the respective Cronbach's alpha for each dimension except

for items on “innovation”, “higher respect for knowledge”, and “related” in the main, developed and sociological dimensions. All the items under main value recorded lower values of .590, .584, .595, and .691 for alpha Cronbach’s, when the respective items were deleted.

Table 4.37

Item-Total Statistics for Nine Dimensions

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Basic Values (.872)					
Tahu Kep Agama	8.92	1.632	.715	.537	.854
Prioriti Agama	8.94	1.466	.818	.670	.759
Amalkan Agama	9.02	1.534	.732	.566	.840
Core Values (.777)					
Fulfilling life needs ethically	12.57	2.783	.571	.377	.697
Fulfilling safety needs ethically	12.62	2.540	.623	.420	.667
Wisdom	12.34	3.041	.495	.268	.737
Justice	12.33	2.980	.550	.312	.709
Main Values (.680)					
Disiplin	12.76	2.147	.506	.300	.590
Kerjasama	12.78	2.120	.515	.292	.584
Akauntabiliti	12.87	2.044	.492	.250	.595
Innovasi	13.29	2.061	.364	.137	.691
Developed Values (.849)					
Ketinggian Ilmu	17.94	3.812	.453	.239	.868
Kejayaan Ketekunan	17.96	3.352	.699	.540	.808
Kepentingan Kualiti	18.00	3.254	.753	.607	.794
Keutamaan Ketepatan	18.05	3.213	.674	.542	.815
Teaching Values (.715)					
Teoretis	12.87	2.047	.454	.245	.685
Utilitarian	12.82	2.034	.544	.312	.627
Fungsian	12.67	2.057	.618	.386	.589
Penghayatan	12.57	2.220	.412	.193	.705

Learning Values (.887)					
Learn for mastering skills	13.11	2.173	.694	.503	.814
Learn for processing	13.24	2.036	.670	.495	.825
Learn for constructing	13.22	2.040	.744	.595	.792
Learn for obtaining knowledge	13.16	2.182	.674	.534	.821
Ideologist (.786)					
Rasionalisme	12.16	2.965	.535	.324	.762
Empirisisme	12.40	2.681	.700	.509	.680
Pragmatism	12.17	2.884	.666	.478	.703
Bersepadu sejagat	12.38	2.737	.505	.283	.789
Sentimental Values (.720)					
Kawalan	7.90	1.667	.476	.256	.712
Perkembangan	8.10	1.270	.645	.417	.504
Peradaban	8.40	1.121	.541	.325	.658
Sociological Values (.725)					
Berkaitan	7.55	2.094	.470	.222	.730
Terpisah	8.01	1.470	.611	.378	.556
Berpadu	7.90	1.417	.591	.361	.586

The same case can be seen for the teaching dimension under the mathematics education value where the Cronbach alpha was recorded as .685, .627, .589, and .705 if respective item was deleted. The corrected item-total correlation between an item and the respective dimensions, sub-constructs, and construct without that item being considered as part of the scale were all above .4, which was considered quite high. Thus, it can be concluded that the item was measuring the same value the rest of the values trying to measure.

Findings from Rasch Analysis. Rasch analysis was used to further inspect the validity of the instrument especially on the unidimensional measurement. The Item Respond Theory was used in which model was matched by the data, identifying and diagnosing sources of discrepancies, and removing items or persons if they are risking the quality of the instrument. The discussion on the pilot study included summary statistics, item separation reliability, item and person reliability for sub-constructs, item infit and outfit, person separation reliability, uni dimensionality, item characteristics curves, rating scale functioning, revision of items, discussions, and summary of pilot study analysis.

Item, person, and separation reliabilities. To analyze how well the data collected fit the Rasch Model, summary statistics of the overall performance is provided in Table 4.38 from 241 respondents who responded to the 34 value items. The second table depicted the summary statistics of only 233 respondents where eight extreme persons were deleted.

The person reliability is seen to improve from .91 to .93 once the extreme cases were eliminated. However, the person Cronbach alpha reduced from .95 to .94. It was expected as Cronbach alpha value was dependent on the number of sample involved. In the present study, item and person reliability indexes from Rasch analysis were 0.97 and 0.93, respectively. Reliability values of more than 0.8 were acceptable, between 0.6 and 0.8 were less tolerable, and values less than 0.6 were not tolerable (Bond & Fox, 2007). The statistical summary table provided the mean of the item which was always set to be at 0.0 logit while the person mean was observed at 3.13 logit. Generally, the instrument was reliable in measuring the constructs (Sekaran, 2003).

The item and person separation index measured the spread for both the items and the persons providing the number of levels in which both the items and the persons can be separated. In this data, the person separation was 3.53 and the model separation index was 3.89. Separation index 1.0 and below indicated that items did not have enough range in position and values ≥ 2 were considered as good (Linacre, 2007). The item separation measure for the real data was 5.82 and 6.09 for the model separation.

Table 4.38

Summary Statistics

Summary of 241 Measured (Extreme and Non-Extreme) Persons

	RAW SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	146.2	34.0	3.31	.39				
S.D.	13.2	.0	1.71	.28				
MAX.	170.0	34.0	8.70	1.84				
MIN.	118.0	34.0	.64	.26				

REAL RMSE	.51	ADJ.SD	1.64	SEPARATION	3.23	Person RELIABILITY	.91
MODEL RMSE	.48	ADJ.SD	1.64	SEPARATION	3.40	Person RELIABILITY	.92

S.E. OF Person MEAN = .11

Person RAW SCORE-TO-MEASURE CORRELATION = .95
CRONBACH ALPHA (KR-20) Person RAW SCORE RELIABILITY = .95

Summary of 233 Measured Persons

	RAW SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	145.4	34.0	3.13	.34	1.03	-.1	1.01	-.1
S.D.	12.6	.0	1.42	.09	.52	2.0	.56	2.0
MAX.	169.0	34.0	7.45	1.02	3.35	5.5	3.73	6.9
MIN.	118.0	34.0	.64	.26	.14	-5.1	.12	-5.3

REAL RMSE	.39	ADJ.SD	1.36	SEPARATION	3.53	Person RELIABILITY	.93
MODEL RMSE	.36	ADJ.SD	1.37	SEPARATION	3.86	Person RELIABILITY	.94

S.E. OF Person MEAN = .09

DELETED: 8 Persons
Person RAW SCORE-TO-MEASURE CORRELATION = .98
CRONBACH ALPHA (KR-20) Person RAW SCORE RELIABILITY = .94

Summary Of 34 Measured Items

	RAW SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	996.2	233.0	.00	.13	1.00	-.1	1.01	.0
S.D.	52.8	.0	.78	.01	.23	2.3	.25	2.2
MAX.	1064.0	233.0	1.76	.14	1.56	5.0	1.69	4.2
MIN.	865.0	233.0	-1.13	.10	.64	-4.1	.61	-4.0

REAL RMSE	.13	ADJ.SD	.77	SEPARATION	5.82	Item RELIABILITY	.97
MODEL RMSE	.13	ADJ.SD	.77	SEPARATION	6.09	Item RELIABILITY	.97

S.E. OF Item MEAN = .14

UMEAN=.000 USCALE=1.000
Item RAW SCORE-TO-MEASURE CORRELATION = -1.00
7922 DATA POINTS. APPROXIMATE LOG-LIKELIHOOD CHI-SQUARE: 11601.91

Table 4.39 demonstrated indices items and person reliability and separation for the three sub-constructs which were the general education values, mathematics education values, and mathematics values. The items for the three sub-constructs have reliability ranging from .93 to .97, while respondents' reliability index is between .77 and .84. Both reliabilities are less than the reliability for the instrument. The mathematics values have the highest item reliability of .97 as compared to the other two sub-constructs although it consists the lowest number of items which is 10. Both items and person showed high reliability indicating having sufficient number of items and persons besides showing the items can represent respective sub-constructs.

Table 4.39

The Item and Person Reliability for Construct and Three Sub-constructs (Pilot Study)

Construct /sub-construct	**Total Items**	**Item Reliability**		**Total Person**	**Person Reliability**	
		Item	**Separation**		**Person**	**Separation**
Values in Mathematics Classrooms	34	.97	5.82	233	.93	3.53
General Education Values	16	.94	3.95	220	.84	2.31
Mathematics Education Values	8	.93	3.57	208	.77	1.81
Mathematics Values	10	.97	5.40	228	.84	2.29

Both the items and persons' separation index were more than 2.0 which were considered good (Linacre, 2005). Separation indices were indicators for items' difficulty levels and persons' level of endorsing the items. Item separation index was between 3.57 to 5.40 and person separation index ranged from 1.81 to 2.29, where both were lower than the separation of items and persons for the instrument which are 5.83 and 3.53 respectively. Persons' separation index was lower than item separation index for all the sub-constructs and the mathematics education values had the lowest separation of 1.81. Lower separation index indicates that the items of the respective sub-constructs were not able to measure the ability of the respondents (Bond & Fox, 2007). Person separation index of 1.81, 2.29, and 3.31 for the three sub-constructs were considered sufficient to conclude that the items could statistically differentiate the distinct ability levels of the respondents.

Item analysis. The Rasch model provided the infit, outfit statistics and the point measure correlation to consider. Fit statistics assisted in identifying items significant to the respective construct and highlighting any misfitting items which may represent some other construct (Smith & Suh, 2003). In addition, it provided information on how the response patterns matched those predicted by the model. Each value item played a significant part in the way a construct was being investigated. The outfit-order statistics identified items which appeared to be influenced by unpredicted response to items, for example when a person with low ability gets a very difficult item correct. On the contrary, infit statistics was influenced by an unexpected pattern of responses near a person's ability estimate, for example when a person gets the item near the person's ability estimate incorrect.

The item infit and outfit statistics summary for the instrument listed down measurement of logit for all items (the column labeled "OUTFIT MNSQ" in the table) as demonstrated in Table 4.4.20. The first column, 'ENTRY NUMBER", corresponded to the 34 value items. 'TOTAL SCORES' indicated the total sum of recorded responses for that item. The 'TOTAL COUNT' was the number of respondents attempted an item and the 'MEASURE' column was the Rasch measure for item difficulty to be endorsed or person ability. "MODEL s.e." represented the standard error of estimates for item difficulty or person ability.

Thus, the items at the top were more misfitting than those at the bottom depending on their MNSQ values. There was information on the z-standard (z-std) value, and Point

Measure Correlation (PMC) to identify outliers or misfit items. Assessment on fit items started with observing the MNSQ which was the ratio of observed and expected values, thus the ideal MNSQ = 1. The following table portrayed the mean square value and the implications.

When infit and outfit were considered, a mean squared value range cutoff was determined by the sum of Mean Infit MNSQ with +S.D. and –S.D. where S.D. stands for the standard deviation. In this sample, an item having larger than 1.00 + 0.23 = 1.23 logit or smaller than 1.00 - 0.23 = 0.77 logit was considered not fulfilling the expectation of the model (Linacre, 2007). Fit statistics higher than 1.23 demonstrated too much variation in response pattern and fit statistics lower than 0.77 indicated too little variation. Bond & Fox, (2007) suggested that for the data to fit the model, the two fit statistics must be in the range of 0.6 logits to 1.4 logits. However, Linacre (2002) suggested slightly different values with greater range for productive measurement (0.5 – 1.5).

Table 4.40

Mean-square Value and Interpretation

Mean-square Value	Implication for Measurement
> 2.0	Distorts or degrades the measurement system. May be caused by only one or two observations.
1.5 - 2.0	Unproductive for construction of measurement, but not degrading.
0.5 - 1.5	Productive for measurement.
< 0.5	Less productive for measurement, but not degrading. May produce misleadingly high reliability and separation coefficients.

Another indicator which enhances the measure of item misfit is the z-std value which indicates the significance of the misfit. Linacre (2007) proposed the acceptable values range of $-2.0 < t < 2.0$. Detail interpretation for is given in Table 4.41.

Table 4.41

Standardized Values and Interpretation

Standardized Value	Implication for Measurement
≥ 3	Data much unexpected if they fit the model (perfectly), so they probably do not. But, with large sample size, substantive misfit may be small.
2.0 - 2.9	Data noticeably unpredictable.
-1.9 - 1.9	Data have reasonable predictability.
≤ -2	Data are too predictable. Other "dimensions" may be constraining the response patterns.

The Point Measure Correlation was another statistic which assisted to further verify the fit of an item. It measured the strength of the item measuring the direction of the construct. Any item which instigated high ability respondents to respond incorrectly or instigated low ability students to respond correctly were likely to exhibit negative values for point measure correlation (Boone & Scantlebury, 2006).

The acceptable parameters were between 0.4 and 0.8 and negative values were items which was not measuring what it was supposed to measure and was highly recommended to be eliminated. The table below illustrated that values for point measure correlations were all between 0.4 and 0.8 and there wasn't any negative point-measure correlation. Items with MNSQ values nearer to 1 and z-std nearer to 0 would have a better fit, a property which can be used to decide whether an item should be retained or not. Items 13, 10, 7, 20, 15, 32, 18, and 12 are found to have the MNSQ values ranging from 0.91 to 1.07 (near to 1) and the z-std ranging from -1.0 to .7 (near to zero). The instrument largely satisfies the Rasch model. However, there were three items which fall outside both the infit and z-std acceptable ranges. In addition, two items fall outside of the acceptable z-std range as suggested by Bond and Fox, (2007). These poor fitting items (NUA1, NUA2, and NUA3) were unable to contribute significantly to the scale. For outfit, two items (NUA1 and NMC3) fall outside both the acceptable ranges for outfit and z-std. On the other hand, nine items fall outside the acceptable z-std range. Misfits indicate that items received unexpected response and respondents' responses were out of expectations.

The items belonging to the group at the bottom of Table 4.42 were items which may overlap or redundant. The rest of the items which were flagged to have misfit were those belonging to the group on top of the table. There were four items identified to be non-homogeneous to the rest of the items in the scale. Three of them were the items representing the general education values and one item representing mathematics values. These 4 items needed to be analyzed further to decide on items to be improved or removed (Linacre, 2005). Items were with positive point-measure correlation, which indicated that success on those items was highly correlated with increasing person ability estimate. The list of the items flagged for further analysis had been identified in Table 4.41 below together with the extracted infit, outfit and z-std values.

Attention should also be given to items which had the same item measure, as these items were potentially measuring the same construct. For example, Table 4.42 indicated that items 4 and 8 have the same measure. This was probably because item 4 was measuring "akhlaq" translated as excellent characteristics and item 8 was measuring the values of discipline. However, these two items do not belong to the same dimension, item four was measuring the dimension of the core value while item 8 was measuring the dimension of the main value. If not, decisions need to be made as to which item to be retained. It was clear that there were no other items in the instrument having the same measure, reducing the chances of needing to remove some items.

Table 4.42

Statistics Summary for 34 items

TABLE 10.1 VALUES IN MATHEMATICS CLASSROOMS ZOU941WS.TXT Feb 6 23:48 2014
INPUT: 241 Persons 34 Items MEASURED: 233 Persons 34 Items 5 CATS 1.0.0

Person: REAL SEP.: 3.53 REL.: .93 ... Item: REAL SEP.: 5.82 REL.: .97
Item STATISTICS: MISFIT ORDER

ENTRY NUMBER	RAW SCORE	COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PTMEA CORR.	EXACT OBS%	MATCH EXP%	Item
1	1052	233	-.89	.14	1.56	5.0	1.69	4.2	A .41	58.8	70.4	NUA1Tahu Kepercayaan Tuhan
3	1030	233	-.49	.13	1.45	4.0	1.35	2.7	B .49	64.4	68.8	NUA3Amal Percaya Tuhan
34	891	233	1.47	.11	1.30	2.8	1.44	4.0	C .53	58.8	60.1	NMC3Bersepadu
2	1049	233	-.84	.14	1.41	3.8	1.21	1.5	D .52	61.8	70.2	NUA2Penting Percaya Tuhan
17	958	233	.63	.12	1.18	1.7	1.37	3.2	E .45	63.5	64.7	PMP1Teori
6	1011	233	-.17	.13	1.29	2.6	1.26	2.2	F .54	69.5	68.1	NUT3Kebijaksanaan
33	865	233	1.76	.10	1.18	1.8	1.29	2.7	G .52	54.1	58.4	NMC2Keterbukaan
11	918	233	1.15	.11	1.12	1.2	1.20	2.0	H .52	56.2	62.2	NUU4Inovasi
25	981	233	.30	.12	1.20	1.9	1.19	1.7	I .49	60.1	66.6	NMI1Rationalism
31	884	233	1.55	.11	1.11	1.1	1.19	1.8	J .58	59.7	59.6	NMS3Peradaban
5	973	233	.42	.12	1.14	1.3	1.18	1.7	K .57	62.2	66.0	NUT2Keselamatan
8	1042	233	-.71	.14	1.04	.5	1.18	1.3	L .52	70.0	69.4	NUU1Disiplin
28	930	233	1.00	.11	1.17	1.6	1.16	1.5	M .60	59.7	63.1	NMI4Integrated
13	1061	233	-1.07	.14	.90	-1.0	1.07	.5	N .55	79.4	71.1	NUK2Ketekunan kejayaan
10	1017	233	-.27	.13	1.06	.7	1.02	.2	O .57	69.5	68.4	NUU3Akauntabiliti
7	1028	233	-.46	.13	1.00	.0	.91	-.7	P .62	72.5	68.8	NUT4Keadilan
20	1027	233	-.44	.13	.99	.0	.91	-.8	Q .61	72.5	68.8	PMP4Penghayatan
15	1039	233	-.65	.13	.93	-.7	.97	-.2	q .60	73.8	69.3	NUK4Ketepatan
32	974	233	.40	.12	.90	-1.0	.95	-.4	p .54	67.0	66.0	NMC1Terpisah
18	968	233	.49	.12	.93	-.7	.94	-.5	o .54	68.7	65.7	PMP2Utiliti
12	1064	233	-1.13	.14	.93	-.7	.89	-.7	n .54	76.0	71.4	NUK1Utama Ilmu
9	1038	233	-.64	.13	.88	-1.3	.91	-.6	m .61	79.4	69.3	NUU2Kerjasama
27	979	233	.33	.12	.89	-1.1	.86	-1.3	l .59	72.5	66.4	NMI3Pragmatism
22	1014	233	-.22	.13	.89	-1.1	.83	-1.5	k .62	74.2	68.3	PMB2Proses Maklumat
4	1042	233	-.71	.14	.88	-1.2	.85	-1.1	j .58	70.8	69.4	NUT1Akhlaq
26	925	233	1.07	.11	.87	-1.3	.87	-1.4	i .59	67.8	62.8	NMI2Empiricism
16	1031	233	-.51	.13	.86	-1.5	.82	-1.5	h .62	76.8	69.0	NUK5Integriti
30	956	233	.66	.12	.81	-2.0	.81	-2.0	g .65	68.7	64.6	NMS2Kemajuan
21	1031	233	-.51	.13	.76	-2.6	.76	-2.1	f .65	79.0	69.0	PMB1Kemahiran
14	1050	233	-.86	.14	.75	-2.8	.72	-2.3	e .64	79.8	70.2	NUK3Kualiti
19	1003	233	-.04	.13	.75	-2.7	.75	-2.5	d .62	75.5	67.7	PMP3Bina Pengetahuan
24	1022	233	-.36	.13	.66	-3.8	.61	-3.8	c .69	79.4	68.6	PMB4Peroleh ilmu
29	1002	233	-.03	.13	.64	-4.0	.65	-3.6	b .66	78.1	67.7	NMS1Kawalan
23	1015	233	-.24	.13	.64	-4.1	.61	-4.0	a .68	77.7	68.3	PMB3Bina Pengetahuan
MEAN	996.2	233.0	.00	.13	1.00	-.1	1.01	.0		69.4	67.0	
S.D.	52.8	.0	.78	.01	.23	2.3	.25	2.2		7.6	3.3	

Four misfitting items were located at the top of the list in which their reliability and separation of items and persons did not fulfill the requirements. These items were further examined where the item and person separation and reliability were generated for all the 34 items, when two items being eliminated (32 items), when three items being eliminated (31 items), and when four items being eliminated as illustrated in Table 4.43 which portrayed the minimum changes in the reliability and the separation values.

Table 4.43

List of Items outside the Acceptable Range

Sub-construct	Items with values outside the range for the outfit MNSQ and outfit z-std.	Infit MNSQ	Infit z-std	Outfit MNSQ	Outfit z-std
General Education Values	NUA1(Know God exists)	1.56	5.0	1.69	4.2
	NUA2 (Importance of believing in God)	1.41	3.8	1.21	1.5
	NUA3 (Practice the belief)	1.45	4.0	1.35	2.7
Mathematics Education Values			None		
Mathematics Values	NMC3(Integrated)	1.3	2.8	1.44	4.0

Table 4.44 demonstrated that the effect was minimum on the separation and reliability of both the items and the persons when comparing the analysis of 34, 32, 31, and 30 items.

Table 4.44

Comparisons when Misfitting Items were eliminated

	34 items	32items NUA1& NUA2 eliminated	31 items NUAI, NUA2, NMC3 eliminated	30 items NUAI, NUA2, NUA3, NMC3 eliminated
Separation of items	5.82	5.92	5.69	5.83
Reliability of items	.97	.97	.97	.97
Separation of persons	3.53	3.49	3.45	3.45
Reliability of persons	.93	.92	.92	.92

Person analysia. In Rasch analysis, reliability can be considered from the perspectives of both the items and person. Person separation indicated the success of the instrument in spreading out respondents' values in mathematics classrooms. It was analogous to the Cronbach's alpha reliability in classical test theory. Table 4.4.18 below indicated the person separation reliability for this pilot study data was 0.93, indicating confidence in the ability to separate the teachers into several levels. It was an estimate on how well the respondents can be differentiated on their levels of mathematics values in classrooms.

Table 4.45

Statistics Summary of 233 Measured (Non-Extreme) Persons

	Raw Score	Count	Measure	Model Error	Infit MNSQ	Infit ZSTD	Outfit MNSQ	Outfit ZSTD
MEAN	145.4	34.0	3.13	.34	1.03	-.1	1.01	-.1
S.D	12.6	.0	1.42	.09	.52	2.0	.56	2.0
MAX	169.0	34.0	7.46	1.02	3.35	5.5	3.73	6.9
MIN	118.0	34.0	.64	.26	.14	-5.1	.12	-5.3

REAL RMSE .39 ADJ SD 1.36 Separation 3.53 Person RELIABILITY .93

MODEL RMSE .36 ADJ SD 1.37 Separation 3.89 Person RELIABILITY .94

Deleted:8 Person
Person RAW SCORE-TO-MEASURE CORRELATION = .98
CRONBACH ALPHA (KR-20) Person RAW SCORE RELIABILITY = .94

Table 4.45 gave an overall indication of the fit of the persons to the model. MNSQ values less than .7 or greater than 1.3 and ZSTD values greater than 2.0 or smaller than -2.0 are generally considered to be potentially misfitting (Bond & Fox, 2007). The infit and outfit of mean square (MNSQ) in the table had expected values of 1.03 and 1.01, and the standardized fit statistics (ZSTD) have expected value of -0.1 for both the infit and outfit.

Table 4.46

Person Statistics: Misfit Order

ENTRY NUMBER	RAW SCORE	COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PTMEA CORR.	EXACT MATCH OBS%	EXACT MATCH EXP%	Person
88	164	34	5.40	.47	1.35	1.1	2.28	2.4	-.30	79.4	82.5	088052pmsy2
108	161	34	4.84	.40	1.48	1.7	1.70	2.0	-.29	61.8	75.6	108072pmsy2
170	157	34	4.26	.36	1.28	1.3	1.29	1.2	-.05	50.0	68.7	170092pmsy2
232	152	34	3.66	.33	2.60	5.5	2.53	5.4	-.09	44.1	63.2	232122pmsy1
167	147	34	3.13	.32	1.09	.5	1.09	.5	-.20	52.9	60.7	167092pmsy1
162	146	34	3.02	.32	1.06	.3	1.06	.3	-.23	55.9	60.7	162092pmsy1
161	145	34	2.92	.32	1.13	.6	1.12	.6	-.10	58.8	61.4	161092pmsy1
171	145	34	2.92	.32	.96	-.1	.95	-.2	-.16	64.7	61.4	171092lmsy1
176	145	34	2.92	.32	1.96	3.3	2.00	3.5	-.11	41.2	61.4	176092lmsy2
96	142	34	2.62	.31	1.45	1.7	1.43	1.6	-.22	61.8	63.4	096062lmsy2
118	137	34	2.15	.30	.30	-3.5	.29	-3.7	-.07	91.2	65.7	118072pmsy1

Item reliability can be affected by having bad responses from misfit person. Respondents providing such data can be categorized as unreliable data and need to be eliminated. To decide on misfit person, MNSQ, z-std values, and PMC of the infit and outfit are used similarly to item misfit. The range for the infit is between 0.53 and 1.03, while the outfit MNSQ range is between 0.5 and 1.56. Bond and Fox (2007) suggested 0.63 – 1.35 as the proposed range for person measure. Eleven persons are identified as unreliable due to the negative values of the Point Measure Correlation as illustrated in Table 4.46

Principal components analysis of residuals (PCAR). One of the method to check for dimensionality of the scale is using PCAR. It is an advocated statistical test in the Rasch Model to look for any pattern in the data indicating non-conformity with the Rasch Model, and whether this unexpectedness shared the same common essential features. The study was checking whether there were potential subclasses of items within the scale or known as the "secondary dimension".

The test will demonstrate the contrast of opposing factors instead of loading on one factors as the procedure of Factor Analysis (Linacre, 2008) which may be misled the unidimensional of a scale. The study followed the proposed criteria where the values of unexplained variance by 1st unexplained variance being less than 3% is excellent, between 3 to 5% is very good, between 5 to 10% is good, between 10 to 15% is moderate and 15% is poor (Fisher, 2007). The raw variances explained by measures were required to have a minimum of 40% (Fisher, 2007) and suggested to be more than 60% (Linacre, 20007). The table below demonstrated that the variances explained by measure are all more than 40%. The data extracted that the variance explained by measures reading from the empirical data as 55.2% to fit the model was 54.8% as depicted in Table 4.47 were considered strong. The unexplained variance emanating from the data was 44.8% and the model's expectation is 45.2% which fulfills the cut-off point of 40% conditions (Fisher, 2007).

Four factors (contrasts) were observed from the principal components analysis of residuals (PCAR) table. The table indicated that the unexplained variance which stands at 5.3% had a contrast of not more than 15%, as required by Rasch analysis. It was shown that 11.9% of the variance was clarified by the first factor of residuals and the ratio of 55.2% and 11.9% is about 4.6 is to 1 which not supportive of unidimensional. Furthermore, factor one extracts 4 units (5.3%) out of the 34 units of variable residual variance noise. As Linacre (2005) states, if any factor extracts more than 3 units, it was likely that a second dimension has come across. If secondary dimensions were significant enough to impact the empirical meaning or use of the measures, the researcher may consider diagnostic actions such as grouping the items into other categories of the values or constructing additional sub-values (Linacre, 1998).

Table 4.47

Table of Standardized Residual Variance (In Eigenvalue Units)

		Empirical			Modeled
Total variance in observations	=	75.9	100.0%		100.0%
Variance explained by measures	=	41.9	55.2%		54.8%
Unexplained variance (total)	=	34.0	44.8%	100.0%	45.2%
Unexplned variance in 1st contrast	=	4.0	5.3%	11.9%	
Unexplned variance in 2nd contrast	=	3.3	4.3%	9.6%	
Unexplned variance in 3rd contrast	=	2.3	3.1%	6.9%	
Unexplned variance in 4th contrast	=	2.0	2.7%	5.9%	

Table 4.48 demonstrated that the ratios of variance explained by measure and variance explained by the first factors were 3.3, 2.1, and 2.5 did not support unidimensional. This is because, if any factor extracts more than 2 units, it is likely that we have come across a second dimension. The analysis also indicated that the three variances explained by measures were all more than 40% as suggested by Rasch Analysis.

Table 4.48

Uni-dimensionality: Standardized Residual Variance for Sub-constructs

Sub-constructs	Variance Explained by Measures (%)(eigen)	Unexplained Variance Explained by 1st Contrast (size)	Ratio of variance explained by measure and variance explained by the first factors
General Education Values	59.1%	2.9 out of 16 items (17.8%)	3.3
Mathematics Education Values	54.3%	2.1 out of 8 items (26.0%)	2.1
Mathematics Value	55.8%	2.2 out of 10 items (22.4%)	2.5

Rating scale functioning. Another factor which may affect the measurement property was the rating scale. To proceed, the data must fulfill the three measuring stability measures. The first criteria required the data to have minimal of 10 observations for each rating scale, the data advanced monotonically with each category, and that OUTFIT MnSq, (Linacre, 2002).

Rasch analysis requires the observed value to increase as the variable difficulty increases. As the response category increases from “1” to “5” the observed average should also increase. An average measure disorder was detected in Table 4.49 since there was an increase and decrease of values observed average indicated the inconsistency in the response pattern. Transition of the decision making from one category to another is captured in the Structure Calibration column. The difference was suggested to be 1.4 apart but cannot be more than five. The differences are recorded as -2.87, -1.03, .26, and 3.6 implying it was not necessary to split the category since they were all less than 5. Having less than 1.4 as depicted in the table below, suggested that category 2, 3, and 4 to be collapsed. If it is more than 5, it is best to split the category. Categories 1, 2, and 3 were not being utilized as there were less than 10 observed count suggesting that it is feasible to consider that it is not serving a purpose in the survey instrument.

Table 4.49

Summary of Category Structure

SUMMARY OF CATEGORY STRUCTURE. Model="R"

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
1	1	5	0	1.94	-.09	1.89	4.14	NONE	(-4.08)	1
2	2	105	1	.94*	.47	1.29	1.48	-2.87	-2.04	2
3	3	721	9	1.43	1.37	1.06	1.12	-1.03	-.33	3
4	4	3963	50	2.54	2.61	.93	.88	.26	2.00	4
5	5	3128	39	4.35	4.29	.94	.94	3.65	(4.77)	5

Linacre (2002) suggested as a rule of thumb that categories with fewer than 10 observations limit the precision and stability of these estimates. Unobserved categories present significant challenges to the interpretation of rating scales. The infit MNSQ was expected to be “1”, where values bigger than 1.5 was considered problematic. Thus category “1” is problematic as it has a value of 1.89.

Figure 4.12 demonstrated the category probabilities on how likely was the reading for each rating category related to the item measures. The y-axis was the probability of responses and x-axis was the item measure.

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        CATEGORY PROBABILITIES: MODES - Structure measures at intersections
P      ++-----+-----+-----+-----+-----+-----+-----+-----+-----+-----++
R  1.0 +                                                             +
O      |                                                             |
B      |1                                                            |
A      | 111                                                         |
B   .8 +    11                                                      5+
I      |      1                                   4               55 |
L      |       1                              4444 4444          5   |
I      |        11                           4         44       5    |
T   .6 +          1                        44            4    55     +
Y      |           1    2222              4               44 5       |
    .5 +            1 22    222     3    4                  *        +
O      |            2*         2 333 3334                  5 4       |
F   .4 +           2  1        3*      433                5   4      +
       |         22    1      3  2    4   33            55     44    |
R      |        2       1   33    22 4      3          5         4   |
E      |      22         113        *        33       5           44 |
S   .2 +    22            31      44 2         3    55              4+
P      |  22            33  11   4    22        33*5                 |
O      |22           333      1*4       22     555 33                |
N      |         3333      4444 1111      ****5      333333          |
S   .0 +*******************555555555******1111***********************+
E      ++-----+-----+-----+-----+-----+-----+-----+-----+-----+-----++
       -5    -4    -3    -2    -1     0     1     2     3     4     5
        Person [MINUS] Item MEASURE
```

Figure 4.12 Categories probabilities

The value for zero logit resembles the points at which the highest and the lowest categories were expected to be detected. It was expected that the plot looks like a series of hills shaped. The choices of response needed to be reconsidered in terms of their labeling and number of response options for categories which never emerged as peaks. Figure 4.12 also indicated some confusion around categories “2” and “3”. The researcher will need to consider the possibility of merging the two categories, making it into a 4-point Likert scale.

Confirmatory factor analysis. The confirmatory factor analysis (CFA) was used to test the validity of the instrument being developed using several fit indices. It is divided into three parts, the general education, mathematics education, and mathematics values. To confirm the factor structure, the following fit indices were selected: root-mean-squared error of approximation (RMSEA), comparative fit index (CFI)), Tucker Lewis Index (TLI), and the standardized root mean square residual (SRMR).

Researchers suggest that SRMRs below 0.08 and RMSEAs below 0.06 would suggest a good fit. This could be enhanced when accompanied by TLI values greater than 0.95 (Hu & Bentler, 1998, 1999). SRMR was critical because it represented the average difference in the correlation matrix used both in estimating the model and the matrix proposed by the model. CFI and TLI were both between 0 and 1, with values close to zero being poor and greater than 0.90 to be good indicators of a fit model.

Table 4.50

Table 4.50

Fit Indices for Confirmatory Factor Models in Sample

	Chi Square	df	TLI	CFI	RMSEA	SRMR
General Education Values	248.312	32	.897	.916	.119	.025
Mathematics Education Values	44.037	19	.956	.970	.075	.016
Mathematics Values	137.766	98	.842	.888	.119	.035

RMSEA = Root Mean Squared Error of Approximation; CI = confidence interval; CFI = Comparative Fit Index.

The fit table above demonstrated that the TLI values for both the GEV and MV were .916 and .970 and the CFI value for mathematics values were .888. They were all below than .90. The root mean square value for all the factors are .025, .016, and .035 which were all below than .08. Values between .85-.89 were considered marginal range by Fan and Sivo (2007). Values of the root mean of square error were all bigger than .06. General education and mathematics values had RMSEA values of .119 and were more than the expected values indicating, while the mathematics education values had .750 which was a marginal value (Hu & Bentler, 1999). The result suggests that the conceptual framework of the values in mathematics classes was not strongly supported by the three factors.

First order confirmatory factor analysis. The analysis was a theoretical based and used to explore the validity and reliability of the items in measuring the designated sub-constructs. In this study the items which were hypothesized to load to the three sub-constructs were demonstrated using the path diagram and parameter loadings in Figures 4.4.5a, 4.4.5b, and 4.4.5c. The standardized factor loadings were scrutinized to check on the convergent validity. It was suggested that factor loadings values must be around .50 or higher and having higher than .70 would be considered as ideal (Hair, Black, Babin, Anderson, and Tatham, 2006).

Loadings for the expanded values and main values to basic values were the only loadings which were below than 0.5. The loadings were .41 and .45 respectively. The rest had loadings more than .5 and factors with loadings more than .8 suggesting good convergent validity. The loading of the path measurement model sub-constructs and dimensions were all recorded to be above .5, which indicated good fit.

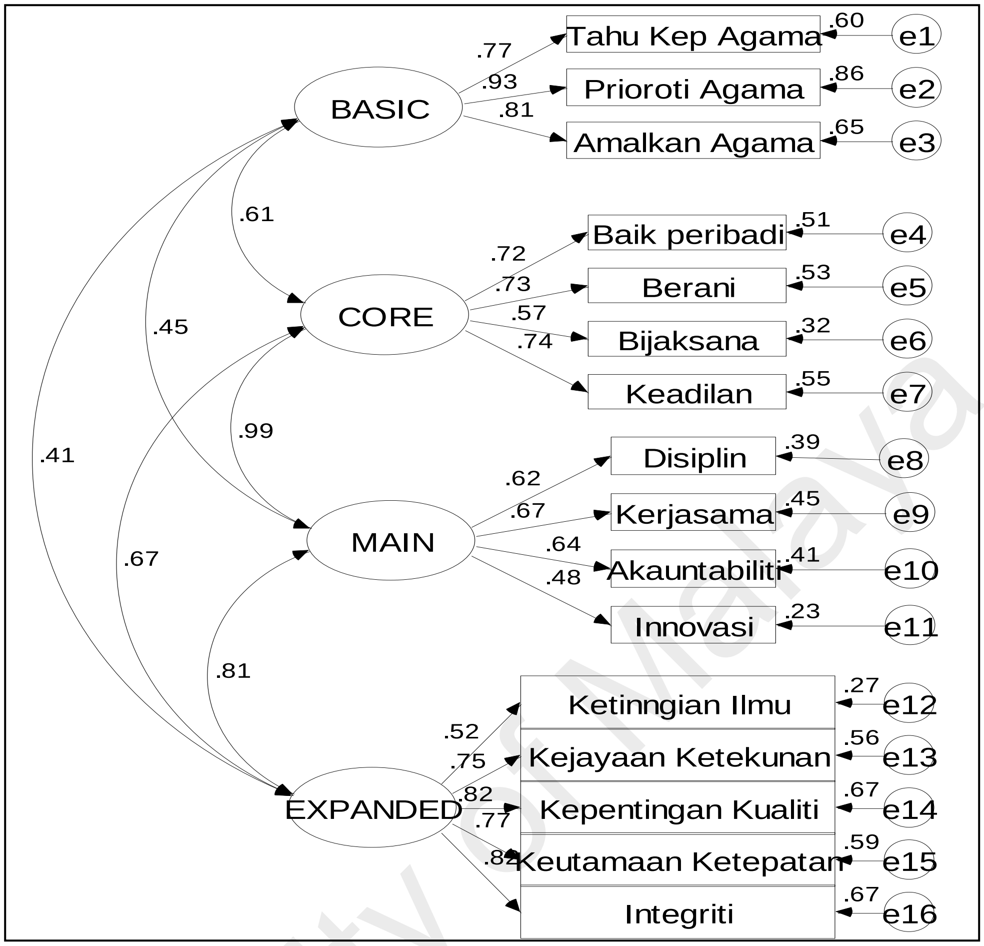

Figure 4.13 The correlated first order model with four dimensions for GEV

The model in figure 4.4.5 had four correlated factors, basic, core, main, and expanded values that was each measured by three, four, four, and five continuous factors indicators respectively. The strong correlation between the core, main, and expanded values suggested a lack of discriminant validity. However, this reflected the common underlying positive values in the general education hence, viewing from the universal integrated approach theory, this is not problematic. All factor loadings were shown to be more than .06 except for *ketinggian ilmu* which was high appreciation on knowledge with factor loading of .52.

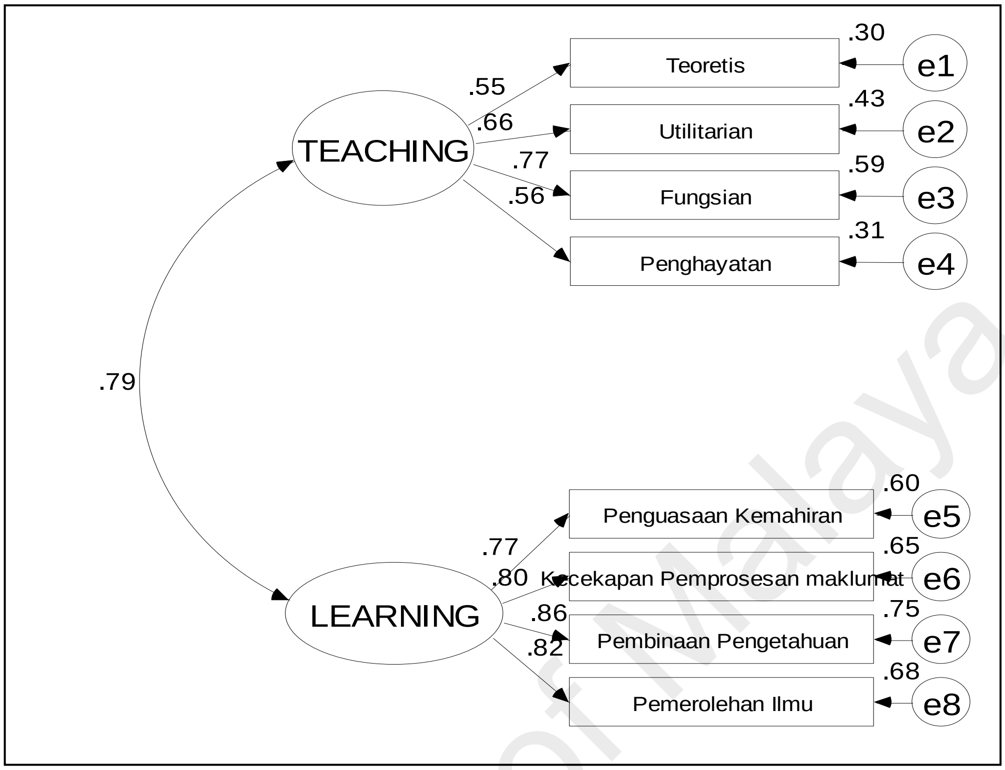

Figure 4.14 The correlated first order model with two dimensions for MEV

The correlation of the two factors in mathematics education values is .79 and factor loadings were all more than .06 except for *teoretis* and *penghayatan* which were items describing the values in teaching mathematics from the perspective of theory and internalization with values of .55 and .56. The items from the learning factors seemed to have better factor loadings than the teaching factor.

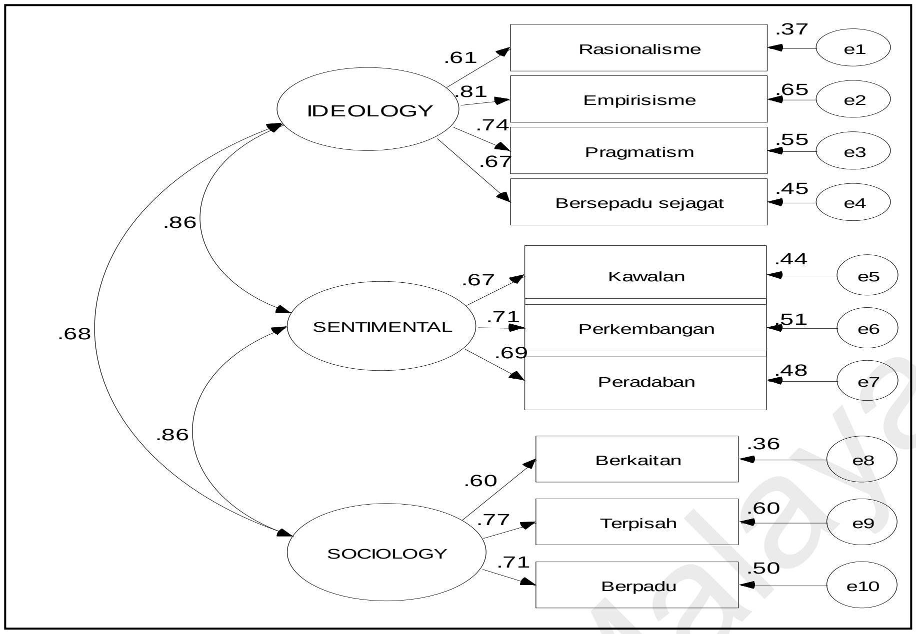

Figure 4.15 The correlated first order model with three dimensions for MV

Factor loadings for the items in Figure 4.4.5c were all more than .60. Generally, only one of the factor loadings were found to be .81 and the rest were all below .80. However, none of the factor loadings were found to be less than .5.

Cross tabulations between sub-constructs and demographic profiles. In this section the cross tabulations of highest academic qualifications, teaching experience, gender, and age group with the scores on the GEV, MEV, MV, and MViC were conducted. All scores were categorized into four ranges of scores, by using the percentile cut off suggested by SPSS. Table 4.4.24 portrays that the scores were fairly distributed into the four categories of the academic qualification where slightly more were in the first two categories of the total scores for all the GEV, MEV, MV, and MViC.

Table 4.51

Cross tabulations between Academic Qualification and Total Scores

Cross tabulation of Academic Qualification and Total General Education Values						
	TOTALGEV	0-65	66-71	72-76	77-80	Total
Academic Qualification	Degree	0	2	1	2	5
	PhD	1	5	2	7	15
	Masters	61	58	48	46	213
	Total	62	65	51	55	233
Cross tabulation of Academic Qualification and Total Mathematics Education Values						
	TOTALMEV	0-32	33-34	35-37	38-40	Total
Academic Qualification	Degree	0	2	2	1	5
	PhD	5	1	2	7	15
	Masters	78	41	45	49	213
	Total	83	44	49	57	233
Cross tabulation of Academic Qualification and Total Mathematics Values						
	TOTALMV	0-37	38-40	41-44	45-50	Total
Academic Qualification	Degree	0	2	2	1	5
	PhD	2	3	6	4	15
	Masters	61	57	57	38	213
	Total	64	61	65	43	233
Cross tabulation of Academic Qualification and Total Values in Mathematics Classrooms						
	TOTAL MViC	0-136	137-146	147-155	156-180	Total
Academic Qualification	Degree	0	3	1	1	5
	PhD	1	5	3	6	15
	Masters	61	53	48	51	213
	Total	62	61	52	58	233

The cross tabulations of the years of experience and the total scores of values, indicate clearly that majority of the scores fall in the two lower categories of scores especially for the MEV, MV, and the total mathematics values in classrooms. The group of those servicing less than five years, mainly scored at the lowest for the GEV, MEV and the total score of values. However, majority of the group scored higher for the mathematics value. On the other hand, the group consisting of those servicing between 6 to 15 years recorded scores on the higher side for the GEV (score of 72-76), MEV (score of 35-37) and they score lower for the MV (score of 38-40). Participants with service of 16 – 25 years have 16 out of 44 people in the higher score of 77-80 for the GEV. However, majority of the scores for MEV and MV fall in the lower group of scores 0-32 and 0-37.

This pattern is also found in the cross tabulations table of the gender and total values of GEV, MEV, MV, and total values given below.

Table 4.52

Cross Tabulations between Teaching Experience and Total Scores

Teaching Experience	TOTAL General Education Values				
	0-65	66-71	72-76	77-80	Total
Less Than 5 years	31	30	23	23	107
6 - 15 years	15	15	19	7	56
16 - 25 years	10	11	7	16	44
Above 26 years	6	9	2	9	26
Total	62	65	51	55	233

	TOTAL Mathematics Values				
	0-37	38-40	41-44	45-50	Total
Less Than 5 years	25	29	32	21	107
6 - 15 years	15	17	15	9	56
16 - 25 years	15	9	11	9	44
Above 26 years	9	6	7	4	26
Total	64	61	65	43	233

	TOTAL Values in Mathematics Classrooms				
	0-136	137-146	147-155	156-180	Total
Less Than 5 years	31	24	25	27	107
6 - 15 years	14	18	13	11	56
16 - 25 years	12	9	11	12	44
Above 26 years	5	10	3	8	26
	62	61	52	58	233
Total					

Table 4.53 indicated that mainly the female scored were more towards the lower category of the total scores. Since there were seven times more female than the male respondents, it is difficult to compare between the two groups.

Table 4.53

Cross tabulation of Gender and the Three Sub-Construct

		Cross tabulation of Gender and Total General Education Values				
		TOTAL GEV ACCORDING TO GROUP				Total
		0-65	66-71	72-76	77-80	
Gender	Male	9	9	5	10	33
	Female	53	56	46	45	200
	Total	62	65	51	55	233

		Cross tabulation of Gender and Total Mathematics Education Values				
		TOTAL MEV ACCORDING To GROUP				Total
		0-32	33-34	35-37	38-40	
Gender	Male	13	5	7	8	33
	Female	70	39	42	49	200
	Total	83	44	49	57	233

		Cross tabulation of Gender and Total Mathematics Values				
		TOTAL MV ACCORDING TO GROUP				Total
		0-37	38-40	41-44	45-50	
Gender	Male	9	7	12	5	33
	Female	55	54	53	38	200
	Total	64	61	65	43	233

		Cross tabulation of Gender and Total Values of Mathematics in Classrooms				
		TOTAL VALUES ACCORDING TO GROUPS				Total
		0-136	137-146	147-155	156-180	
Gender	Male	9	6	11	7	33
	Female	53	55	41	51	200
	Total	62	61	52	58	233

The cross tabulations of age group and total scores for all the sub-constructs and the total demonstrated the same pattern where majority of the respondents were in the lower score categories. This pattern was especially obvious for the age group of 26 – 35 and 46 above which had higher number of respondents (78%) as compared to the other two age groups. Thus, the perceptions of the four age groups on the three categories of values and its total cannot be clearly differentiated.

Table 4.54

Cross Tabulation between Age Group and the Three Sub-constructs

Cross tabulation between Age Group and Total GEV

		TOTAL GEV ACCORDING TO GROUPS				Total
		0-65	66-71	72-76	77-80	
Age Group	Below 25 years	4	4	6	9	23
	26 - 35 years	40	33	31	17	121
	36 - 45	5	10	5	8	28
	46 and above	13	18	9	21	61
Total		62	65	51	55	233

Cross tabulation between Age Group and Total MEV

		TOTAL MEV ACCORDING TO GROUPS				Total
		0-32	32-34	35-37	38-40	
Age Group	Below 25 years	4	4	6	9	23
	26 - 35 years	49	26	19	27	121
	36 - 45	9	4	10	5	28
	46 and above	21	10	14	16	61
Total		83	44	49	57	233

Cross tabulation Age Group Total MV According to Group

		TOTAL MV ACCORDING TO GROUPS				Total
		0-37	38-40	41-44	45-50	
Age Group	Below 25 years	2	8	6	7	23
	26 - 35 years	35	33	34	19	121
	36 - 45	6	7	9	6	28
	46 and above	21	13	16	11	61
Total		64	61	65	43	233

Cross tabulation Age Group Total Values According to Groups

		TOTAL VALUES in MATHEMATICS CLASSROOMS				Total
		0-136	137-146	147-155	156-180	
Age Group	Below 25 years	4	2	8	9	23
	26 - 35 years	38	34	24	25	121
	36 - 45	6	7	9	6	28
	46 and above	14	18	11	18	61
Total		62	61	52	58	233

The cross tabulation clearly indicated that generally scores for individuals were recorded for the high values resulting in a higher range for the total scores. The distributions of the respondents were found to be quite consistent where more were recorded in the lowest range of the total scores.

Items review. There were several options for follow up for items which were found to be potentially problematic: complete elimination, or changing some or all the item. These adjustments would likely contribute towards the validity arguments towards the revised version of the instrument although further statistical test maybe required. All the items were reviewed and more attention were given to items which are flagged as misfitting.

The preceding analysis suggested that item 1, 2, and 3 needed to be reviewed as these items together with item 34 were at the top list of the statistics summary for item in Table 4.4.20 (refer also Table 4.4.21 and Table 4.4.22). After analyzing the three items, it was found that all of them which represent the first dimension in the general education values are supposed to indicate the values of being religious and having faith. The first item stresses on the awareness of being religious, the second item focuses on whether one focuses on the importance of bring religious, and the third focuses on whether one practice the faith when they are in their mathematical classes. Since the three of them have high correlations to one another, it is an indication that they are measuring almost the same value. However, the magnitude of the improvement obtained when applying the Rasch procedures are not particularly significant but are notable.

The first three items were further analyzed by the researcher since statistics test revealed that they are redundant or not able to discriminate the respondents. The three items which were thought to be saying the same thing were detailed out into five values following Krathwol's affective domain taxonomy in organizing educational consequences related to the complication of thinking in the affective field. The values are namely the receiving or observation, responding or action, valuing, organization or system of values, and characterization or behavioral. These values will be evaluated by respondents based on their religious beliefs and faith. The revised instrument will now consist of 36 items instead of 34 items since items NUA1, NUA2, and NUA3 are now elaborated into five different values in relation to the basic values concerning faith and believing in God. The revised version is in accordance to one of the suggestion by the expert during the development stage who mentioned in his comment: "Check if there is a need to break the item into two or three items related to the sub-indicators of the values". The basic value started with one item, it was increased to three items for the pilot and to five (5) for the revised version.

It is also important to note that item 34, although showed some signs of not fitting the model, it has a high item discrimination which is why it is retained by the researcher. However, some adjustments were made to the item, after considering the feedback from one of the expert who suggested that the original item "discussion, abstractness of mathematics, and its relation with religion knowledge" is being replaced by "relationship of mathematics knowledge and religion" since it is easier to comprehend. The discussion below will be on the items being remained but reviewed together with reasons for the decision.

Modification of items. The findings indicated that even though many of the items have acceptable psychometric properties, thirteen items have been identified earlier to have values of MNSQ and/or z-std outside the required range: 0.6 to 1.4 for the MNSQ and -2.0 to 2.0 for z-std. as discussed above. Out of 13 items, 11 of them are revised and

2 remained as the original. The items were revised either by adding a word, a phrase, and more examples for clarity purposes or to ensure that it fit the conceptual definitions of the values. The two items were thought to be clear in describing the values that it was supposed to measure are remained.

The items for the values of good characteristics (NUT1) and brave (NUT2) were rephrased, to include the phrases "survival needs" and "safety needs" whose meanings are closer to the conceptual definition. The phrases "... focusing on excellent characteristics." is now changed to " .. focusing on fulfilling survival needs in excellent manner.". Survival needs in this context, refer to the physiology needs for food, drinks, eat, rest, breath, sex, and place to stay. The rephrased item refers to the necessity of having excellent characteristics in broader context which is in human survival needs. Item NUT2 is rephrased from "... focusing on safety ..." to "... focusing on safety needs in an excellent manner...". The word safety needs refer to the safety of one's life, family, belongings, good names, and financials. Rephrasing both NUT1 and NUT2 make the items closer to the conceptual definitions of the two values where excellent manners are needed in fulfilling the survival and safety needs.

The word "culture" was added to all the five items under the dimension of expanded values. For example, in item NUK1, "…the worth of knowledge..." is now changed to "…the culture of the worth of knowledge…" Part of the item NUK2, "…the success of perseverance…", is now changed to "…the culture of perseverance…". Item NUK3 is changed to ".. the culture of quality…" instead of "…importance of quality…", while item NUK4 is changed to "..the culture of precision…" instead of " … the virtue of precision…", and in item NUK5, "…the integrity…" is replaced by the phrase "…the culture of integrity…" was used. The word culture will further enhance the values of worth of knowledge, success of perseverance, importance of quality, virtue of precision, and power of integrity. Nik Azis (2012(a) and 2012(b)) mentioned that culture is the practices of a certain group of people which embrace their thinking process, actions, behaviors, dressings, language, religious practices, communications, marriage, working, economic activities, techniques, education, politics, business, literature, science, sports, arts, and music (Nik Azis, 2012). For example, the phrase "...culture of virtue of precision.." refers to the way of life of a certain society in dealing with matters related to the virtue of precision which includes beliefs, knowledge, feelings, experiences actions, values, attitude, culture, rituals, and daily practices. This way of life in relation to virtue of precision, will then be the identity of the society which is a differentiating factor from other society. Six value items out of sixteen from the category of general education values were remained.

The next category of values is the mathematics education values which were divided into two dimensions, the teaching and the learning values. The first three items under the dimension of teaching are the values of theorists, utilitarian, and functional. All the items describing these values were rephrased to focus on the conceptual definition. The item NPP1 was rephrased to a simpler version where the term "... to focus on theory in teaching.." is explained further by ".. to focus on teaching so that students are able to understand higher level of mathematics knowledge..". The reviewed version gave a clearer picture of the meaning of theorists, making it easier for the respondents to grasp the meaning of the related values. The next item, which is NPP2 and NPP4 were remained the same, while item NPP3 has minor changes where the word phrase "building knowledge" was replaced by "generating sophisticated knowledge for better life". The word generating was found to be more suitable as students were expected to not only build but create new or sophisticated knowledge to be used in making life better for humankind. There were no changes made to all items in the dimension of learning, NPM1, NPM2, NPM3, and NPM4 were all being remained as they were.

The last category is the mathematics value which has three dimensions: ideology, sentimental and sociology. There are minor changes made to the four items under the dimension of ideology. For the first item NMI1, the word “proving” is replaced by “proving idea” to further clarify the meaning of proving. In NMI2, the word “activity” is replaced by “experiences”. The word “activity” was restricted to things done by a person or group of people while experience on the other hand is defined as events or knowledge shared by members of a group which had some influences in the way they do their thinking and the way they behave. Thus, experience covers a wider scope of practical in class. To further enhance the value of pragmatism, “problem solving” was added to item NMI3, while words like “continuity, comparison, and developing meaning” were used to highlight the characteristics of the integrated values to NMI4.

The three items in the dimension of sentimental were all revised to make it clearer and easier to understand. To describe the value of control, “mastering rules” was added and “understanding procedures and applications” is shortened to “understanding procedures”. Part of the phrase “development of knowledge through investigation” in item NMS2 represented the development values, was shortened to “focusing on idea” and “generalization” was now written as “generalization of phenomena” which will describe the value precisely. Part of the item in NMS3, “contribution of mathematics towards a superior civilization” was replaced by “developing of self-discipline and superior civilization”, self-discipline was added to enhance that civilization starts within a person. These changes simplified the items and made them easier to understand.

The last dimension of the instrument was the sociological aspect of mathematics values. Some changes were made to all the three items NMG1, NMG2, and NMG3 to make the items easier to comprehend. Words like “relation, openness, and explanation of ideas” were examples chosen to replace “discussion and endorsement of ideas” which was vague to interpret the values of related for NMG1. As for NMG2, “the wonders and abstraction of ideas” was replaced by “amazing, mysterious, and abstract ideas” which was simpler to understand. The phrase “discussion, abstractness of mathematics, and its relation with religion knowledge” in the last item, NMG3, was being replaced by “relationship of mathematics knowledge and religion” since it was easier to comprehend. Items with ** were those items with MNSQ near to 1 and z-std near zero, considered as better fit items. Although these eight items have been identified as fit, only three were remained as the originals where the rest experience minimal changes. They were either rephrased to focus on the conceptual definition, examples or words were added for clarity. A summarized version of the revised version and the reasons for changes can be found in Table 4.4.28 in Appendix A.

Logistics matters. The researcher noted a few important aspects related to logistic matters. It was important to identify the key person to assist in distributing the survey forms at each college to ensure that all the mathematics lecturers at each branch campus took part in the survey. Calls were made to inform the representative of the procedure. Basically, the respondents only need about 20-30 minutes to answer the survey. The representatives were to collect the survey form and mailed them back to the researcher. The researcher bears all the mailing cost using pre-paid services from Pos Laju. As much as possible the researcher tried to reduce the amount of work to be done by the representatives. Instead of e-mailing the survey form and asked the representatives to photocopy them, the researcher sent the exact number of copies to each branch campus after getting the information on the number of lecturers in a branch. All the representatives were very helpful and survey forms were received in the given duration of time given to them. Several calls were made to explain on the objective of the survey, procedure of answering the instrument, and sending back the instrument.

There was no problem for the respondents to understand the instructions given in the survey form, the format of the survey form was presentable and well accepted, as there was no comment received or problem arises on that matter. The arrangement of items, overall layout, and design of the instrument done to the three categories of the values, seemed to be acceptable by the respondents. The only change made by the researcher in the demographic part of the survey was to the question on "Do you like mathematics?". Changes were made because, all respondents answered yes to the question, indicating that the question cannot discriminate the respondents. Instead of asking that question, the respondents were asked to rank nine mathematics contents following their interest. The contents are arithmetic, algebra, geometric, calculus, trigonometry, probability, statistics, measurement, and discrete mathematics. In terms of the estimated time needed to answer the survey, it was found that as predicted the respondents could finish them in less than 20 minutes. What had been planned seemed to work well during the pilot study and the researcher plan to emulate the whole procedures in collecting data during the pilot study for the real study.

Summary. The pilot study managed to identify several practical challenges in following the research procedure. The researcher took note of several areas to be improved during execution of the research for the real study. Firstly, not only it was very important to have a representative for each college, it was more important that the person was someone who was holding a post and could give instruction to the lecturers. This was very important as the researcher was trying to get 100% respond from each college. Secondly ample time must be given to the representative to distribute and return the questionnaire, and more important was the researcher needs to personally do the follow up to ensure that the responds were received on time for analysis. Thirdly the researcher proceeded with the idea of preparing prepaid envelopes for the representative to return the questionnaire to ensure that the questionnaire arrived safely. Fourthly, the researcher had to set deadlines for them to return the responds. The following were the findings of the pilot study.

1. The means of items were between 3.76 and 4.58 and since the sample is more than 200, the risk from being not normal is negliable so the researcher will still use parametric statistical tests, although the skewness indicated being far from normal.
2. Cronbach's alpha values for the three sub-constructs and values in mathematics classrooms were .901, .870, .876, and .939. The Cronbach alphas for the nine dimensions were more than .70 except for the main value which had value of .680.
3. Item-total statistics for the three sub-constructs, construct, and the nine dimensions were all more than .30, an indication that the correlations of each items with the respective sub-constructs, construct, and dimensions were strong.
4. The values of Cronbach alpha when a respective item was deleted were generally found to be less than the Cronbach alphas for the three sub-constructs, construct, and the nine dimensions with very few exceptions.
5. The Item Reliability for Construct and Three Sub-constructs were all more than .90 and the item separation reliability were all more than 2.0. The person reliability for construct and three sub-constructs were all more than .70 and the

person separation reliability were more than 2.0 except for mathematics education value.

6. Item analysis using Rasch identified four items which were outside the accepted mean square and z- standard ranges, however there were not much difference in terms of the item and person reliability when the items were deleted systematically.
7. The findings for Principal analysis of residuals (PCAR) were not supportive of the unidimensional of the scale since there was an indication that a second dimension existed. However, there was no evidence of the existence of sever construct-irrelevant factors although there were indications of existence of a second dimension from the PCAR test.
8. The rating scale analysis showed the need to consider collapsing the rating scale for “2” and “3”, which might result in data lost.
9. The confirmatory factor analysis indicated that model fit suggested that the three factors did not provide good explanation of the construct for this sample based on the fit indices for confirmatory factor models.
10. The factor loadings of the path measurement model for GEV, MEV, MV and dimensions were all recorded to be above .5, indicate good-fit of the model.
11. The cross tabulations of the three level scores of construct and sub-construct with age, gender, teaching experience, academic qualifications showed that the scores mainly fall at the two lower levels of the scores.

This pilot study has shown that the use of SPSS software and the IRT procedures can provide valuable psychometric information of measures for instrument development. The analysis offered some usable feedbacks such as misfit items, misuse of response scale, which provide helpful information to aide in decision making, scale improvement, shade lights on the validity of the instrument developed. This theory-based measurement instrument for measuring values in mathematics classrooms was proved to be reliable and valid in this pilot study.

Real Study. The revised instrument was administered to 325 lecturers in thirteen matriculation colleges in the country. This was done upon getting approval from the Department of Matriculation in the Ministry of Education Malaysia and the director of each college. The focus of the evaluation stage was to study the construct validity after the instrument had gone through several validation processes including interviews with participants of the focus group, feedback from panels of experts, elimination and addition of items, and measuring construct validity during pilot study. Results were obtained using the Statistical Package for the Social Sciences (SPSS) for Windows 23.0 and Winstep and Facets Rasch Software version 3.72.3.

The discussion starts with descriptive group statistics which includes frequency, percentage, valid percentage, and cumulative percentage. This is followed by normality test on the constructs, three sub-construct, nine (9) dimensions, and 36 items using the Kurtosis and skew coefficients besides studying the Shapiro-Wilk value. Results for reliability analysis on the constructs, sub-constructs, and dimensions were considered by analysing the Alpha Cronbach values while the inter item correlation, item total correlation, and Cronbach's alpha if respective item is deleted were studied for reliability of items.

The next section demonstrated the frequency analysis of the sub-constructs and construct following the age group, highest education, and teaching experience. Next was the discussion on Rasch analysis which included the item and person reliability for both the sub-constructs and construct, item and person map, and rating scale. The uni-dimensionality analysis was investigated using the Confirmation Factor Analysis (CFA) and Pincipal Components Analysis of Residuals which involved several statistical tests to decide how well the model fits the data.

There were two parts in the cross tabulations discussions and chi-square discussion. The first part was the analysis of the cross tabulations between age group, academic background and teaching experience. The second part was the analysis of the cross tabulations between the scale and the sub constructs and cross tabulations between the three sub-constructs. Profiling investigation report were done for high and low scores for the three sub-constructs and the construct. Analysis of the inclination of the respondents towards the four dimensions of teaching psychology and the four dimensions of mathematical views. A listing of the findings with regards to the descriptive analysis and validity and reliability enhancement of the instrument in the evaluation stage can be found at the end of the chapter. Due to the large number of tables produced for the many different analyses that were conducted, only a few will be shown in this section and the rest can be found in the Appendices.

Demographic profile. The demographic data of the participants consisted of age group, highest academic level, and teaching experiences. Although information on race was not collected from the participants, the lecturers of the matriculation colleges were predominantly Malay followed by Chinese.

Table 4.55

Gender of Sample

	Gender	Frequency	Percent	Cumulative Percent
Valid	Male	93	28.6	28.6
	Female	232	71.4	100.0
	Total	325	100.0	

There were 93 (28.6%) male and 232 (71.4%) female lecturers in the sample totalling to 325 lecturers from matriculation colleges in the country.

Table 4.56

Age Groups

Age Group	Frequency	Percent	Cumulative Percent
Below 30	101	31.1	31.1
31-40	139	42.8	73.8
Above 41	85	26.2	100.0
Total	325	100.0	

Most the respondents (42.8%) belong to the 31 – 40 years of age followed by those below 30 years of age (31.1%). The smallest number belongs to the above 41 group.

Table 4.57

Academic Background of Sample

Education	Frequency	Percent	Cumulative Percent
Degree	249	76.6	76.6
Masters	76	23.4	100.0
Total	325	100.0	

There were 249 lecturers with degree and this represents the highest percentage (76.6%) of the respondents in the sample. The rest of the lecturers (76) were with master degrees. The last three groups for number of years of experiences: 6 – 10 years, 11 – 15 years, and more than 15 years have about the same number of respondents. There were 73 (22.5%), 79 (24.3%), and 74 (22.8%) respondents respectively. This is followed by 62 (19.1%) respondents with less than 3 years of teaching experiences. The smallest numbers of respondents (37) are in the 3 – 5 years of experience category.

Table 4.58

Teaching Experience of Sample

Teaching Experience	Frequency	Percent	Cumulative Percent
Less than 3 years	62	19.1	19.1
3 - 5 years	37	11.4	30.5
6 - 10 years	73	22.5	52.9
11 - 15 years	79	24.3	77.2
More than 15 years	74	22.8	100.0
Total	325	100.0	

Normality test. The data was first scanned to detect any missing data. It was found that there were only 7 missing data from six respondents and the researcher assumed the data to be missing at random and imputed them with the value 3 which represented "not sure". This is because missing data will possess a serious problem to the integrity of the statistical results and claims (Kline, 2005).

Normality of the construct, sub-constructs, dimensions, and the items the researcher used Shapiro-Wilk since the sample is between n = 3 to 2000. The p-values for Shapiro-Wilk were all smaller than .05 indicating the data did not come from a normal distribution. However, with large enough sample sizes of greater than 30 or 40., problems related to non-normal distribution would not cause major problems (Pallant, 2007).

Table 4.59

Kolmogorov-Smirnov and Shapiro-Wilk Tests of Construct and Sub-Constructs

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
General Education Value	.075	325	.000	.971	325	.000
Mathematics Education Value	.147	325	.000	.928	325	.000
Mathematics Value	.130	325	.000	.969	325	.000
Mathematics Values in Classrooms	.071	325	.000	.979	325	.000

a. Lilliefors Significance Correction

Skewness measured the asymmetry and kurtosis is a measured the 'peakedness' of any distribution. Table 4.60 demonstrated the values of skewness and kurtosis for the three sub-constructs and the scale.

Table 4.60

Skewness and Kurtosis Statistics for the Constructs and Sub-constructs

	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Math Education Value	34.5692	3.59170	-.260	.135	.302	.270
Math Value	41.2462	4.74482	-.069	.135	.354	.270
General Education Value	77.2277	7.55702	-.089	.135	-.378	.270
Math Values in Class	153.0431	14.16475	-.071	.135	-.069	.270

All the skew values in Table 4.5.6 are negative, indicated that the values were heavier towards the left of the mean portraying a positive skew. The skewness values were between -.089 to .071. Bulmer (1979) suggested that if value of skewness is between -0.5 and 0.5, it is an indication that the item has a symmetric distribution.

Table 4.61

Skewness and Kurtosis Statistics for the Nine Dimensions

	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
GEV - Basic	21.6462	3.13793	-1.133	.135	3.585	.270
GEV - Core	16.6185	2.16074	-.270	.135	-.042	.270
GEV - Main	17.1662	1.85844	-.035	.135	-.553	.270
GEV -Expanded	21.7969	2.23648	.015	.135	-.773	.270
MEV - Teaching	16.9938	1.98139	-.387	.135	.661	.270
MEV - Learning	17.5754	1.89003	-.174	.135	-.371	.270
MV - Ideology	16.7969	2.06275	-.177	.135	.008	.270
MV - Sentimental	12.5231	1.54867	-.359	.135	1.077	.270
MV - Sociological	11.9262	1.77971	-.116	.135	-.197	.270

Kurtosis measured the peak of a distribution values >7 would meant a substantially away from normal distribution (West et al., 1996). The excess kurtosis should be zero for a perfectly normal distribution. Distributions with positive excess kurtosis refer to high peak, and distributions with negative excess kurtosis are distributions with flatter topped curve.

The values for skewness were between -2 and +2 for the construct and sub-constructs which were considered acceptable (George & Mallery, 2010). Table 4.5.7 indicated that the skewness statistics for the nine dimensions were all within the acceptable range from -2 to 2 of being normal distributions. All kurtosis values were within the range of < 7, indicating normal distribution, (West et al., (1996). Table 4.5.8 described the descriptive statistics containing the information on mean, standard deviation, skewness, and the kurtosis values for all the 36 items in the order of increasing means.

Table 4.62

Descriptive Statistics for 36 Items

	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
NMC2 Openness	3.70	.874	-.531	.135	.314	.270
NMC3 Integrated*	3.95	.790	-.852	.135	1.556	.270
NUU4 Innovativeness	4.00	.705	-.270	.135	-.209	.270
NUT2 Fulfilling safety needs	4.00	.772	-.451	.135	-.141	.270
NUT1 Fulfilling life needs ethically	4.05	.718	-.425	.135	.036	.270
NMI2 Empiricism	4.08	.666	-.343	.135	.142	.270
NMS2 Development	4.10	.662	-.491	.135	.681	.270
PMP2 Teach for functionality	4.14	.691	-.585	.135	.575	.270
NMI4 Integrated	4.19	.609	-.289	.135	.295	.270
NMS3 Civilization*	4.20	.629	-.630	.135	1.929	.270
PMP1 Teach for higher math*	4.22	.695	-.889	.135	1.429	.270
NMS1 Control*	4.23	.646	-.670	.135	1.201	.270
NMI1 Rationalism*	4.25	.660	-.649	.135	.731	.270
NUA3 Evaluate values*	4.26	.718	-.995	.135	1.974	.270
PMP4 Teach to internalize knowledge*	4.27	.629	-.581	.135	.836	.270
NMC1 Separated	4.27	.595	-.352	.135	.381	.270
NUT3 Wisdom*	4.27	.677	-.817	.135	1.124	.270
NMI3 Pragmatism*	4.27	.635	-.667	.135	1.124	.270
NUA4 Build value system*	4.29	.747	-1.063	.135	1.738	.270
NUT4 Justice*	4.29	.660	-.658	.135	.505	.270
NUU3 Accountability**	4.32	.591	-.325	.135	-.124	.270
NUA2 Respond to values*	4.33	.732	-1.213	.135	2.428	.270
NUK5 Culture of integrity**	4.33	.598	-.450	.135	.337	.270
NUK3 Culture of quality	4.33	.567	-.132	.135	-.674	.270
PMB2 Learn for processing*	4.33	.609	-.904	.135	3.098	.270
NUK1 Culture of knowledge**	4.34	.580	-.409	.135	.449	.270
NUA5 Act out values*	4.36	.686	-1.174	.135	2.847	.270
PMB3 Learn for constructing	4.36	.569	-.294	.135	-.115	.270
PMP3 Teach to generate knowledge	4.36	.547	-.053	.135	-.840	.270
NUK4 Culture of precision	4.39	.576	-.405	.135	-.137	.270
NUK2 Culture of diligence	4.40	.550	-.157	.135	-.930	.270
NUU1 Discipline	4.40	.577	-.426	.135	-.135	.270
NUA1 Attention to values*	4.41	.649	-1.191	.135	3.350	.270

PMB4 Learn for obtaining knowledge**	4.42	.547	-.297	.135	-.216	.270
NUU2 Teamwork	4.44	.533	-.128	.135	-1.205	.270
PMB1 Learn for mastering skills	4.46	.541	-.270	.135	-1.096	.270

Items were seen to be negatively skewed and the highest levels of skewness and kurtosis seemed to occur on the basic values of the general education and the learning values of mathematics education. Skew values smaller than -2 and greater than 2 or absolute kurtosis larger than 7 were referred to determine substantial non-normal data. Since the sample size is 325, which exceeds 200 cases it reduces the risk of problems associated with skewness and kurtosis in data sets (Tabachnick & Fidell, 2007).

Reliability analysis. This section discussed the internal consistency of each of the three sub-constructs, construct, dimensions, and items by studying the Cronbach's alpha coefficient for internal consistency reliability for the construct, sub-constructs, and dimensions as the index of test reliability. The reliability for items were determined by analysing the Cronbach alpha values for standardized items, inter-item correlation, corrected item-to-total correlation, and Cronbach's Alpha if item is deleted.

Table 4.63

Cronbach's Alpha for Sub-constructs and Construct

	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items.	N of Items
GEV	.918	.920	18
MEV	.882	.887	8
MV	.882	.887	10
ViMC	.952	.953	36

A fairly high reliability coefficient (Cronbach's $\alpha > 0.70$) was considered as having a reliability. The values of Cronbach's alpha for the three sub-constructs and the construct were all above 0.8. The Cronbach's alphas for all nine dimensions ranged from .675 to .932 which were reasonably acceptable although some of the values were not too high. The highest value comes from the basic dimension and the lowest comes from the sociological dimension.

Table 4.64

Reliability of the Nine Dimensions

Values	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	Number of Items
Basic	.932	.933	5
Core	.760	.760	4
Main	.768	.782	4
Expanded	.838	.839	5
Teaching	.771	.777	4
Learning	.853	.854	4
Ideology	.815	.815	4
Sentimental	.718	.717	3
Sociological	.675	.683	3

Inter-item and item-total statistics for sub-construct and construct. Inter-item values were expected to be positive demonstrating that the items were measuring the same underlying characteristics. Briggs and Cheek (1986) recommended an acceptable optimal range between .20 and .40 for the inter-item correlation. The greater the relative number of positive relationships, the stronger those relationships were. High inter-item correlations were indications that items were contributing uniquely to the construct and may be a deterrent from unidimensional of the scale.

Negative values suggested that the respective items were not correctly reverse scored. In this study, all items were positively stated thus there was no need to reverse the scores. The corrected item-total correlations were the correlations between scores on each item and the total scale scores (or sub-scale). A correlation value of less than 0.2 or 0.3 indicated that an item did not related well with the scale thus faced the possibility of being dropped (Field, A., 2005) and correlations of .30 to .70 were considered acceptable (de Vaus, 2004). To establish the criterions for item-total correlations, it required that at least half of the remained items correlated with total scores in the range of .30 and .70 (Carmines and Zeller 1974). The Cronbach's alpha value when an item was deleted may demonstrate improvement in value of alpha when an item is deleted is a sign that the item should be removed. Low Cronbach's Alpha Coefficient value and mean inter-item correlation are indications that the items need to be removed Pallant (2006).

Table 4.65

Item-Total Statistics: General Education Values

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
NUA1 Attention to values	72.82	51.180	.593	.730	.913
NUA2 Respond to values	72.90	50.243	.610	.780	.913
NUA3 Evaluate values	72.96	50.097	.639	.766	.912
NUA4 Build value system	72.94	49.570	.664	.690	.911
NUA5 Act out values	72.87	50.428	.637	.674	.912
NUT1 Fulfilling life needs ethically	73.18	51.567	.487	.421	.916
NUT2 Fulfilling safety needs ethically	73.22	50.280	.569	.486	.914
NUT3 Wisdom	72.95	51.124	.570	.392	.914
NUT4 Justice	72.94	50.709	.634	.475	.912
NUU1 Discipline	72.83	51.396	.650	.565	.912
NUU2 Teamwork	72.79	52.211	.599	.576	.913
NUU3 Accountability	72.90	51.074	.673	.548	.911
NUU4 Innovativeness	73.22	51.601	.495	.405	.916
NUK1 Culture of knowledge	72.89	51.848	.589	.527	.913
NUK2 Culture of diligence	72.83	52.038	.601	.604	.913
NUK3 Culture of quality	72.90	51.699	.624	.641	.912
NUK4 Culture of precision	72.83	52.559	.505	.482	.915
NUK5 Culture of integrity	72.90	51.733	.584	.520	.913

The general education scale consisted of 18 items representing four dimensions. The inter-item ranges from .147 to .823. The corrected item-total correlation was between .487 to.673 (all values more than .30) suggesting a high internal consistency for the general education values. The general education values have good internal consistency of .918 and all alpha values when an item was deleted remained below .918, it was a signal that all items should be kept.

The next scale was the mathematics education values which consisted of eight values items belonging to two dimensions related to teaching and learning of mathematics. The inter-item values were all within .360 to .714 indicating that all the items were not redundant. Almost all the items in this scale have corrected item-total correlation scores in the range .579 to .730 which were more than .3 indicating high internal consistency. The items "learn from constructing knowledge" and "learn to master the skill" have higher values of corrected item-total values. On the other hand, the Cronbach's alpha for the mathematics education value was .882, slightly lower than the Cronbach alpha for the general education values, but still portrayed high internal consistency reliability.

Table 4.66

Item-Total Statistics: Mathematics Education Values

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
PMP1 Teach for higher math	30.34	9.887	.579	.341	.876
PMP2 Teach for functionality	30.43	9.882	.585	.366	.876
PMP3 Teach to generate knowledge	30.21	10.277	.663	.478	.867
PMP4 Teach to internalize knowledge	30.30	9.957	.642	.445	.868
PMB1 Learn for mastering skills	30.10	10.143	.715	.557	.862
PMB2 Learn for processing	30.24	10.039	.645	.513	.868
PMB3 Learn for constructing knowledge	30.21	9.956	.730	.614	.860
PMB4 Learn for obtaining knowledge	30.15	10.203	.686	.557	.864

The last column contained values of Cronbach's Alpha less than .882 when item is deleted implied that the items contributed towards the scale. Table 4.5.12 contained all the details of the item total statistics of the mathematics education values.

The third sub-construct is the mathematics value which has 10 items belonging to three dimensions. The inter-item correlations ranged from .296 to .604. The lowest being .296 which is the correlation between "integrated values" of the sociological dimension and "control values" which was the sentimental dimension of mathematics value. All the item-total correlations were above .3 and ranges from .528 to .687 as demonstrated in the item-total statistics in Table 4.5.13. It will be a threat if any of the items has value close to zero because it is an indication of poor correlation of the item with the mathematics scale, and probably should consider the option of removing the item from this scale because it is measuring other than the rest of the items were measuring. The values of alpha if item was deleted portrayed that all the items has Cronbach's alpha less than .882.

This means if the item was deleted the reliability will drop indicating it would be a bad idea to get rid the respected items.

Table 4.67

Item-Total Statistics: Mathematics Values

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
NMI1 Rationalism	36.99	18.457	.638	.452	.868
NMI2 Empiricism	37.17	18.164	.687	.517	.865
NMI3 Pragmatism	36.97	18.762	.609	.412	.871
NMI4 Integrated	37.06	18.627	.669	.502	.867
NMS1 Control	37.02	18.827	.583	.396	.872
NMS2 Development	37.15	18.258	.675	.482	.866
NMS3 Civilization	37.05	18.927	.584	.437	.872
NMC1 Separated	36.97	18.743	.663	.520	.867
NMC2 Openness	37.54	17.669	.555	.356	.878
NMC3 Integrated	37.30	18.321	.528	.327	.878

The inter-item statistics for each item with values in mathematics classrooms which ranges from .094 to .823 as displayed in Table 4.5.14. The internal consistency is .951 which is considered high. The correlations between an item and the total sum scores for 36 items varies in the range .448 to .651 indicating good relationship between items and the scale.

The internal consistencies of the scale (coefficient alpha) if the respective items are deleted are in the range of .949 to .950. If any of the alphas in the column of alpha if item is deleted is greater than .950, the reliability analysis should be done again without that item. However, the Cronbach’s alpha when item was deleted was smaller when they are all included in the scale of values in mathematics classes indicating the item need not be removed.

Table 4.68

Item-*Total Statistics: Values in Mathematics Classrooms*

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
NUA1 Attention to values	148.63	191.159	.505	.950
NUA2 Respond to values	148.72	189.728	.515	.950
NUA3 Evaluate values	148.78	189.210	.552	.949
NUA4 Build value system	148.75	188.223	.579	.949
NUA5 Act out values	148.69	190.043	.535	.950
NUT1 Fulfilling life needs ethically	148.99	190.636	.478	.950
NUT2 Fulfilling safety needs	149.04	188.551	.542	.950
NUT3 Wisdom	148.77	189.863	.553	.949
NUT4 Justice	148.75	188.817	.628	.949
NUU1 Discipline	148.64	190.193	.635	.949
NUU2 Teamwork	148.60	192.215	.551	.949
NUU3 Accountability	148.72	190.387	.607	.949
NUU4 Innovativeness	149.04	189.458	.551	.949
NUK1 Culture of knowledge	148.70	190.420	.617	.949
NUK2 Culture of diligence	148.64	191.045	.611	.949
NUK3 Culture of quality	148.71	190.219	.646	.949
NUK4 Culture of precision	148.65	191.716	.538	.950
NUK5 Culture of integrity	148.71	189.835	.634	.949
PMP1 Teach for higher mathematics	148.82	189.513	.556	.949
PMP2 Teach for functionality	148.90	188.525	.613	.949
PMP3 Teach to generate knowledge	148.68	191.612	.577	.949
PMP4 Teach to internalize knowledge	148.77	189.133	.642	.949
PMB1 Learn for mastering skills	148.58	190.936	.629	.949
PMB2 Learn for processing	148.71	189.694	.631	.949
PMB3 Learn for constructing	148.68	190.452	.628	.949
PMB4 Learn for obtaining knowledge	148.62	191.278	.598	.949
NMI1 Rationalism	148.79	188.925	.621	.949
NMI2 Empiricism	148.96	188.449	.642	.949
NMI3 Pragmatism	148.77	190.092	.579	.949
NMI4 Integrated	148.85	189.799	.624	.949
NMS1 Control	148.82	190.756	.531	.950
NMS2 Development	148.95	189.593	.582	.949

NMS3 Civilization	148.84	189.738	.607	.949
NMC1 Separated	148.77	189.629	.651	.949
NMC2 Openness	149.34	189.095	.448	.951
NMC3 Integrated	149.10	188.037	.553	.950

Inter-item and item-total statistics for nine dimensions. The researcher investigated the inter-item relationship within the nine dimensions: basic, core, main, expanded, teaching, learning, ideology, sentimental, and sociological. Findings were demonstrated in Table 4.69 to Table 4.77.

Table 4.69

Inter-items Correlation and Item-Total Statistics (Basic Values)

Inter-Item Correlation Matrix (Basic Values)

	NUA1 Attention to values	NUA2 Respond to values	NUA3 Evaluate values	NUA4 Build value system	NUA5 Act out values
NUA1 Attention to values	1.000	.823	.753	.646	.703
NUA2 Respond to values	.823	1.000	.810	.691	.733
NUA3 Evaluate values	.753	.810	1.000	.771	.716
NUA4 Build value system	.646	.691	.771	1.000	.713
NUA5 Act out values	.703	.733	.716	.713	1.000

Item-Total Statistics (Basic Values)

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
NUA1 Attention to values	17.24	6.688	.815	.710	.919
NUA2 Respond to values	17.32	6.187	.858	.773	.910
NUA3 Evaluate values	17.38	6.243	.860	.753	.909
NUA4 Build value system	17.36	6.348	.781	.649	.925
NUA5 Act out values	17.29	6.577	.795	.637	.922

Inter-item correlations for the basic values were all positive values between .646 and .823. Corrected item-total correlations were within .781 - .860 and the recorded Cronbach's alpha if item deleted, gave values which were less than .932 (Cronbach alpha for general education values). This was good because deleting the item will only lower the Cronbach's alpha value. The inter-item correlations for the core values were recorded to be within .340 to .590 with values of corrected of item-total to be between the ranges of .495 to .623 for the four items. The values of Cronbach's alpha when item was deleted, in the last column were all below .760 (the Cronbach's alpha for the core value), indicating reliable item.

Table 4.70

Inter-items Correlation and Item-Total Statistics (Core Values)

Inter-Item Correlation Matrix (Core Values)

	NUT1 Fulfilling life needs ethically	NUT2 Fulfilling safety needs	NUT3 Wisdom	NUT4 Justice
NUT1 Fulfilling life needs ethically	1.000	.590	.340	.406
NUT2 Fulfilling safety needs	.590	1.000	.406	.446
NUT3 Wisdom	.340	.406	1.000	.462
NUT4 Justice	.406	.446	.462	1.000

Item-Total Statistics (Core Values)

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
NUT1 Fulfilling life needs ethically	12.57	2.783	.571	.377	.697
NUT2 Fulfilling safety needs	12.62	2.540	.623	.420	.667
NUT3 Wisdom	12.34	3.041	.495	.268	.737
NUT4 Justice	12.33	2.980	.550	.312	.709

Inter item correlations for the main values are in the range of .300 - .660 and the item-total correlations found to be within .412 - .642 which were well within the criteria of .30 to .70.

Table 4.71

Inter-items Correlation and Item-Total Statistics (Main Values)

Inter-Item Correlation Matrix (Main Value)

	NUU1 Discipline	NUU2 Teamwork	NUU3 Accountability	NUU4 Innovativeness
NUU1 Discipline	1.000	.660	.534	.346
NUU2 Teamwork	.660	1.000	.596	.300
NUU3 Accountability	.534	.596	1.000	.405
NUU4 Innovativeness	.346	.300	.405	1.000

Item-Total Statistics (Main Value)

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
NUU1 Discipline	12.77	2.069	.633	.478	.681
NUU2 Teamwork	12.73	2.162	.642	.518	.682
NUU3 Accountability	12.84	2.028	.640	.431	.676
NUU4 Innovativeness	13.16	2.112	.412	.188	.814

The last item which was innovativeness showed a high value of .814 when item was deleted and since the value was more than the Cronbach's alpha for main value which was .768, attention was given to this item as it was a potential item needed to be removed to maintain internal consistency.

Table 4.72

Inter-items Correlation and Item-Total Statistics (Expanded Values)

Inter-Item Correlation Matrix (Expanded Values)

	NUK1 Culture of knowledge	NUK2 Culture of diligence	NUK3 Culture of quality	NUK4 Culture of precision	NUK5 Culture of integrity
NUK1 Culture of knowledge	1.000	.644	.583	.390	.378
NUK2 Culture of diligence	.644	1.000	.691	.407	.434
NUK3 Culture of quality	.583	.691	1.000	.439	.523
NUK4 Culture of precision	.390	.407	.439	1.000	.608
NUK5 Culture of integrity	.378	.434	.523	.608	1.000

Item-Total Statistics (Expanded Values)

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted

NUK1 Culture of knowledge	17.46	3.348	.621	.461	.810
NUK2 Culture of diligence	17.40	3.314	.692	.570	.791
NUK3 Culture of quality	17.46	3.225	.715	.561	.784
NUK4 Culture of precision	17.40	3.445	.573	.406	.823
NUK5 Culture of integrity	17.47	3.324	.606	.452	.815

The reliability value for the expanded values was recorded at .838 with positive inter-item correlations from .378 to .691 which is still within criteria. No redundancies of items are detected. The corrected item- total correlations are within .573 to .715, clearly shown a reasonable relation between the items and the dimensions. All the items demonstrated a lower Cronbach's alpha (.784 to .823) than .838 which was the reliability of the expanded value dimension. Thus, the items were not candidates to be removed.

Table 4.73

Inter-items Correlation and Item-Total Statistics (Teaching Values)

Inter-Item Correlation Matrix (Teaching Values)

	PMP1 Teach for higher mathematics	PMP2 Teach for functionality	PMP3 Teach to generate knowledge	PMP4 Teach to internalize knowledge
PMP1 Teach for higher mathematics	1.000	.455	.412	.425
PMP2 Teach for functionality	.455	1.000	.456	.460
PMP3 Teach to generate knowledge	.412	.456	1.000	.586
PMP4 Teach to internalize knowledge	.425	.460	.586	1.000

Item-Total Statistics (Teaching Values)

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
PMP1 Teach for higher mathematics	12.77	2.320	.530	.283	.742
PMP2 Teach for functionality	12.86	2.266	.568	.323	.720
PMP3 Teach to generate knowledge	12.63	2.566	.605	.401	.707

PMP4 Teach to internalize knowledge	12.72	2.355	.609	.410	.697

The mathematics education value is the second sub-construct which has two dimensions, (teaching and learning) and eight (8) items. The Cronbach's alpha for the dimension of teaching was .771, which was an acceptable value. All the inter-item correlations fall within the range .412 to .586. The four items were also found to have item-total correlations of .530 to .609 which was within the pre-specified range of .30 to .70. The Cronbach's alphas when respective item was deleted were all less than the group Cronbach's alpha .771. This was an indication that all the items in this group were reliable.

Table 4.74

Inter-items Correlation and Item-Total Statistics (Learning Values)

Inter-Item Correlation Matrix (Learning Values)

	PMB1 Behaviorists	PMB2 Information Processing	PMB3 Radical Constructivism	PMB4 Integrated Approach
PMB1 Behaviorists	1.000	.654	.578	.540
PMB2 Information Processing	.654	1.000	.589	.489
PMB3 Radical Constructivism	.578	.589	1.000	.714
PMB4 Integrated Approach	.540	.489	.714	1.000

Item-Total Statistics (Learning Values)

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
PMB1 Behaviorists	13.11	2.173	.694	.503	.814
PMB2 Information Processing	13.24	2.036	.670	.495	.825
PMB3 Radical Constructivism	13.22	2.040	.744	.595	.792
PMB4 Integrated Approach	13.16	2.182	.674	.534	.821

The dimension on learning recorded positive inter-item correlation of .489 to .714 which were acceptable. However, the correlation between "learning to obtain knowledge" and "learning to construct knowledge" were found to be high in correlation (.714) suggesting possibility of being redundant for value more than .7. The Cronbach's alpha for the learning dimension (.853) is a lot higher than the Cronbach's alpha for the teaching dimension (.771). Item-total correlations are in acceptable range from .670 to .744. All the items were considered reliable because the respective Cronbach's alpha values when the item was deleted were within .792 to .825 which were less than the dimension's Cronbach's alpha.

Table 4.75

Inter-items Correlation and Item-Total Statistics (Ideological Values)

Inter-Item Correlation Matrix (Ideological Values)

	NMI1 Rationalism	NMI2 Empiricism	NMI3 Pragmatism	NMI4 Universal Integrated Approach
NMI1 Rationalism	1.000	.550	.446	.502
NMI2 Empiricism	.550	1.000	.532	.601
NMI3 Pragmatism	.446	.532	1.000	.519
NMI4 Universal Integrated Approach	.502	.601	.519	1.000

Item-Total Statistics (Ideological Values)

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
NMI1 Rationalism	12.54	2.557	.597	.364	.785
NMI2 Empiricism	12.72	2.389	.690	.480	.740
NMI3 Pragmatism	12.52	2.627	.595	.360	.785
NMI4 Universal Integrated Approach	12.61	2.591	.659	.441	.757

The mathematics value has three dimensions with ten items. The dimensions were the ideology, sentimental, and sociological. The ideology value which had four items with Cronbach's alpha of .815. All inter-items correlations are within .446 to .601, indicating no items were redundant. The item-total correlations fall between .480 to.538. All the items maintain a high reliable Cronbach alpha when an item was deleted. The values of Cronbach's alpha when the item was deleted were all less than .815.

Table 4.76

Inter-items Correlation and Item-Total Statistics (Sentimental Values)

Inter-Item Correlation Matrix (Sentimental Values)

	NMS1 Control	NMS2 Development	NMS3 Civilization
NMS1 Control	1.000	.534	.382
NMS2 Development	.534	1.000	.458
NMS3 Civilization	.382	.458	1.000

Item-Total Statistics (Sentimental Values)

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
NMS1 Control	8.30	1.215	.538	.309	.628
NMS2 Development	8.43	1.122	.597	.361	.552
NMS3 Civilization	8.32	1.312	.480	.236	.696

Inter-item correlations of the sentimental dimension fall within .382 to .534. The corrected item-total correlations are between .480 and .597 portraying a reasonable correlation between the three items to the dimension. The recorded value of Cronbach's alpha is .718, and the values of Cronbach's alpha in the last column remained lower than that which is an indication that the items are all reliable. The Cronbach's alpha value is the lowest for the last dimension as compared to the other ten (10) dimensions in the instrument.

Table 4.77

Inter-items Correlation and Item-Total Statistics (Sociological Values)

Inter-Item Correlation Matrix (Sociological Values)

	NMC1 Separated	NMC2 Openness	NMC3 Integrated
NMC1 Separated	1.000	.364	.412
NMC2 Openness	.364	1.000	.478
NMC3 Integrated	.412	.478	1.000

Item-Total Statistics (Sociological Values)

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
NMC1 Separated	7.65	2.048	.449	.206	.645
NMC2 Openness	8.22	1.364	.509	.262	.567
NMC3 Integrated	7.98	1.496	.542	.294	.506

The sociology dimension has Cronbach Alpha value of .675. Item correlations were within the range of .364 to .478 while item-total was within .449 to .542. All the items correlation is below the dimension correlation of .675 when an item was deleted. Table 4.78 summarizes the discussion above on reliabilities, inter-item, item-total, and item correlation if deleted.

Table 4.78

Summary of Item Reliability Analysis

	Cronbach's Alpha	Inter-Item Correlation	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	N of Items
GEV	.918	.147 to .823	.487 to .673	.911 to .916	18
MEV	.882	.360 to .714	.579 to .730	.860 to .876	8
MV	.882	.296 to .604	.528 to .687	.866 to .878	10
Vim	.952	.094 to .823	.448 to .651	.949 to .951	36
Basic	.932	.430 and .70	.781 to 860	.909 to .925	5
Core	.760	.340 to .590	.495 to .571	.667 to .737	4
Main	.768	.300 to .660.	.412 to .642	.676 to .814*	4

Developed	.838	.378 to .691	.573 to .715,	.784 to .823	5
Teaching	.771	.412 to .586	.530 to .609	.697 to .742	4
Learning	.853	.489 to .714.	.670 to .694	.792 to .825	4
Ideology	.815	.446 to .601	.480 to.538	.552 to .696	4
Sentimental	.718	.382 to .534	.480 to .597	.552 to .696	3
Sociological	.675	.364 to .478	.449 to .542.	.506 to .645	3

*item on innovativeness gave higher Cronbach's alpha when deleted

All correlations values were positive values implying items were measuring the same underlying characteristics, in which the values were reasonable since if they were too huge it demonstrated strong relationship between items in the same sub-construct or dimensions. The item-total correlations were seen to be within .30 to .70 and can be considered acceptable (de Vaus, 2004).

In this study, factor analysis was used to determine the dimensionality of the scale because Cronbach's alpha only indicated good internal consistency but not uni-dimensionality.

Summary of statistics for items and person. A statistical summary table was generated in Table 4.5.25, to demonstrate the fit indices for items and person. The two types of fit indices available were the mean square (MNSQ) and standardized fit statistics (ZSTD). The person and item reliability exposed how the person and items fit to the model. Good person and item reliability required values of more than 0.8 and separation index for both person and items recommended values of more than 2 (Bond & Fox, 2007).

Table 4.79

Summary of 314 Measured (Non-Extreme) Persons

	RAW SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	152.1	36.0	2.69	.34	1.02	-.1	1.00	-.2
S.D.	13.4	.0	1.46	.10	.63	2.4	.63	2.4
MAX.	179.0	36.0	7.22	1.02	3.97	8.9	4.61	8.8
MIN.	109.0	36.0	-.47	.20	.08	-5.4	.06	-5.6

REAL RMSE .39	ADJ.SD	1.41	SEPARATION	3.63	Person RELIABILITY	.93
MODEL RMSE .35	ADJ.SD	1.42	SEPARATION	4.00	Person RELIABILITY	.94
S.E. OF Person MEAN = .08						

MAXIMUM EXTREME SCORE: 11 Persons

SUMMARY OF 325 MEASURED (EXTREME AND NON-EXTREME) Persons

	RAW SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	153.0	36.0	2.88	.39				
S.D.	14.1	.0	1.77	.29				
MAX.	180.0	36.0	8.46	1.83				
MIN.	109.0	36.0	-.47	.20				

REAL RMSE .51	ADJ.SD	1.70	SEPARATION	3.34	Person RELIABILITY	.92
MODEL RMSE .48	ADJ.SD	1.71	SEPARATION	3.52	Person RELIABILITY	.93
S.E. OF Person MEAN = .10						

Person RAW SCORE-TO-MEASURE CORRELATION = .95
CRONBACH ALPHA (KR-20) Person RAW SCORE RELIABILITY = .95

SUMMARY OF 36 MEASURED (NON-EXTREME) Items

	RAW SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	1326.6	314.0	.00	.11	1.00	-.2	1.00	-.1
S.D.	51.5	.0	.56	.01	.23	2.4	.25	2.3
MAX.	1396.0	314.0	1.70	.12	1.53	5.0	1.67	6.2
MIN.	1149.0	314.0	-.85	.09	.72	-3.4	.71	-3.2

REAL RMSE .11	ADJ.SD	.55	SEPARATION	4.84	Item RELIABILITY	.96
MODEL RMSE .11	ADJ.SD	.55	SEPARATION	5.06	Item RELIABILITY	.96
S.E. OF Item MEAN = .10						

UMEAN=.000 USCALE=1.000
Item RAW SCORE-TO-MEASURE CORRELATION = -1.00
11304 DATA POINTS. APPROXIMATE LOG-LIKELIHOOD CHI-SQUARE: 16459.17

A total of 11304 data collected from 325 respondents answering the 36 items were analysed. Mean of the items was set at an arbitrary .00, while person mean was at 2.69. Based on the table above, the person reliability showed a high value of .93 with separate index of 3.63 for 314 respondents as compared to .92 with separate index of 3.34 for 325 respondents, recording an increase in reliability when eleven (11) extreme cases were eliminated. Furthermore, the item was sufficient to separate the respondents into four groups of different perceptions levels.

The equivalent indicator for the Rasch IRT model for Cronbach's alpha was the person reliability (Wright & Masters, 1981). The Cronbach's alpha for the instrument is .95 while the person separation reliability is recorded at .93. The items reliability on the other hand was registered at .96 with separation index of 4.48, where items were effective in separating individuals into four ability levels.

Item measure order. Item difficulty in this perception study was defined as how favourable would an item being endorsed. An easy item would be the one which would be endorsed favourably. The order of item difficulty, which was indicated in the column headed "measure" was illustrated in Table 4.5.26. Items started from an easier to agree at the bottom to harder to agree as one moved to the top of the list.

The items difficulties lay between -.85 to 1.70 logits, in the column with "measure" as the heading. Item 23 (learn for mastering skills) and item 11 (teamwork) were extremely easy items being at the bottom of the column with difficulty levels of -.85 and -.74. Item 26 (learn to obtain new knowledge) was easy with the difficulty level of -.65. Item 35 (openness) was considered as the most difficult items with a score of 1.70. Items 36 (integrated), 7 (fulfilling safety needs ethically), and 13 (innovativeness) were the mathematics values and the general education values with level of difficulty of 1.07, .90, and .90 logits.

Table 4.80

Item Statistics

INPUT: 325 Persons 36 Items MEASURED: 325 Persons 36 Items 5 CATS 1.0.0

Person: REAL SEP.: 3.63 REL.: .93 ... Item: REAL SEP.: 4.84 REL.: .96

Item STATISTICS: MEASURE ORDER

ENTRY NUMBER	RAW SCORE	COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PTMEA CORR.	EXACT MATCH OBS%	EXACT MATCH EXP%	Item
35	1149	314	1.70	.09	1.42	4.2	1.67	6.2	.51	55.1	58.0	NMC2 Openness
36	1228	314	1.07	.09	1.15	1.6	1.24	2.4	.58	66.2	64.0	NMC3 Integrated
7	1246	314	.90	.10	1.20	2.0	1.31	3.0	.56	63.4	65.0	NUT2 Fulfilling safety needs ethically
13	1246	314	.90	.10	1.03	.3	1.11	1.2	.58	62.4	65.0	NUU4 Innovativeness
6	1261	314	.75	.10	1.24	2.4	1.48	4.3	.50	62.4	66.2	NUT1 Fulfilling life needs ethically
28	1271	314	.65	.10	.81	-2.1	.83	-1.8	.65	67.8	66.7	NMI2 Empiricism
32	1276	314	.60	.10	.92	-.9	.96	-.3	.59	67.8	67.0	NMS2 Development
20	1290	314	.45	.10	.98	-.2	1.02	.3	.60	65.3	67.7	PMP2 Teach for functionality
30	1307	314	.27	.11	.78	-2.4	.81	-2.0	.62	70.7	68.2	NMI4 Integrated
33	1310	314	.23	.11	.87	-1.4	.80	-2.1	.61	70.7	68.2	NMS3 Civilization
19	1318	314	.14	.11	1.19	1.9	1.21	1.9	.54	62.7	68.4	PMP1 Teach for higher mathematics
31	1319	314	.13	.11	1.08	.8	1.03	.3	.55	72.3	68.4	NMS1 Control
27	1327	314	.03	.11	.98	-.2	.93	-.7	.61	68.8	68.5	NMI1 Rationalism
3	1331	314	-.01	.11	1.32	3.2	1.26	2.4	.54	67.2	68.7	NUA3 Evaluate values
22	1333	314	-.04	.11	.86	-1.5	.81	-1.9	.63	71.0	68.7	PMP4 Teach to internalize knowledge
8	1334	314	-.05	.11	1.18	1.9	1.19	1.8	.55	70.1	68.7	NUT3 Wisdom
29	1334	314	-.05	.11	.99	.0	.94	-.5	.58	70.4	68.7	NMI3 Pragmatism
34	1334	314	-.05	.11	.76	-2.8	.71	-3.2	.64	73.2	68.7	NMC1 Separated
4	1339	314	-.11	.11	1.41	4.0	1.34	3.0	.55	63.4	68.9	NUA4 Build value system
9	1340	314	-.12	.11	1.00	.0	1.01	.1	.60	69.1	68.9	NUT4 Justice
12	1350	314	-.25	.11	.85	-1.7	.83	-1.7	.60	74.2	69.2	NUU3 Accountability
2	1351	314	-.26	.11	1.53	5.0	1.41	3.5	.51	66.2	69.2	NUA2 Respond to values
18	1352	314	-.27	.11	.83	-2.0	.81	-1.8	.62	75.8	69.2	NUK5 Culture of integrity
16	1353	314	-.28	.11	.72	-3.4	.71	-3.0	.64	75.8	69.2	NUK3 Culture of quality
24	1353	314	-.28	.11	.87	-1.5	.83	-1.6	.61	75.2	69.2	PMB2 Learn for processing information
14	1356	314	-.32	.11	.80	-2.3	.75	-2.5	.62	80.3	69.4	NUK1 Culture of knowledge
5	1361	314	-.39	.11	1.34	3.4	1.20	1.8	.52	68.2	69.4	NUA5 Act out values
21	1362	314	-.40	.11	.79	-2.4	.77	-2.3	.58	77.1	69.4	PMP3 Teach to generate knowledge
25	1362	314	-.40	.11	.77	-2.8	.76	-2.3	.61	75.5	69.4	PMB3 Learn for constructing knowledge
17	1373	314	-.54	.11	.96	-.4	.95	-.4	.54	67.8	69.8	NUK4 Culture of precision
10	1375	314	-.57	.12	.80	-2.4	.75	-2.4	.62	76.1	69.8	NUU1 Discipline
15	1375	314	-.57	.12	.76	-2.9	.71	-2.8	.60	78.0	69.8	NUK2 Culture of diligence
1	1378	314	-.61	.12	1.30	3.2	1.23	1.9	.50	65.3	69.8	NUA1 Attention to values
26	1381	314	-.65	.12	.79	-2.6	.77	-2.1	.58	74.8	69.8	PMB4 Learn to obtaining knowledge
11	1388	314	-.74	.12	.83	-2.1	.89	-.9	.55	74.8	70.1	NUU2 Teamwork
23	1396	314	-.85	.12	.74	-3.4	.78	-1.9	.60	77.1	70.2	PMB1 Learn for mastering skills
MEAN	1326.6	314.0	.00	.11	1.00	-.2	1.00	-.1		70.1	68.2	
S.D.	51.5	.0	.56	.01	.23	2.4	.25	2.3		5.5	2.3	

The hierarchy of the items demonstrated that the three of the five most challenging items which were on top of the list were related to the general education values. Out of ten (10) most challenging items, six were from the mathematics values. Only one came from the values of mathematics education.

Item misfit. In Rasch analysis, item measure order provided an indication of construct validity (Smith, 2001). The infit and outfit mean square of the data were preferred for this studies since they can identify a wide range of potential sources of unexpected response. To identify the polarity of items that measure the values in mathematics classrooms, the point measure correlation (PTMEA Corr) must be positive, indicating the items measure the required construct (Linacre, 2002). Negative values of point measure correlation show that the items are not measuring values in mathematics classes (Linacre 2003). Items with more than .38 of PTMEA CORR value enable the researcher to distinguish the respondent accordingly.

The item misfit table demonstrated the order of misfit item. Item 35 (openness) and item 2 (responding to the system of values) which were on top of the list were found to be misfitting since their infit and outfit MNSQ values are outside the range of 0.5<x<1.5. Furthermore, their ZSTD were outside the range -2 < x < 2 (refer Table 4.5.27). Infit value is more sensitive towards the responses of the targeted persons' responses pattern or vice versa (Linacre, 2002). On the other hand, the outfit value is sensitive to the items with difficulty far from person, or vice versa.

Table 4.81

Items Statistics: Misfit Order

ENTRY NUMBER	RAW SCORE	COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PTMEA CORR.	EXACT MATCH OBS%	EXACT MATCH EXP%	Item
35	1149	314	1.70	.09	1.42	4.2	1.67	6.2	A .51	55.1	58.0	NMC2 Openness
2	1351	314	-.26	.11	1.53	5.0	1.41	3.5	B .51	66.2	69.2	NUA2 Respond to values
6	1261	314	.75	.10	1.24	2.4	1.48	4.3	C .50	62.4	66.2	NUT1 Fulfilling life needs ethically
4	1339	314	-.11	.11	1.41	4.0	1.34	3.0	D .55	63.4	68.9	NUA4 Build value system
5	1361	314	-.39	.11	1.34	3.4	1.20	1.8	E .52	68.2	69.4	NUA5 Act out values
3	1331	314	-.01	.11	1.32	3.2	1.26	2.4	F .54	67.2	68.7	NUA3 Evaluate values
7	1246	314	.90	.10	1.20	2.0	1.31	3.0	G .56	63.4	65.0	NUT2 Fulfilling safety needs ethically
1	1378	314	-.61	.12	1.30	3.2	1.23	1.9	H .50	65.3	69.8	NUA1 Attention to values
36	1228	314	1.07	.09	1.15	1.6	1.24	2.4	I .58	66.2	64.0	NMC3 Integrated
19	1318	314	.14	.11	1.19	1.9	1.21	1.9	J .54	62.7	68.4	PMP1 Teach for higher mathematics
8	1334	314	-.05	.11	1.18	1.9	1.19	1.8	K .55	70.1	68.7	NUT3 Wisdom
13	1246	314	.90	.10	1.03	.3	1.11	1.2	L .58	62.4	65.0	NUU4 Innovativeness
31	1319	314	.13	.11	1.08	.8	1.03	.3	M .55	72.3	68.4	NMS1 Control
20	1290	314	.45	.10	.98	-.2	1.02	.3	N .60	65.3	67.7	PMP2 Teach for functionality
9	1340	314	-.12	.11	1.00	.0	1.01	.1	O .60	69.1	68.9	NUT4 Justice
29	1334	314	-.05	.11	.99	.0	.94	-.5	P .58	70.4	68.7	NMI3 Pragmatism
27	1327	314	.03	.11	.98	-.2	.93	-.7	Q .61	68.8	68.5	NMI1 Rationalism
32	1276	314	.60	.10	.92	-.9	.96	-.3	R .59	67.8	67.0	NMS2 Development
17	1373	314	-.54	.11	.96	-.4	.95	-.4	r .54	67.8	69.8	NUK4 Culture of precision
11	1388	314	-.74	.12	.83	-2.1	.89	-.9	q .55	74.8	70.1	NUU2 Teamwork
33	1310	314	.23	.11	.87	-1.4	.80	-2.1	p .61	70.7	68.2	NMS3 Civilization
24	1353	314	-.28	.11	.87	-1.5	.83	-1.6	o .61	75.2	69.2	PMB2 Learn for processing information
22	1333	314	-.04	.11	.86	-1.5	.81	-1.9	n .63	71.0	68.7	PMP4 Teach to internalize knowledge
12	1350	314	-.25	.11	.85	-1.7	.83	-1.7	m .60	74.2	69.2	NUU3 Accountability
28	1271	314	.65	.10	.81	-2.1	.83	-1.8	l .65	67.8	66.7	NMI2 Empiricism
18	1352	314	-.27	.11	.83	-2.0	.81	-1.8	k .62	75.8	69.2	NUK5 Culture of integrity
30	1307	314	.27	.11	.78	-2.4	.81	-2.0	j .62	70.7	68.2	NMI4 Integrated
14	1356	314	-.32	.11	.80	-2.3	.75	-2.5	i .62	80.3	69.4	NUK1 Culture of knowledge
10	1375	314	-.57	.12	.80	-2.4	.75	-2.4	h .62	76.1	69.8	NUU1 Discipline
21	1362	314	-.40	.11	.79	-2.4	.77	-2.3	g .58	77.1	69.4	PMP3 Teach to generate knowledge
26	1381	314	-.65	.12	.79	-2.6	.77	-2.1	f .58	74.8	69.8	PMB4 Learn for obtaining knowledge
23	1396	314	-.85	.12	.74	-3.4	.78	-1.9	e .60	77.1	70.2	PMB1 Learn for mastering skills
25	1362	314	-.40	.11	.77	-2.8	.76	-2.3	d .61	75.5	69.4	PMB3 Learn for constructing knowledge
15	1375	314	-.57	.12	.76	-2.9	.71	-2.8	c .60	78.0	69.8	NUK2 Culture of diligence
34	1334	314	-.05	.11	.76	-2.8	.71	-3.2	b .64	73.2	68.7	NMC1 Separated
16	1353	314	-.28	.11	.72	-3.4	.71	-3.0	a .64	75.8	69.2	NUK3 Culture of quality
MEAN	1326.6	314.0	.00	.11	1.00	-.2	1.00	-.1		70.1	68.2	
S.D.	51.5	.0	.56	.01	.23	2.4	.25	2.3		5.5	2.3	

Item 35 is openness which is a dimension in the mathematics value and item 2, a dimension within the general education which describes how individuals respond towards a certain system are not discriminating person abilities in a manner consistent with other items and will be investigated further. Items 6 (fulfilling life needs ethically) and item 4 (build a value system) had three out of four fit statistics that were greater than the misfitting criteria.

Below is the list consisting items which are thought to be outside the fitting criteria. Table 4.5.27 showed that all the point measure for all the items were positive and more than .3. Only one item (NUA2 – Responding to value) has infit mean square greater than 1.5 and none was smaller than 0.5 and only one item (NMC2 – Openness) has outfit means square greater than 1.5 and the rest of the values were more than 0.5 and less than 1.5. Five items had outfit z-standard more than or equal to 3.0, implying that the data obtained is very unexpected to fit the mode and ten items with values less than -2. Two items had outfit standard of less than -3 and one has infit standard less than -3. This is a sign of data being too predictable.

Table 4.82

Items Found to be Outside the Fitting Criteria

ENTRY NUMBER	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD		PTMEA CORR.	Item
35	1.42	4.2	1.67	6.2	A	.51	NMC2 Openness
2	1.53	5.0	1.41	3.5	B	.51	NUA2 Respond to values
6	1.24	2.4	1.48	4.3	C	.50	NUT1 Fulfilling life needs ethically
4	1.41	4.0	1.34	3.0	D	.55	NUA4 Build value system
5	1.34	3.4	1.20	1.8	E	.52	NUA5 Act out values
3	1.32	3.2	1.26	2.4	F	.54	NUA3 Evaluate values
7	1.20	2.0	1.31	3.0	G	.56	NUT2 Fulfilling safety needs ethically
1	1.30	3.2	1.23	1.9	H	.50	NUA1 Attention to values
36	1.15	1.6	1.24	2.4	I	.58	NMC3 Integrated
11	.83	-2.1	.89	-.9	q	.55	NUU2 Teamwork
33	.87	-1.4	.80	-2.1	p	.61	NMS3 Civilization
28	.81	-2.1	.83	-1.8	l	.65	NMI2 Empiricism
30	.78	-2.4	.81	-2.0	j	.62	NMI4 Integrated
14	.80	-2.3	.75	-2.5	i	.62	NUK1 Culture of knowledge
10	.80	-2.4	.75	-2.4	h	.62	NUU1 Discipline
21	.79	-2.4	.77	-2.3	g	.58	PMP3 Teach to generate knowledge
26	.79	-2.6	.77	-2.1	f	.58	PMB4 Learn for obtaining knowledge
23	.74	-3.4	.78	-1.9	e	.60	PMB1 Learn for mastering skills
25	.77	-2.8	.76	-2.3	d	.61	PMB3 Learn for constructing knowledge
15	.76	-2.9	.71	-2.8	c	.60	NUK2 Culture of diligence
34	.76	-2.8	.71	-3.2	b	.64	NMC1 Separated
16	.72	-3.4	.71	-3.0	a	.64	NUK3 Culture of quality

Table 4.82 listed the items which were not within the expected range for any of the fit index. However, there was no item which was outside the required ranges for all the infit mean square, infit z-standard, outfit mean square, outfit z-standard, and the point measure correlation.

Person measure order. Respondents with MNSQ outside the optimum range between 0.5 and 1.5 for both the infit and outfit categories and ZSTD outside of -2.0 and 2.0 for both the infit and outfit categories were detected. Out of 325 respondents 39 were found to have at least one of the four values to be outside the optimum range. Out of 39 only eight have MNSQ infit and output values to be more than 2.0 and ZSTD to be > 3.0. Having values of MNSQ greater than 2.0 indicates that the person may degrade the measurement system, however this might be caused by only one or two observations. Having ZSTD values outside the optimal range indicates that the person's responses were much unexpected.

Rating scale. In order to figure out the appropriateness of the rating scale used in this study, which may also contributed towards the construct validity of the instrument, the rating scale (1= extremely disagree, 2= disagree, 3= not sure, 4= agree, and 5=extremely agree) was evaluated according to Linacre's (2002) three essential criteria; which were (1) there must be at least 10 responses to each category rating; (2) the average measure of each category must increase incrementally, and (3) each of the five category must have a mean square (MNSQ) outfit of < 2.0. The respondents rating scales must meet all three criteria for it to be acceptable and not contributing towards any disorder in the measurements.

The summary of category structure (Table 4.5.29) indicated that the first criterion was met with at least 21 respondents per category. However, the second criterion was not met as rating categories decreases from the first to the second category (.87 to .39) before increasing incrementally (1.21, 2.20, and 3.95).

Table 4.83

Summary of Category Structure

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
1	1	21	0	.87	-.57	1.82	2.73	NONE	(-3.42)	1
2	2	143	1	.39*	.24	1.08	1.19	-2.08	-1.81	2
3	3	956	8	1.21	1.16	1.06	1.07	-1.20	-.55	3
4	4	6336	56	2.20	2.25	.92	.89	-.21	1.70	4
5	5	3848	34	3.95	3.90	.96	.94	3.50	(4.62)	5

The third and final criterion (outfit MnSq < 2.0) indicated that each rating-scale category is performing close to mean randomness with MnSq values from .89 to 2.73. However, category one violated the criteria with value 2.73 which is more than 2.0. It was also noted that the category calibration was increasing with respect to the category as expected. A disorder of increment was an indication that a category was relatively rarely observed.

The plot in Figure 4.16 demonstrated the category probability curve which illustrated the probability of responding towards a specific category. The category probability should look like a range of hills. Categories which never emerge as peaks corresponded to disordered Rasch-Andrich threshold which suggested the need to re-consider the choice of response options both in terms of the number of response options and the labels used.

The findings suggest collapsing the categories of '1" and "2". This might improve the values of fit indices in IRT models (Olivares, Weintraub, & Epstein, 2009), reduced the burden on the respondent and save time. However, they demonstrated that convergent and discriminant validity measures were relatively unaffected by the number of response categories. This type of modification usually results in loss of information, including sensitivity of the instrument.

```
  CATEGORY PROBABILITIES: MODES - Structure measures at intersections

P      ++-----+-----+-----+-----+-----+-----+-----+-----+-----++
R  1.0 +                                                       +
O      |                                                       |
B      |                                                       |
A      |11                                                     |
B   .8 +  11                                                 55+
I      |    1                          4444444             55  |
L      |     11                       44       44          5    |
I      |       1                     4           44       5     |
T   .6 +        1                  4              4    55      +
Y      |         1                4                44 5        |
    .5 +          1              4                   *         +
O      |           1            4                   5 4        |
F   .4 +          22*2222 33333*3                  5   44      +
       |        22  1   3*    4  33              55      4     |
R      |       2     1 3  22 4     3            5         4    |
E      |     22       *     *       33         5           44  |
S   .2 +   22       33 11 44 2        33     55              44+
P      |222        3     *    22        33 55                  |
O      |        333    44 11    22      55*33                  |
N      |    3333    444     111   2***55     33333             |
S   .0 +************55555555555****111*************************+
E      ++-----+-----+-----+-----+-----+-----+-----+-----+-----++
       -4    -3    -2    -1     0     1     2     3     4     5
        Person [MINUS] Item MEASURE
```

Figure 4.16 Probability curves for rating scale

Olivares et al., 2009 suggested that adding or collapsing the number of response categories was a trade-off between the precision of the instrument and the goodness of fit. For example, if the number of items was large or if the items were highly discriminating but the goodness of fit of the model is questionable, fewer response categories can be considered. On the other hand, if the number of items were small or when the items showed low discrimination but you expect the model to fit well, more response categories should be provided to reduce concerns about poor precision of the instrument (Olivares et al., 2009).

Evaluation of model goodness of fit indices. Confirmatory factor analysis dealt with the assessment of the relationship between construct and the indicators variables and simultaneously validate the hypothesised theoretical framework because it was very important that the measurement of variables involved were psychometrically sound (Byrne, 2010). A structural modelling software was typically used for confirmatory factor analysis. The study on the Structural Equation Model (SEM) used AMOS to perform the confirmatory factor analysis to assess the hypothesized measurement model in a structural equation model for the values in mathematics classrooms instrument. The hypotheses for this latent structure were based on the framework by Nik Azis (2009) where value in mathematics classrooms was categorized into three sub-constructs. The three sub-constructs were further categorized into nine dimensions, in which each dimension is represented by several value items. However, the conceptual definitions of the latent variable, its sub-constructs, and dimensions were all based on the universal integrated approach. The study used several statistics since a model may achieve a good fit on one fit statistics but inadequate on another fit statistics test. The study has 325 respondents which meant it has reasonable number of samples following Bentler & Chou (1987) that the ratio of samples and items should be 5:1. Normally, 200 is a good number for the SEM study. Other statistical methods would require one statistical test to determine the significance, however, CFA required several statistical tests to determine how well the model fit the data used. A good model is an indication that the model is plausible and not necessarily correct.

The model fit would be justified with several goodness-of-fit indices such as; Chi-square/df, Root mean square error (RMSEA), Goodness-of-Fit index (GFI), Tucker-Lewis Index (TLI), Normed Fix Index (NFI) as the relative fit indices, and Comparative Fit Index (CFI) as the noncentrally-based indices were used as fit indices. Analyses were conducted using Amos 23 software and the thresholds followed as a guideline were given in Table 4.79. The chi-square value, however it was highly sensitive to sample size and almost always significant with large sample size, thus it was not considered as a measure of goodness fit (Harrington, 2009), instead the chi-square normalised by degrees of freedom

(Chi-square/df) was used in this study. The ratio of Chi-square/df should be less than 3.0 to have a good fit (Hair et al., 2010).

GFI is a measure fit between the hypothesized model and the observed covariance matrix, NFI analysed the discrepancy between the chi-squared value of the proposed model and the null model, CFI which is also known as the Bentler Comparative Fit Index compares the model of interest with some alternative, such as the null or independence model. Roughly, it represents the extent to which the model of interest is better than the independence model. Values that approach 1 indicate acceptable fit. RMSEA represents the square root of the average or mean of the covariance residuals, which are the differences between corresponding elements of the observed and predicted covariance matrix.

Table 4.84

CFA Model Fit Indices for the Three Sub-constructs

Measure	**Recommended Values**	**Fit**
Chi-square/df (cmin/df)	≤ 3.0 good <5sometimes permissible	Hair et al. (2010)
p-value for the model	>.05	Hu & Bentler (1998, 1999)
CFI	≥..90	Hu & Bentler (1998, 1999)
GFI	≥..90	Hu & Bentler (1998, 1999)
NFI	≥..90	Hu & Bentler (1998, 1999)
TLI	≥..90	Hu & Bentler (1998, 1999)
RMSEA	≤.06	Byrne (2009)

The researcher conducted the first and second order construct for the general education values, mathematics education values, and mathematics values. The first order construct referred how the dimensions loaded into the respective items. Meanwhile, second order CFA was employed to validate the theorized sub-constructs loaded into certain number of dimensions for this data (Kline, 2005). In this study for example the theory posited that general education value consisted of four dimensions (basic, core, main, and expanded) in which each dimension was measured using certain number of items.

The confirmatory factor analysis pointed that the model for the general education in Figure 4.5.7 was not fully a good fit since: $\chi2/df = 3.64$; GFI = .856; CFI = .898, NFI = .866, TLI = .884, RMSEA = .087. However, the values of GFI, CFI, and TLI for example were all close to .90.

The results showed that the factor loading of basic, core, main, and expanded were .60, .86, 1.01., and .89 implying general education value loads well on the four dimensions.

Table 4.85

Path Coefficients for Dimensions of General Education Values

Dimension	Ranges
Basic	.81 - .90
Core	.60 - .72
Main	.57 - .76
Expanded	.59 - .83

The paths coefficients (standardized regression coefficients) or the factor loading for the first order constructs varied between values of .57 to .90 for general education values. The ranges of path coefficients for all the dimensions were summarized in Table 4.85.

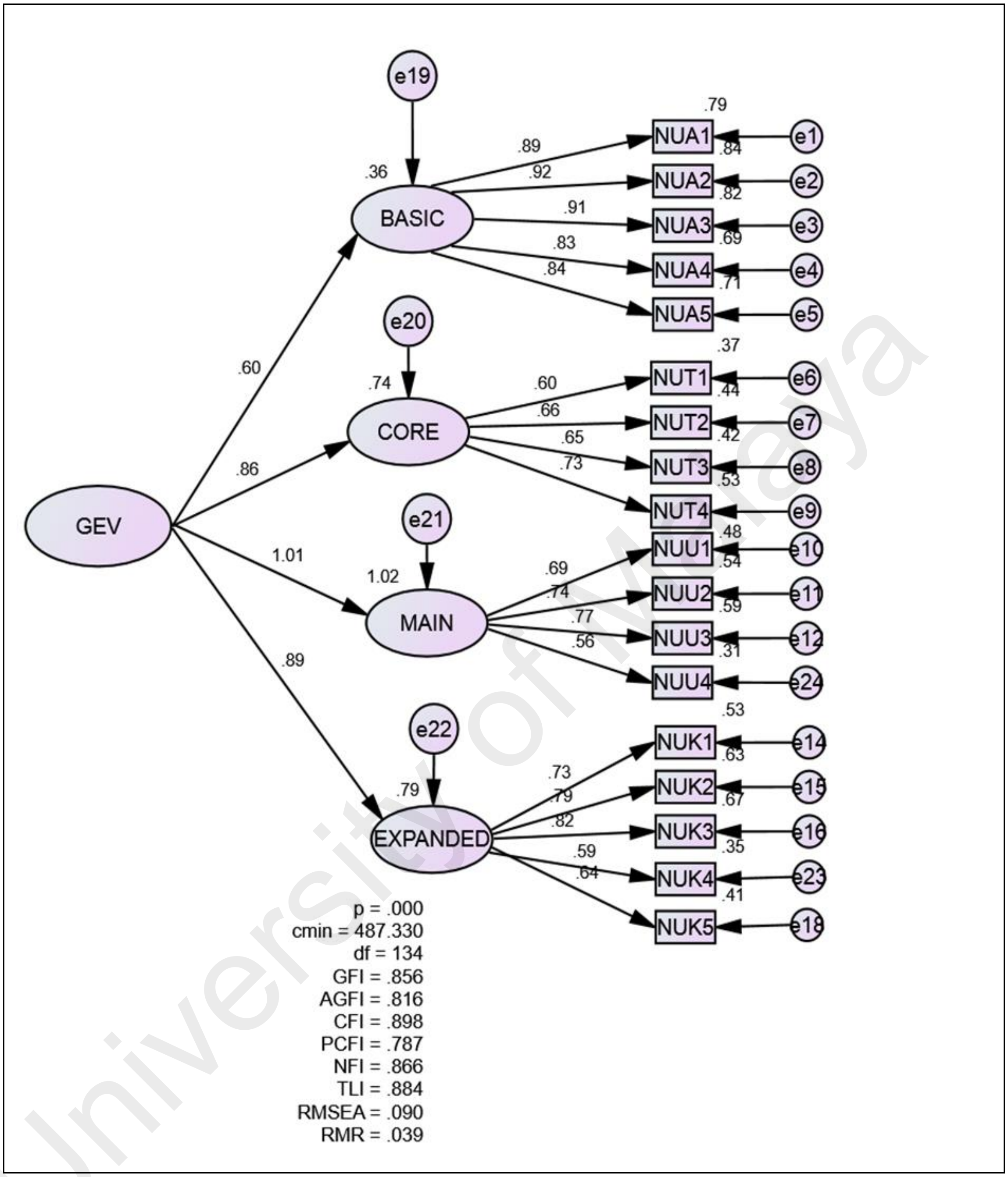

Figure 4.17 *The factor loading for first and second order construct - General Education Values*

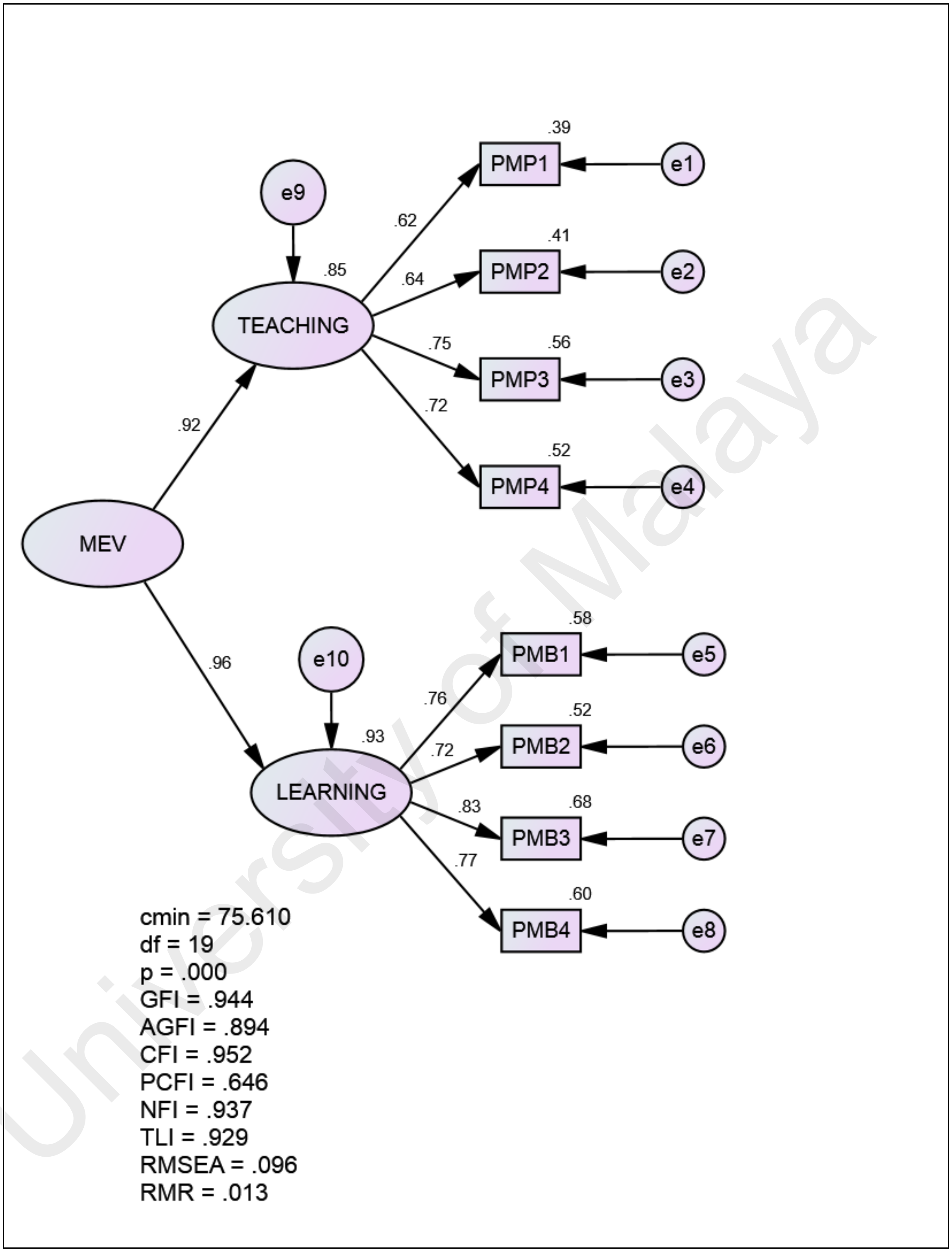

Figure 4.18 The factor loading for first and second order construct - Mathematics Education Values

The goodness fit indices for the mathematics education values were found to be at an acceptable level where chi square/df = 3.97, GFI = .944, AGFI = .894, CFI = .952, RMSEA = .096, and RMR = .013. The path coefficients (standardized regression coefficients) vary from .62 to .83 for the mathematics education values confirmatory factor analysis and were all above .50. The ranges of path coefficients for all the dimensions are summarized in Table 4.5.32. Factor loadings are generally above .50, indicators of an acceptable fit of the items in the mathematics education values.

Table 4.86

Ranges of Path Coefficients for all the Dimensions of Mathematics Education Values

Dimension	Ranges
Teaching	.62 - .75
Learning	.72 - .83

The factor loading for the second order constructs were .85 and .93 which reflected that the theory that mathematics education values consisted of the dimensions of teaching and learning were well supported theoretically.

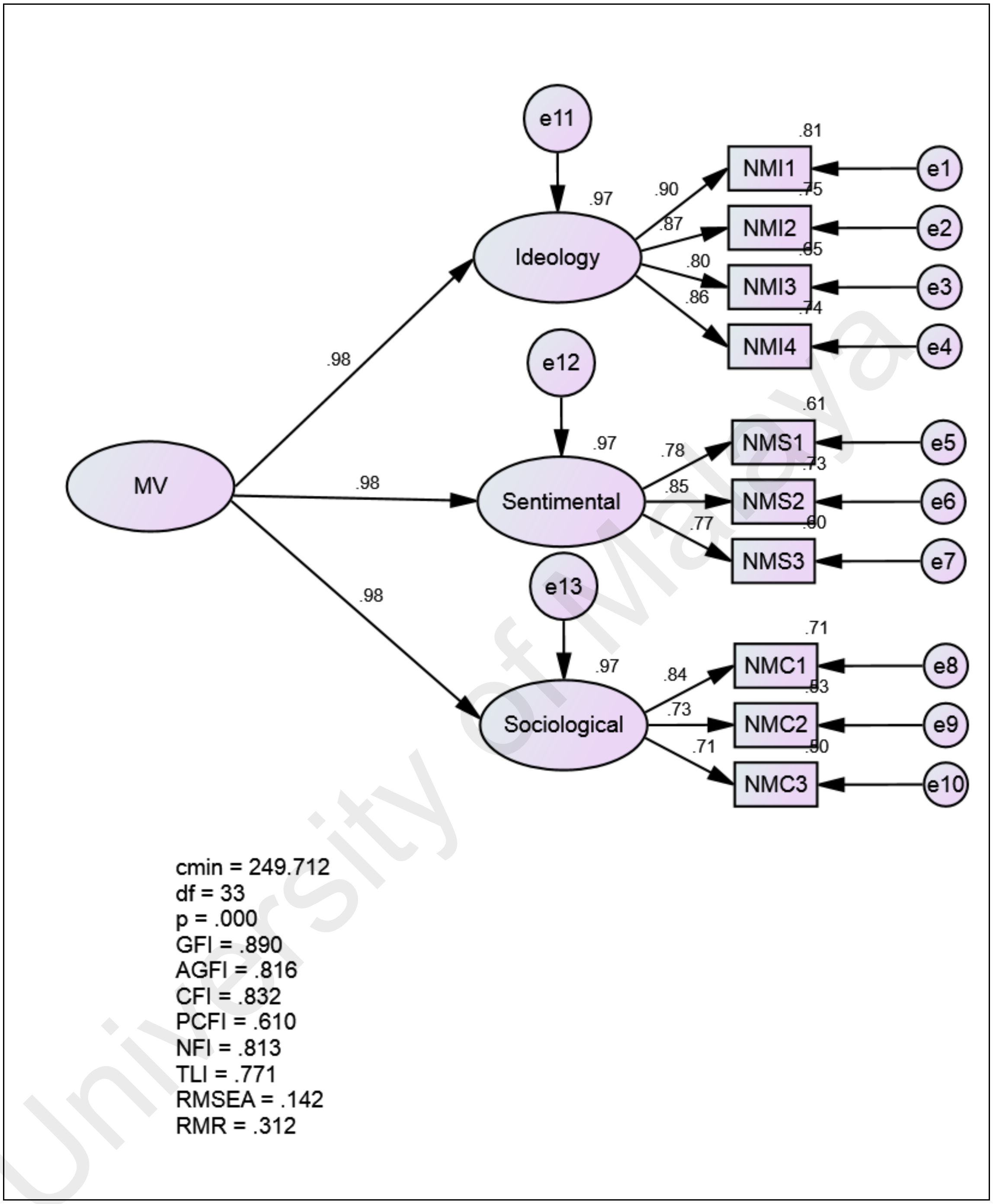

Figure 4.19 The factor loading for first and second order construct - Mathematics Values

The fitness indexes were chi square/df = 7.57, GFI = .890, AGFI = .816, CFI = .832, NFI = .813, TLI = .771, RMSEA = .142, and RMR = .312 indicated that the mathematics values were not fit. However, all measurements of the first order factor loading for the three dimensions: ideology, sentimental, and sociological values were found to be .98. The path coefficients for the mathematics values (standardized regression coefficients) vary between .57 and .77 for confirmatory factor analysis. Once again, the fitness indexes do not meet the required level as recommended by the literature even though all factor loadings are above the threshold of 0.5, indicating the theory that the mathematics values were made up of three dimensions were not supported in theory and with previous research for this sample.

Table 4.87

Path Coefficients for Dimensions of Mathematics Values

Dimension	Ranges
Ideology	.68 - .77
Sentimental	.64 - .75
Sociology	.57 - .73

Since the factor loading for the first order construct of general education values consisted of small values (.56 and .590) for items NUU4 and NUK4, they were eliminated and the goodness fit indices were studied again.

Table 4.88

C*omparisons of Fitting Indices*

		cim/df	p-value	GFI	AGFI	CFI	PCFI	NFI	TLI	RMSEA	RMR
GEV	All	3.64	.000	.856	.816	.898	.787	.866	.884	.090	.039
MEV	All	3.97	.000	9.44	.894	.952	.646	.937	.929	.096	.013
MV	All	7.56	.000	.890	.816	.832	.610	.813	.771	.142	.312
MViC	All	4.37	.000	.622	.576	.708	.667	.654	.690	.102	.345
GEV	Minus NUU4	3.52	.000	.866	.826	.910	.790	.880	.897	.088	.037
GEV	Minus NUK4	3.32	.000	.873	.836	.916	.795	.885	.903	.085	.040
GEV	Minus NUU4 and NUK4	3.13	.000	.885	.876	.906	.562	.901	.918	.065	.037

Table 4.88 demonstrated how the indices changed when NUU4, NUK4, and both were eliminated. It can be seen some of the indices showed some improvements when these items were eliminated. This was not done for the mathematics education and mathematics values as the path diagrams did not have any factor loading for first order construct being less than .60.

The table also demonstrated the fit indices for the three sub-constructs: general education values, mathematics education value, and mathematics value. Values for GFI, CFI, NFI, and TLI were all reasonable for the three sub-constructs since they demonstrated values close to .9. The cim/df for general education and mathematics values were below .5 which were considered acceptable, but it was above .5 for the mathematics values. It can be concluded that the structure of the three sub-constructs were acceptable.

Principal component analysis of the residuals. In addition to fit statistics, the study used the principal component analysis of residuals to check unidimensional. Principal component analysis of the residuals (PCAR) provided information on whether a substantial factor exists in the residuals after the primary measurement dimension had been estimated

(Linacre, 1998). The unidimensional for each sub-construct was analysed by examining the first contrast from the items' PCAR. Table 4.5.35, Table 4.5.36, and Table 4.5.37 demonstrated the standardized variance for the three sub-constructs followed by the summary of the analysis of PCAR on sub-constructs and construct.

Table 4.89

Standardized Residual Variance (in Eigenvalue units) for GEV

		Empirical		Modelled
Total variance in observations =	39.8	100.0%		100.0%
Variance explained by measures =	21.8	54.7%		54.0%
Unexplained variance (total) =	18.0	45.3%	100.0%	46.0%
Unexplned variance in 1st contrast =	3.8	9.6%	21.2%	
Unexplned variance in 2nd contrast =	2.1	5.2%	11.6%	
Unexplned variance in 3rd contrast =	1.8	4.4%	9.7%	
Unexplned variance in 4th contrast =	1.5	3.6%	8.1%	
Unexplned variance in 5th contrast =	1.1	2.8%	6.1%	

Table 4.90

Standardized Residual Variance (in Eigenvalue units) for MEV

		Empirical	Modeled	
Total variance in observations =	17.7	100.0%		100.0%
Variance explained by measures =	9.7	54.7%		54.0%
Unexplained variance (total) =	8.0	45.3%	100.0%	46.0%
Unexplned variance in 1st contrast =	1.6	9.2%	20.2%	
Unexplned variance in 2nd contrast =	1.5	8.2%	18.2%	
Unexplned variance in 3rd contrast =	1.1	6.4%	14.2%	
Unexplned variance in 4th contrast =	1.0	5.9%	13.1%	
Unexplned variance in 5th contrast =	.8	4.7%	10.4%	

Table 4.91

Standardized Residual Variance (in Eigenvalue units) for MV

		Empirical		Modeled
Total variance in observations =	22.1	100.0%		100.0%
Variance explained by measures =	12.1	54.7%		54.0%
Unexplained variance (total) =	10.0	45.3%	100.0%	46.0%
Unexplned variance in 1st contrast =	2.1	9.3%	20.6%	
Unexplned variance in 2nd contrast =	1.3	5.8%	12.7%	

General education values seemed to be multidimensional because the 1st contrast in the unexplained variance had a size of 3.8 which was larger than 2.0. However, the 1st contrast in the unexplained variance for mathematics education values was 1.6 and mathematics values was 2.1 which was an indication that there was no possibility of having a second dimension. The raw variance explained by the measures for all the three sub-constructs were 54.7% which were acceptable values.

Table 4.92

Summary of the Standardized Residual Variance (Eigenvalue units)

Construct and sub-constructs	Raw variance explained		Unexplained variance in 1st Contrast	
	Eigenvalue	Empirical	Eigenvalue	Empirical
General Education Value	21.8	54.7%	3.8	9.6
Mathematics Education Value	9.7	54.7	1.6	9.2
Mathematics Value	12.1	54.7	2.1	9.3

Eigenvalues of unexplained variance in 1st contrast was more than 3 for general education values which was an indicative of an existence of another dimension and less than three for mathematics education values and mathematics values which indicated uni dimensionality within these constructs. The items in each sub-construct explained a total of 54.7% of the variance which was considered high. The PCAR results showed the multidimensionality for the general education due to the high eigen values (more than 3.0) for the unexplained variances indicating the existence of a second dimension and possibility of unidimensional for mathematics education values and mathematics values.

Crosstabulations and Chi Square analysis. Cross tabulation is used to describe the relationships between two or more categorical (nominal or ordinal) variables. Cross tabulation, produced observed counts and percentages, expected counts and percentages, residuals, and chi-square. The Chi-Square tests the hypothesis that the row and column variables were independent, without indicating strength or direction of the relationship. Categories were all independent, mutually exclusive, and there were at least five (5) counts in each sample.

Cross tabulation was used to discover the pattern of the relationship (linear or not), the strength of the relationship, its direction, and whether the relationship can be generalized to the population from which the sample was drawn. The discussion on cross tabulation will include the cross tabulation between sub-constructs and demographic profile and cross tabulations between the three sub-constructs and construct.

Cross tabulations of sub-constructs and demographic profiles. The cross-tabulations between age group, highest education, and teaching experiences with general education values, mathematics education values, mathematics values, and values in mathematics classes are discussed in this section.

Table 4.93

Range of Scores for all Sub-constructs and Constructs

	General Education Value	Mathematics Education Value	Mathematics Value	Mathematics Values in Classrooms
Number of Items	18	8	10	36
Low	1 – 77	1 - 34	1 - 40	1 – 152
High	78 - 90	35 - 40	41 - 50	153 – 180

Scores were divided into low and high following the percentiles information provided by SPSS as demonstrated in Table 4.5.39. Three cross tabulations between age group, education background, and teaching experience were presented from Table 4.94 to Table 4.105.

Table 4.94

Crosstabulation and Chi-Square Test: Age Group and General Education

			GEV LEVELS		
			LOW	HIGH	Total
AGE GROUP	30 and Below	Count	63	38	101
		Expected Count	54.7	46.3	101.0
		% within AGE GROUP	62.4%	37.6%	100.0%
		% within GEV LEVELS	35.8%	25.5%	31.1%
		% of Total	19.4%	11.7%	31.1%
	31 - 40	Count	71	68	139
		Expected Count	75.3	63.7	139.0
		% within AGE GROUP	51.1%	48.9%	100.0%
		% within GEV LEVELS	40.3%	45.6%	42.8%
		% of Total	21.8%	20.9%	42.8%
	41 and above	Count	42	43	85
		Expected Count	46.0	39.0	85.0
		% within AGE GROUP	49.4%	50.6%	100.0%
		% within GEV LEVELS	23.9%	28.9%	26.2%
		% of Total	12.9%	13.2%	26.2%
Total		Count	176	149	325
		Expected Count	176.0	149.0	325.0
		% within AGE GROUP	54.2%	45.8%	100.0%
		% within GEV LEVELS	100.0%	100.0%	100.0%
		% of Total	54.2%	45.8%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.050[a]	2	.132
Likelihood Ratio	4.084	2	.130

Linear-by-Linear Association	3.299	1	.069
N of Valid Cases	325		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 38.97.

There was no statistically association between age group and general education values since $\chi2(2) = 4.050$ and p value is .132. The chi-square is not significant using the .05 threshold.

Table 4.95

Crosstabulations and Chi-Square Test: Age Group and Mathematics Education Values

			MEV LEVELS		
			LOW	HIGH	Total
AGE GROUP	30 and Below	Count	59	42	101
		Expected Count	53.8	47.2	101.0
		% within AGE GROUP	58.4%	41.6%	100.0%
		% within MEV LEVELS	34.1%	27.6%	31.1%
		% of Total	18.2%	12.9%	31.1%
	31 - 40	Count	68	71	139
		Expected Count	74.0	65.0	139.0
		% within AGE GROUP	48.9%	51.1%	100.0%
		% within MEV LEVELS	39.3%	46.7%	42.8%
		% of Total	20.9%	21.8%	42.8%
	41 and above	Count	46	39	85
		Expected Count	45.2	39.8	85.0
		% within AGE GROUP	54.1%	45.9%	100.0%
		% within MEV LEVELS	26.6%	25.7%	26.2%
		% of Total	14.2%	12.0%	26.2%
Total		Count	173	152	325
		Expected Count	173.0	152.0	325.0
		% within AGE GROUP	53.2%	46.8%	100.0%
		% within MEV LEVELS	100.0%	100.0%	100.0%
		% of Total	53.2%	46.8%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig (2-sided)
Pearson Chi-Square	2.155[a]	2	.341
Likelihood Ratio	2.159	2	.340
Linear-by-Linear Association	.435	1	.510
N of Valid Cases	325		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 39.75.

This result indicated that there was no relationship between age group and mathematics education values. Here the $\chi2(2) = (2.155)$ and $p = .341$ indicating not significant. Again, there was no relationship between age group and mathematics education values.

Table 4.96

Crosstabulations and Chi-Square Test: Age Group and Mathematics Values

			MV LEVELS		
			LOW	HIGH	Total
AGE GROUP	30 and Below	Count	59	42	101
		Expected Count	53.1	47.9	101.0
		% within AGE GROUP	58.4%	41.6%	100.0%
		% within MV LEVELS	34.5%	27.3%	31.1%
		% of Total	18.2%	12.9%	31.1%
	31 - 40	Count	67	72	139
		Expected Count	73.1	65.9	139.0
		% within AGE GROUP	48.2%	51.8%	100.0%
		% within MV LEVELS	39.2%	46.8%	42.8%
		% of Total	20.6%	22.2%	42.8%
	41 and above	Count	45	40	85
		Expected Count	44.7	40.3	85.0
		% within AGE GROUP	52.9%	47.1%	100.0%
		% within MV LEVELS	26.3%	26.0%	26.2%
		% of Total	13.8%	12.3%	26.2%
Total		Count	171	154	325
		Expected Count	171.0	154.0	325.0
		% within AGE GROUP	52.6%	47.4%	100.0%
		% within MV LEVELS	100.0%	100.0%	100.0%
		% of Total	52.6%	47.4%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig (2-sided)
Pearson Chi-Square	2.453[a]	2	.293
Likelihood Ratio	2.460	2	.292
Linear-by-Linear Association	.673	1	.412
N of Valid Cases	325		

a. 0 cells (0.0%) have expected count less than 5.

b. The minimum expected count is 40.28.

Table 4.96 showed that there was no statistically significant association between age group and mathematics values since $\chi2(2) = 2.453$ and the significant level is $p = .293$ which is more than .05.

Table 4.97

Crosstabulations and Chi-Square Test of Age Group and Mathematics Values in Classroom

			MViC LEVELS		
			LOW	HIGH	Total
AGE GROUP	30 and Below	Count	57	44	101
		Expected Count	52.5	48.5	101.0
		% within AGE GROUP	56.4%	43.6%	100.0%
		% within MViC LEVELS	33.7%	28.2%	31.1%
		% of Total	17.5%	13.5%	31.1%
	31 - 40	Count	72	67	139
		% within AGE GROUP	51.8%	48.2%	100.0%
		% within MViC LEVELS	42.6%	42.9%	42.8%
		% of Total	22.2%	20.6%	42.8%
	41 and above	Count	40	45	85
		% within AGE GROUP	47.1%	52.9%	100.0%
		% within MViC LEVELS	23.7%	28.8%	26.2%
		% of Total	12.3%	13.8%	26.2%
Total		Count	169	156	325
		% within AGE GROUP	52.0%	48.0%	100.0%
		% within MViC LEVELS	100.0%	100.0%	100.0%
		% of Total	52.0%	48.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig (2-sided)
Pearson Chi-Square	1.630[a]	2	.443
Likelihood Ratio	1.632	2	.442
Linear-by-Linear Association	1.625	1	.202
N of Valid Cases	325		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 40.80.

The crosstabulations of age group and mathematics values in classroom indicated that the Pearson chi-square value was p = .443 which was more than .05 with $\chi2(2)$ = 1.630. There was no significant relationship between age group and values in mathematics classroom. The next discussion covered the crosstabulation of education background and the general education, mathematics education, and mathematics values.

Table 4.98

Crosstabulations and Chi-Square Test of Education Background and General Education Values

			GEV LEVELS		
			LOW	HIGH	Total
Education Level	Degree	Count	142	108	250
		% within Education Level	56.8%	43.2%	100.0%
		% within GEV 2 LEVELS	80.7%	72.5%	76.9%
		% of Total	43.7%	33.2%	76.9%
	Masters and above	Count	34	41	75
		Expected Count	40.6	34.4	75.0
		% within Education Level	45.3%	54.7%	100.0%
		% within GEV 2 LEVELS	19.3%	27.5%	23.1%
		% of Total	10.5%	12.6%	23.1%
Total		Count	176	149	325
		Expected Count	176.0	149.0	325.0
		% within Education Level	54.2%	45.8%	100.0%
		% within GEV 2 LEVELS	100.0%	100.0%	100.0%
		% of Total	54.2%	45.8%	100.0%

Chi-square

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.055[a]	1	.080
Likelihood Ratio	3.047	1	.081
Linear-by-Linear Association	3.046	1	.081
N of Valid Cases	325		

The Pearson chi-square value was p = .080 for the crosstabulation of education background with general education values which was more than .05. The chi-square values were $\chi2(1)$ = 3.055. There was no significant relationship between education background and the general education values.

Table 4.99

Crosstabulations and Chi-Square Test of Education Background and Mathematics Education Values

			MEV LEVELS		
			LOW	HIGH	Total
Education Level	Degree	Count	145	105	250
		% within Education Level	58.0%	42.0%	100.0%
		% within MEV 2 LEVELS	83.8%	69.1%	76.9%
		% of Total	44.6%	32.3%	76.9%
	Masters and above	Count	28	47	75
		% within Education Level	37.3%	62.7%	100.0%
		% within MEV 2 LEVELS	16.2%	30.9%	23.1%
		% of Total	8.6%	14.5%	23.1%
Total		Count	173	152	325
		% within Education Level	53.2%	46.8%	100.0%
		% within MEV 2 LEVELS	100.0%	100.0%	100.0%
		% of Total	53.2%	46.8%	100.0%

Chi-square

	Value	Df	Asym Sig (2-sided)
Pearson Chi-Square	9.898[a]	1	.002
Likelihood Ratio	9.936	1	.002
Linear-by-Linear Association	9.867	1	.002
N of Valid Cases	325		

Table 4.99 showed that the relationship between education background and mathematics education values was significant. This is because $\chi 2(1) = 9.898$ and the significant level is $p = .002$ which is less than .05. It can be seen from the table that majority (145 out of 173) of the respondents of low scores belonged to those respondents with degree and majority (105 out of 152) of the high scorers also came from the same group. On the other hand, those degree holders were mainly at the low scores and the master degree holders were mainly at the high scores of mathematics education values.

Table 4.100

Crosstabulations and Chi-Square Test of Education Background and Mathematics Values

			MV 2 LEVELS		
			LOW	HIGH	Total
Education Level	Degree	Count	142	108	250
		% within Education Level	56.8%	43.2%	100.0%
		% within MV 2 LEVELS	83.0%	70.1%	76.9%
		% of Total	43.7%	33.2%	76.9%
	Masters and above	Count	29	46	75
		% within Education Level	38.7%	61.3%	100.0%
		% within MV 2 LEVELS	17.0%	29.9%	23.1%
		% of Total	8.9%	14.2%	23.1%
Total		Count	171	154	325
		% within Education Level	52.6%	47.4%	100.0%
		% within MV 2 LEVELS	100.0%	100.0%	100.0%
		% of Total	52.6%	47.4%	100.0%

Chi-square

	Value	df	Asymp. Sig (2-sided)
Pearson Chi-Square	7.609[a]	1	.006
Likelihood Ratio	7.636	1	.006
Linear-by-Linear Association	7.586	1	.006
N of Valid Cases	325		

The relationship between education background and mathematics values was found to be significant since p = .006 which was smaller than .05. Respondents with degree were mainly found in the low category of the mathematics values score. The score is 142 out of 250. On the other hand, master's degree holders were mainly found in the high category of the mathematics values scores. Generally, for both the high and low scores, majority of the respondents were from those with degrees.

Table 4.101

Crosstabulations and Chi-Square Test of Education Background and Values in Mathematics Classrooms

			MViC LEVELS		
			LOW	HIGH	Total
Education Level	Degree	Count	142	108	250
		% within Education Level	56.8%	43.2%	100.0%
		% within MViC LEVELS	84.0%	69.2%	76.9%
		% of Total	43.7%	33.2%	76.9%
	Masters and above	Count	27	48	75
		% within Education Level	36.0%	64.0%	100.0%
		% within MViC LEVELS	16.0%	30.8%	23.1%
		% of Total	8.3%	14.8%	23.1%
Total		Count	169	156	325
		% within Education Level	52.0%	48.0%	100.0%
		% within MViC2 LEVELS	100.0%	100.0%	100.0%
		% of Total	52.0%	48.0%	100.0%

Chi-square

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10.000[a]	1	.002
Likelihood Ratio	10.078	1	.002
Linear-by-Linear Association	9.969	1	.002
N of Valid Cases	325		

The education background for the respondent seemed to have a significant relationship with the values in mathematics classrooms. It can was demonstrated that $\chi2(1) = 10.000$ and $p = .002$ which was less than .05. It could be seen that majority of the respondents from the low and high categories came from the respondents with degree and a lower number of the degree holders belonged to the high category. The case was opposite for those with masters and above.

Table 4.102

Crosstabulation and Chi-Square Test of Teaching Experience and General Education Values

			GEV LEVELS		Total
			LOW	HIGH	
Teaching Experience	Less than 3 years	Count	36	26	62
		% within Teaching Experience	58.1%	41.9%	100.0%
		% within GEV 2 LEVELS	20.5%	17.4%	19.1%
		% of Total	11.1%	8.0%	19.1%
	3 - 5 years	Count	26	11	37
		% within Teaching Experience	70.3%	29.7%	100.0%
		% within GEV LEVELS	14.8%	7.4%	11.4%
		% of Total	8.0%	3.4%	11.4%
	6 - 10 years	Count	34	39	73
		% within Teaching Experience	46.6%	53.4%	100.0%
		% within GEV LEVELS	19.3%	26.2%	22.5%
		% of Total	10.5%	12.0%	22.5%
	11 - 15 years	Count	45	34	79
		% within Teaching Experience	57.0%	43.0%	100.0%
		% within GEV LEVELS	25.6%	22.8%	24.3%
		% of Total	13.8%	10.5%	24.3%
	More than 15 years	Count	35	39	74
		% within Teaching Experience	47.3%	52.7%	100.0%
		% within GEV LEVELS	19.9%	26.2%	22.8%
		% of Total	10.8%	12.0%	22.8%
Total		Count	176	149	325
		% within Teaching Experience	54.2%	45.8%	100.0%
		% within GEV LEVELS	100.0%	100.0%	100.0%
		% of Total	54.2%	45.8%	100.0%

Chi-square

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.594[a]	4	.108
Likelihood Ratio	7.730	4	.102
Linear-by-Linear Association	2.181	1	.140
N of Valid Cases	325		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is16.96.

The inspection on the Pearson chi-square test statistics saw p = .108 and value indicated that $\chi(2)(4) = 7.594$ showed that teaching experience in this sample did not differ significantly with general education values.

Table 4.103

Crosstabulation and Chi-Square Test of Teaching Experience and Mathematics Education Values

			MEV LEVELS		Total
			LOW	HIGH	
Teaching Experience	Less than 3 years	Count	32	30	62
		% within Teaching Experience	51.6%	48.4%	100.0%
		% within MEV LEVELS	18.5%	19.7%	19.1%
		% of Total	9.8%	9.2%	19.1%
	3 - 5 years	Count	26	11	37
		% within Teaching Experience	70.3%	29.7%	100.0%
		% within MEV 2 LEVELS	15.0%	7.2%	11.4%
		% of Total	8.0%	3.4%	11.4%
	6 - 10 years	Count	28	45	73
		% within Teaching Experience	38.4%	61.6%	100.0%
		% within MEV 2 LEVELS	16.2%	29.6%	22.5%
		% of Total	8.6%	13.8%	22.5%
	11 - 15 years	Count	49	30	79
		% within Teaching Experience	62.0%	38.0%	100.0%
		% within MEV 2 LEVELS	28.3%	19.7%	24.3%
		% of Total	15.1%	9.2%	24.3%
	More than 15 years	Count	38	36	74
		% within Teaching Experience	51.4%	48.6%	100.0%
		% within MEV 2 LEVELS	22.0%	23.7%	22.8%
		% of Total	11.7%	11.1%	22.8%
Total		Count	173	152	325
		% within Teaching Experience	53.2%	46.8%	100.0%
		% within MEV 2 LEVELS	100.0%	100.0%	100.0%
		% of Total	53.2%	46.8%	100.0%

Chi-square

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	13.427[a]	4	.009
Likelihood Ratio	7.730	4	.007
Linear-by-Linear Association	2.181	1	.006
N of Valid Cases	325		

a. 0 cells (0.0%) have expected count less than 5.
b. The minimum expected count is16.96.

Table 4.104

Crosstabulation and Chi-Square Test: Experience and Mathematics Values

			LOW	HIGH	Total
Teaching Experience	Less than 3 years	Count	29	33	62
		Expected Count	32.6	29.4	62.0
		% within Teaching Experience	46.8%	53.2%	100.0%
		% within MV 2 LEVELS	17.0%	21.4%	19.1%
		% of Total	8.9%	10.2%	19.1%
	3 - 5 years	Count	27	10	37
		Expected Count	19.5	17.5	37.0
		% within Teaching Experience	73.0%	27.0%	100.0%
		% within MV 2 LEVELS	15.8%	6.5%	11.4%
		% of Total	8.3%	3.1%	11.4%
	6 - 10 years	Count	33	40	73
		Expected Count	38.4	34.6	73.0
		% within Teaching Experience	45.2%	54.8%	100.0%
		% within MV 2 LEVELS	19.3%	26.0%	22.5%
		% of Total	10.2%	12.3%	22.5%
	11 - 15 years	Count	42	37	79
		Expected Count	41.6	37.4	79.0
		% within Teaching Experience	53.2%	46.8%	100.0%
		% within MV 2 LEVELS	24.6%	24.0%	24.3%
		% of Total	12.9%	11.4%	24.3%
	More than 15 years	Count	40	34	74
		Expected Count	38.9	35.1	74.0
		% within Teaching Experience	54.1%	45.9%	100.0%
		% within MV 2 LEVELS	23.4%	22.1%	22.8%
		% of Total	12.3%	10.5%	22.8%
Total		Count	171	154	325
		Expected Count	171.0	154.0	325.0
		% within Teaching Experience	52.6%	47.4%	100.0%
		% within MV 2 LEVELS	100.0%	100.0%	100.0%
		% of Total	52.6%	47.4%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	8.678[a]	4	.070
Likelihood Ratio	8.956	4	.062
Linear-by-Linear Assoc	.032	1	.858
N of Valid Cases	325		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 17.53.

Results from Table 4.104 suggested that there was a statistical significant difference between the underlying distribution between the score of the teaching experience and mathematics education values with χ2(4) = 13.427 and p = .009. The crosstabulation table suggested that there were more respondents in the low category as compared to the high category. Out of 173 in the low category majority of them were those with 11 -15 years of experience followed by those with more than 15 years of experience. Out of 154 respondents in the high score group majority was in the 6 – 10-year group. Once again, the results indicated that there was no significant relationship between the teaching experience and mathematics values where the χ2(4) = 8.678 and p = .070 which was more than .05.

Table 4.105

Crosstabulation and Chi-Square Test of Teaching Experience and Values in Mathematics Classrooms

			MViC LEVELS		Total
			LOW	HIGH	
Teaching Experience	Less than 3 years	Count	29	33	62
		% within Teaching Experience	46.8%	53.2%	100.0%
		% within MViC 2 LEVELS	17.2%	21.2%	19.1%
		% of Total	8.9%	10.2%	19.1%
	3 - 5 years	Count	27	10	37
		% within Teaching Experience	73.0%	27.0%	100.0%
		% within MViC 2 LEVELS	16.0%	6.4%	11.4%
		% of Total	8.3%	3.1%	11.4%
	6 - 10 years	Count	34	39	73
		% within Teaching Experience	46.6%	53.4%	100.0%
		% within MViC 2 LEVELS	20.1%	25.0%	22.5%
		% of Total	10.5%	12.0%	22.5%
	11 - 15 years	Count	44	35	79
		% within Teaching Experience	55.7%	44.3%	100.0%
		% within MViC 2 LEVELS	26.0%	22.4%	24.3%
		% of Total	13.5%	10.8%	24.3%
	More than 15 years	Count	35	39	74
		% within Teaching Experience	47.3%	52.7%	100.0%
		% within MViC 2 LEVELS	20.7%	25.0%	22.8%
		% of Total	10.8%	12.0%	22.8%
Total		Count	169	156	325
		% within Teaching Experience	52.0%	48.0%	100.0%
		% within MViC 2 LEVELS	100.0%	100.0%	100.0%
		% of Total	52.0%	48.0%	100.0%

Chi-Square Test

	Value	df	Asymp. Sig. (2-sided)

Pearson Chi-Square	9.148[a]	4	.058
Likelihood Ratio	9.437	4	.051
Linear-by-Linear Association	.175	1	.676
N of Valid Cases	325		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 17.76.

The findings indicated that the relationship between teaching experience and values in mathematics classrooms was quite significant since $p = 0.058$ with $\chi2(4) = 9.148$. A summary of the findings from the cross tabulations for the three demographic profiles with the sub-constructs and construct were given in Table 4.5.52. The table contained information on the cells with expected count of less than 5, the Chi-values and the p-values with respective decisions are in the last column.

Table 4.106

Summary of the Cross tabulations of Demographic Profiles with Values

Category	Sub constructs	expected count less than 5	Chi square and p values	Conclusion
Age Group	GEV	0 cells	χ^2 (2,325) = 4.050 and p = .132	not significant
	MEV	0 cells	χ^2 (2,325) = 2.155 and p = .341	not significant
	MV	0 cells	χ^2 (2,325) = 2.453 and p = .293	not significant
	ViMC	0 cells	χ^2 (2,325) = 1.630 and p = ..443	not significant
Education Background	GEV	0 cells	χ^2 (2, 325) = 3.055 and p = .080	not significant
	MEV	0 cells	χ^2 (2,325) = 9.898 and p = .002	significant
	MV	0 cells	χ^2 (2,325) = 7.69 and p = .006	significant
	ViMC	0 cells	χ^2 (2,325) = 10.000 and p =.002	significant
Teaching Experience	GEV	0 cells	χ^2(4,325) = 7.594 and p = .108	not significant
	MEV	0 cells	χ^2(4,325) = 13.472 and p = .009	significant
	MV	0 cells	χ^2(4,325) = 8.678 and p = .070	not significant
	ViMC	0 cells	χ^2(4,325) = 9.148 and p = .058	not significant

The summary indicated that education background was found to be significantly related to mathematics education, mathematics values, and value in mathematics education. However, it was not significantly related to the general education values. Teaching experience was also found to be significantly associated to mathematics education values. This is because the Chi-square values were all slightly larger and the p-values were generally less than .05.

Crosstabulations between sub-constructs and construct. Crosstabulations between the three sub constructs and the construct were analysed to check whether the relationships between the sub-constructs and constructs are significant. Table 4.5.53,

Table 4.107, and Table 4.108 showed the properties of the crosstabulations between values in mathematics classrooms and general education values, mathematics education values, and mathematics values. The crosstabulation between values in mathematics classrooms and the general education values was consistent.

Table 4.107

Crosstabulations and Chi-Square Test between Values in Mathematics Classrooms and General Education Values

			GEV LEVELS			Total
			LOW	MEDIUM	HIGH	
ViMC LEVELS	LOW	Count	12	6	0	18
		% within ViMC LEVELS	66.7%	33.3%	0.0%	100.0%
		% within GEV LEVELS	70.6%	3.5%	0.0%	5.5%
		% of Total	3.7%	1.8%	0.0%	5.5%
	MEDIUM	Count	5	154	20	179
		% within ViMC LEVELS	2.8%	86.0%	11.2%	100.0%
		% within GEV LEVELS	29.4%	90.6%	14.5%	55.1%
		% of Total	1.5%	47.4%	6.2%	55.1%
	HIGH	Count	0	10	118	128
		% within ViMC LEVELS	0.0%	7.8%	92.2%	100.0%
		% within GEV LEVELS	0.0%	5.9%	85.5%	39.4%
		% of Total	0.0%	3.1%	36.3%	39.4%
Total		Count	17	170	138	325
		% within ViMC LEVELS	5.2%	52.3%	42.5%	100.0%
		% within GEV LEVELS	100.0%	100.0%	100.0%	100.0%
		% of Total	5.2%	52.3%	42.5%	100.0%

Chi-square

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	350.672[a]	4	.000
Likelihood Ratio	294.184	4	.000
Linear-by-Linear Association	214.818	1	.000
N of Valid Cases	325		

a. 1 cells (11.1%) have expected count less than 5. The minimum expected count is .94.

Most those in the low, medium and high level of general education levels were also in the same category low, medium, and high of the values in mathematics classrooms.

The chi-square test showed that $\chi^2(4,325) = 350.672$ and p = .000, indicating a highly significant relationship between the two variables.

Table 4.108

Crosstabulations and Chi-Square Test between Values in Mathematics Classrooms and Mathematics Education Value

			MEV LEVELS			Total
			LOW	MEDIUM	HIGH	
ViMC LEVELS	LOW	Count	5	12	1	18
		% within ViMC LEVELS	27.8%	66.7%	5.6%	100.0%
		% within MEV LEVELS	100.0%	8.4%	0.6%	5.5%
		% of Total	1.5%	3.7%	0.3%	5.5%
	MEDIUM	Count	0	125	54	179
		% within ViMC LEVELS	0.0%	69.8%	30.2%	100.0%
		% within MEV LEVELS	0.0%	87.4%	30.5%	55.1%
		% of Total	0.0%	38.5%	16.6%	55.1%
	HIGH	Count	0	6	122	128
		% within ViMC LEVELS	0.0%	4.7%	95.3%	100.0%
		% within MEV LEVELS	0.0%	4.2%	68.9%	39.4%
		% of Total	0.0%	1.8%	37.5%	39.4%
Total		Count	5	143	177	325
		% within ViMC LEVELS	1.5%	44.0%	54.5%	100.0%
		% within MEV LEVELS	100.0%	100.0%	100.0%	100.0%
		% of Total	1.5%	44.0%	54.5%	100.0%

Chi-square

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	244.394[a]	4	.000
Likelihood Ratio	205.931	4	.000
Linear-by-Linear Association	162.803	1	.000
N of Valid Cases	325		

a. 3 cells (33.3%) have expected count less than 5. The minimum expected count is .28.

Next, the researcher investigates the relationship between values in mathematics classes with mathematics education values. Table 4.5.54, indicated that more than half of the total (54.5%) of the respondents were in the high score level of the mathematics education values, followed by 44.0% in the medium category, and only 1.5% in the low category. It was also shown that out of the 143 of medium level of MEV, 125 of them

(87.4%) are in the medium level score of the ViMC. The case is the same where out of 177 of the high level of the MEV score, 68.9% are in the high level ViMC. At the same time, majority of those who score medium level on the ViMC are in the medium score for the MEV and majority who score high for the ViMC also score high in the MEV. The relationship is highly significant considering χ^2 (4,325) = 226.011 and p = .000.

Table 4.109 *Crosstabulations and Chi-Square Test between Values in Mathematics Classrooms and Mathematics Value*

			MEV LEVELS			Total
			LOW	MEDIUM	HIGH	
GEV LEVELS	LOW	Count	5	9	3	17
		% within GEV LEVELS	29.4%	52.9%	17.6%	100.0%
		% within MEV LEVELS	100.0%	6.3%	1.7%	5.2%
		% of Total	1.5%	2.8%	0.9%	5.2%
	MEDIUM	Count	0	113	57	170
		% within GEV LEVELS	0.0%	66.5%	33.5%	100.0%
		% within MEV LEVELS	0.0%	79.0%	32.2%	52.3%
		% of Total	0.0%	34.8%	17.5%	52.3%
	HIGH	Count	0	21	117	138
		% within GEV LEVELS	0.0%	15.2%	84.8%	100.0%
		% within MEV LEVELS	0.0%	14.7%	66.1%	42.5%
		% of Total	0.0%	6.5%	36.0%	42.5%
Total		Count	5	143	177	325
		% within GEV LEVELS	1.5%	44.0%	54.5%	100.0%
		% within MEV LEVELS	100.0%	100.0%	100.0%	100.0%
		% of Total	1.5%	44.0%	54.5%	100.0%

Chi-Square

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	177.592[a]	4	.000
Likelihood Ratio	122.991	4	.000
Linear-by-Linear Association	97.854	1	.000
N of Valid Cases	325		

a. 3 cells (33.3%) have expected count less than 5. The minimum expected count is .26.

The cross tabulations of values in mathematics in classrooms and mathematics values displayed the same pattern for the medium and high levels of both variables as the previous cross tabulations. Majority of those in the medium and high levels of GEV are in the respective medium and high levels of values in mathematics in classrooms. As an example, 83.8% of the medium level score of the ViMC are also in the medium score for GEV. The relationship is highly significant as □2 (4,325) = 244.394 and p = .000.

Table 4.110

Crosstabulations and Chi-Square Test between General Education Values and Mathematics Education Values

			MEV LEVELS			Total
			LOW	MEDIUM	HIGH	
GEV LEVELS	LOW	Count	5	9	3	17
		% within GEV LEVELS	29.4%	52.9%	17.6%	100.0%
		% within MEV LEVELS	100.0%	6.3%	1.7%	5.2%
		% of Total	1.5%	2.8%	0.9%	5.2%
	MEDIUM	Count	0	113	57	170
		% within GEV LEVELS	0.0%	66.5%	33.5%	100.0%
		% within MEV LEVELS	0.0%	79.0%	32.2%	52.3%
		% of Total	0.0%	34.8%	17.5%	52.3%
	HIGH	Count	0	21	117	138
		% within GEV LEVELS	0.0%	15.2%	84.8%	100.0%
		% within MEV LEVELS	0.0%	14.7%	66.1%	42.5%
		% of Total	0.0%	6.5%	36.0%	42.5%
Total		Count	5	143	177	325
		% within GEV LEVELS	1.5%	44.0%	54.5%	100.0%
		% within MEV LEVELS	100.0%	100.0%	100.0%	100.0%
		% of Total	1.5%	44.0%	54.5%	100.0%

Chi-Square

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	191.360[a]	4	.000
Likelihood Ratio	174.961	4	.000
Linear-by-Linear Association	144.867	1	.000
N of Valid Cases	325		

a. 5 cells (55.6%) have expected count less than 5. The minimum expected count is .08.

Table 4.110 showed that the relationship of the general education values and the mathematics education values are significant since □2(4,325) = 177.592 and p = .000. The medium scorers of the mathematics education values are also the medium scorers of the general education values with percentage of 66.5% and 79.0% respectively.

Participants in the high category of mathematics education values are also in the high category of the general education values with 84.8% and in the high category of the MEV values with 66.1%.

Cross tabulations of mathematics education and mathematics values were found to be insignificantly related with χ^2 (4,325) = 191.360 and p = .000. Participants in the low category of the mathematics values were mainly at the medium level of mathematics education values. Most the medium score were in the medium score of the mathematics values. The same pattern was seen for the high scores as seen in Table 4.5.57.

Table 4.111

Crosstabulations and Chi-Square Test between Mathematics Education Value and Mathematics Values

			MV LEVELS			Total
			LOW	MEDIUM	HIGH	
MEV LEVELS	LOW	Count	2	3	0	5
		Expected Count	.1	2.8	2.1	5.0
		% within MEV LEVELS	40.0%	60.0%	0.0%	100.0%
		% within MV LEVELS	40.0%	1.7%	0.0%	1.5%
		% of Total	0.6%	0.9%	0.0%	1.5%
	MEDIUM	Count	3	130	10	143
		Expected Count	2.2	79.6	61.2	143.0
		% within MEV LEVELS	2.1%	90.9%	7.0%	100.0%
		% within MV LEVELS	60.0%	71.8%	7.2%	44.0%
		% of Total	0.9%	40.0%	3.1%	44.0%
	HIGH	Count	0	48	129	177
		Expected Count	2.7	98.6	75.7	177.0
		% within MEV LEVELS	0.0%	27.1%	72.9%	100.0%
		% within MV LEVELS	0.0%	26.5%	92.8%	54.5%
		% of Total	0.0%	14.8%	39.7%	54.5%
Total		Count	5	181	139	325
		Expected Count	5.0	181.0	139.0	325.0
		% within MEV LEVELS	1.5%	55.7%	42.8%	100.0%
		% within MV LEVELS	100.0%	100.0%	100.0%	100.0%
		% of Total	1.5%	55.7%	42.8%	100.0%

Chi-Square

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	.669	.036	16.162	.000[c]
Ordinal by Ordinal	Spearman Correlation	.672	.037	16.299	.000[c]
N of Valid Cases		325			

a. Not assuming the null hypothesis.
b. Using the asymptotic standard error assuming the null hypothesis.
c. Based on normal approximation.

Table 4.112

Crosstabulations and Chi-Square test between General Education Value and Mathematics Value

			MV LEVELS			Total
			LOW	MEDIUM	HIGH	
GEV LEVELS	LOW	Count	4	13	0	17
		% within GEV LEVELS	23.5%	76.5%	0.0%	100.0%
		% within MV LEVELS	80.0%	7.2%	0.0%	5.2%
		% of Total	1.2%	4.0%	0.0%	5.2%
	MEDIUM	Count	1	132	37	170
		% within GEV LEVELS	0.6%	77.6%	21.8%	100.0%
		% within MV LEVELS	20.0%	72.9%	26.6%	52.3%
		% of Total	0.3%	40.6%	11.4%	52.3%
	HIGH	Count	0	36	102	138
		% within GEV LEVELS	0.0%	26.1%	73.9%	100.0%
		% within MV LEVELS	0.0%	19.9%	73.4%	42.5%
		% of Total	0.0%	11.1%	31.4%	42.5%
Total		Count	5	181	139	325
		% within GEV LEVELS	1.5%	55.7%	42.8%	100.0%
		% within MV LEVELS	100.0%	100.0%	100.0%	100.0%
		% of Total	1.5%	55.7%	42.8%	100.0%

Chi-Square

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	.568	.042	12.404	.000[c]
Ordinal by Ordinal	Spearman Correlation	.563	.044	12.236	.000[c]
N of Valid Cases		325			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Cross tabulations between general education and mathematics values was found to be highly significant since χ^2 (4,325) = 150.412 and p = .000 The table demonstrated that it was similar with the previous findings where most the medium scorers of the mathematics values are also the medium scorers of the general education values with percentage of 77.6% and 72.9% respectively. Participants in the high category of mathematics values are also in the high category of the general education values with 73.9% and 73.4% respectively as demonstrated by Table 4.5.58.

Table 4.113

Summary of the Crosstabulations and Chi Square between Constructs and Sub-constructs

Cross tabulations	Expected count less than 5	Chi square and p values	Conclusion
Values in Mathematics Classrooms and General Education Values	1 cells (11.1%)	χ^2 (4,325) = 350.672 and p = .000	highly significant
Values in mathematics classes with mathematics education values.	3 cells (33.3%)	χ^2 (4,325) = 226.011 and p = .000.	highly significant
Values in mathematics in classrooms and mathematics values	3 cells (33.3%)	χ^2 (4,325) = 244.394 and p = .000.	highly significant
Mathematics Education Value and Mathematics Values	5 cells (55.6%)	with χ^2 (4,325) = 191.360 and p = .000	insignificant
General education values and the mathematics education values	. 3 cells (33.3%)	χ^2(4,325) = 177.592 and p = .000.	highly significant
General education and mathematics values	3 cells (33.3%)	χ^2 (4,325) = 150.412 and p = .000	highly significant

Table 4.113 summarized the discussion on the cross tabulations between constructs and sub-constructs. All relationships were found to be highly significant except for the relationship between mathematics values education and mathematics values. It can be seen from the crosstabulations that the constructs have significant relationships in which respondents with high in general education values for example would have high scores in mathematics education values and mathematics values. Those with medium scores of mathematics education values would have medium scores of mathematics values.

Respondents' profile on the construct and sub-constructs. This section discussed the profiling of the respondents with high and low scores for the respective sub-constructs and construct. Table 4.5.60 portrayed that respondents with high scores in the three sub-constructs and construct were lecturers within the age of 31-40 years, hold a degree, and had between 6 – 10 years of teaching experience. However, the relationship was only reliable for mathematics education and samples with degree and have between 6 to 10 years of experience.

Table 4.114

Profiling of the Respondents with High Scores of the Sub-constructs and Construct

	Age	Education Background	Teaching Experiences
GEV	31-40 years	Degree	6-10 years
p-value	.132	.080	.108
MEV	31-40 years	Degree	6–10 years
p-value	.341	.002	.009
MV	31-40 years	Degree	6 – 10 years
p-value	.293	.006	.070
MViC	31-40 years	Degree	6 –10
p-value	.443	.002	.058

The high scorers of mathematics values were significantly related to the education background. This is also true for the high scorers for the mathematics values in mathematics classrooms. High scorers of mathematics education values, mathematics values, and values in mathematics classrooms were significantly related to the education background.

Table 4.115 demonstrated that the respondents with low scores were those in the age group of 31 – 40, holds a degree, and had 11- 15 years of teaching experience. The only difference between the low and high scores was the teaching experience. The high scores respondents had 6 -10 years' experience while the low scores respondents had 11 – 15 years of experience.

Table 4.115

Profiling of the Respondents with Low Scores of the Sub-construct and Construct

	Age	Education Background	Teaching Experiences
GEV	31-40 years	Degree	11-15 years
p-value	.132	.080	.108
MEV	31-40 years	Degree	11-15 years
p-value	.341	.002	.009
MV	31-40 years	Degree	11-15 years
p-value	.293	.022	.070
ViMC	31 -40 years	Degree	11-15 years
p-value	.443	.002	.058

The table indicated that the low scorers of mathematics education values, mathematics values, and values in mathematics classrooms were highly significant with the education background, while only mathematics values was significantly related to the number of years' experience in teaching. All the subconstructs and constructs were not significantly related to the age groups.

Factors influencing values in mathematics classrooms. To analyse factors contributing towards the scores for the sub-constructs and construct, the Kruskal Wallis which is a rank-based nonparametric test that can be used to determine if there were significant differences between age group and the sub-constructs and construct scores.

Table 4.117 demonstrated the mean rank with the chi-square and p-values for each sub-construct and constructs which indicated that none of the mean differences was found to be significant, thus there will be no further inspection within age group will be done.

Table 4.116

Kruskal Wallis Mean Rank for Age Groups with Sub-constructs and Construct

	Age	N	Mean Rank	Chi-square	d	Asymp. Sig.
	Below 30	101	149.64			
GEV 2 LEVELS	31-40	139	168.00	4.037	2	.133
	Above 40	85	170.71			
	Total	325				
	Below 30	101	154.57			
MEV 2 LEVELS	31-40	139	170.00	2.148	2	.342
	Above 40	85	161.56			
	Total	325				
	Below 30	101	153.57			
MV 2 LEVELS	31-40	139	170.17	2.445	2	.294
	Above 40	85	162.47			
	Total	325				
	Below 30	101	155.79			
MViC 2 LEVELS	31-40	139	163.33	1.625	2	.444
	Above 40	85	171.03			
	Total	325				

The Kruskal-Wallis test for the education background with sub-constructs and construct revealed that there were significant mean differences for the mathematics education values, mathematics values, values in mathematics education and education background with $\chi2(1,325) = 9.867$, p = .02, $\chi2(1,325) = 7.586$, p = .006, and $\chi2(1,325) = 9.969$, p = .002 respectively.

Table 4.117

Kruskal Wallis Mean Rank for Education Background with Sub-constructs and Construct

	Education Background	N	Mean Rank	Chi-square	d	Asymp. Sig.
	Degree	250	158.70			
GEV	Masters and PhD	75	177.33	3.046	1	.081
	Total	325				
	Degree	250	155.25			
MEV 2	Masters and PhD	75	188.83	9.867	1	.002
	Total	325				
	Degree	250	156.20			
MV 2	Masters and PhD	75	185.67	7.586	1	.006
	Total	325				
	Degree	250	155.20			
MViC	Masters and PhD	75	189.00	9.969	1	.002
	Total	325				

Since there were only two groups in the education background, it can be deduced that the mean of mathematics education values, mathematics values, and values in mathematics education were more for the respondents with masters as compared to respondents with degree.

Table 4.118 indicated that there was a significant difference between mathematics education values and teaching experience with $\chi2(1,325) = 13.386$, $p = .010$ where the group with 6 – 10 years of experience had the highest mean followed by those with more than 15 years. However further investigation will be done to compare the mean scores of groups within the teaching experience and mathematics education values.

Table 4.118

Kruskal Wallis Mean Rank for Teaching Experience with Sub-constructs and Construct

	Teaching Experience	N	Mean Rank	Chi-Square	d	Asymp. Sig.
GEV	Less than 3 years	62	156.65			
	3 - 5 years	37	136.81	7.570	1	.104
	6 - 10 years	73	175.32			
	11 - 15 years	79	158.44			
	More than 15 years	74	174.14			
	Total	325				
MEV	Less than 3 years	62	165.63			
	3 - 5 years	37	135.31	13.386		.010
	6 - 10 years	73	187.17		1	
	11 - 15 years	79	148.71			
	More than 15 years	74	166.05			
	Total	325				
MV	Less than 3 years	62	172.49			
	3 - 5 years	37	129.92	8.651	1	.070
	6 - 10 years	73	175.04			
	11 - 15 years	79	162.11			
	More than 15 years	74	160.66			
	Total	325				
MViC	Less than 3 years	62	171.49			
	3 - 5 years	37	128.92	9.119	1	.058
	6 - 10 years	73	171.82			
	11 - 15 years	79	156.99			
	More than 15 years	74	170.64			
	Total	325				

The Mann Whitney test indicated that those having more experience had higher mean rank of 61.40 as compared to 43.85 for the groups with 3-5 years of experience and 6 -10 years of experience. However, it is the opposite for the 6-10 years and 11-15 years. In which the group with lesser number of experience had higher mean rank of 85.85 as compared to 67.89.

Table 4.119

Mann Whitney Test for Teaching Experience Groups Mean Rank for Mathematics Education Values

	Teaching Experience	N	Mean Rank	Sum of Ranks	Chi-square	z	Asymp. Sig.
MEV	3 - 5 years	37	43.85	1622.50			
	6 - 10 years	73	61.40	4482.50	919.500	-3.149	.002
	Total	110					
MEV	6 - 10 years	73	85.85	6267.00			
	11 - 15 years	79	67.86	5361.00	2201.000	-2.906	.004
	Total	152					

It can be concluded teaching experience is the only factor contributing towards the score of the mathematics education values and only the pairs of 3-5 with 6-10 and 6-10 with 11-15 were found to have significance mean difference.

Respondents' inclination towards learning psychology. The psychological perspectives are theories of learning that focus on how learning occurs. These psychological orientations provide structures for the instructional aspects of teaching, involving methods that are related to their perspective on learning which were enhanced or inhibit involvement in learning

Table 4.120

Items for each of the Dimension for Teaching Psychology

Psychological Perspective	Code	Description	Value Item
Behaviourist	PMB1	Learn for mastering skills	I always prioritize on mastering the skills in learning mathematics. *Saya sentiasa mengutamakan penguasaan kemahiran dalam pembelajaran matematik*.
Information Processing	PMB2	Learn to process information	I always prioritize on efficiency in information processing when learning mathematics. Saya sentiasa mengutamakan kecekapan memproses maklumat dalam pembelajaran matematik.
Constructivist Perspective	PMB3	Constructing knowledge	I always prioritize on construction of knowledge in learning mathematics. Saya sentiasa mengutamakan pembinaan pengetahuan dalam pembelajaran matematik.
Integrated Approach	PMB4	Universal Integrated	I always prioritize the relationship of mathematics knowledge with spiritual aspect in mathematics classes. Saya sentiasa mengutamakan perkaitan antara pengetahuan matematik dan agama dalam kelas matematik

This section is investigating the psychological perspective inclination of the respondents. Table 4.120 exhibits the value item representing each of the main psychological perspectives; behaviourist, information processing, radical constructivist, and integrated approach. Frequencies of the four-teaching psychology were demonstrated as histograms in Figure 4.5.5. Behaviourist perspective indicates a flat peak but the distribution is not too far to the right and information processing theory has the highest peak. All the perspectives were skewed to the right.

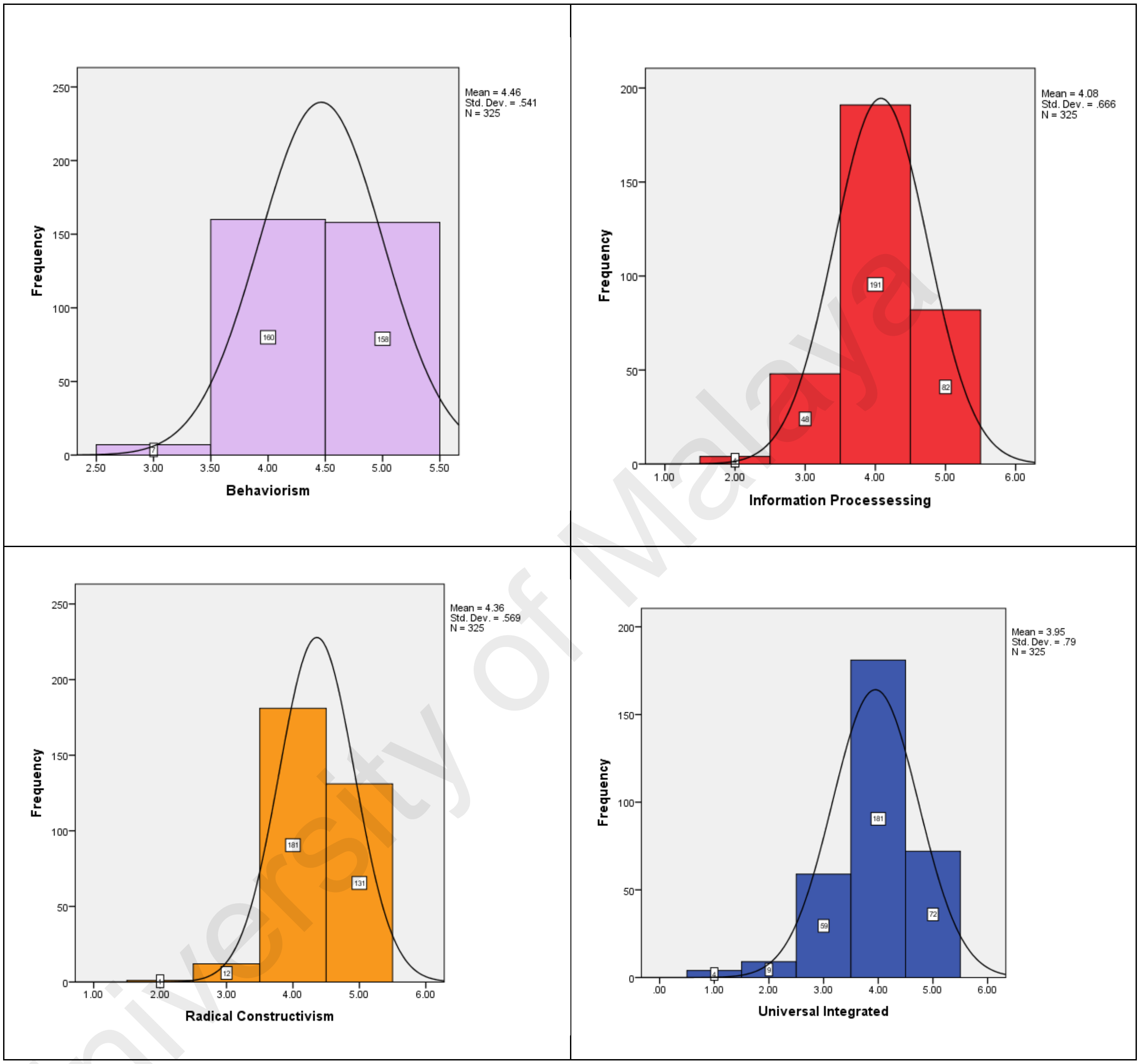

Figure 4.20 Frequency histograms for learning psychology

The descriptive statistics of the psychological perspective are given in Table 4.5.68. Behaviourist perspective has the highest mean of 4.4646 and the lowest mean is the universal integrated perspective which is 3.9477. The skew values are all negative, indicating that the tail was more towards the left end side. Information processing and universal integrated perspective has bigger values of skew indicating a longer tail to the right if compared to behaviourist perspective and information processing. It is an indication that more respondents are situated at the higher side of the mean for the behaviourist theory and the universal integrated perspective. Since the skew values are less than two they are substantially normal.

Table 4.121

Descriptive Statistics for Learning Psychology

	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Behaviourist perspective	3.00	5.00	4.4646	.54104	-.270	.135	-1.096	.270
Information Processing	1.00	5.00	4.333	.609	-.904	.135	3.0979	.270
Radical Constructivist	2.00	5.00	4.3600	.56895	-.294	.135	-.115	.270
Universal Integrated perspective	1.00	5.00	3.9477	.78981	-.852	.135	1.556	.270

Constructivist perspective and universal integrated perspective have high peaks, due to the positive values of the kurtosis. In addition, both are skewed to the right. Behaviourist perspective has the flattest peak compared to the rest, indicating not normal although the statistics of kurtosis were not more than 7.0.

To compare the means among the groups in the demographic profiles, the researcher used Kruskal Wallis. Kruskal Wallis is a non-parametric test and was used when there was one independent variable with three or more levels and an ordinal dependent variable. It was a rank-based nonparametric test that can be used to determine if there were statistically significant differences between three or more groups of an independent variable on a continuous or ordinal dependent variable. Here the dependent variables were the values for psychological domain and the independent variables were the age group, education background, and teaching experience.

The data fulfilled the Kruskal Wallis assumptions: First, the dependent variables which were teaching psychology and mathematics view were ordinal data. The age range has three categories, education background has two categories and teaching experience has five categories fulfilling the second requirements of having at least two categories. Here the independent variables that meet this criterion include age group (three groups), education background (two groups), and teaching experience (five groups).

Table 4.122

Table of Ranks for Age Group and Teaching Psychology

	Age Group	N	Mean Rank
Behaviorism	Less than 30	101	159.01
	31 - 40	139	166.91
	41 and above	85	161.34
	Total	325	
Information Processing	Less than 30	101	156.19
	31 - 40	139	168.27
	41 and above	85	162.47
	Total	325	
Radical Constructivism	Less than 30	101	150.35
	31 - 40	139	173.32
	41 and above	85	161.16
	Total	325	
Universal Integrated	Less than 30	101	152.70
	31 - 40	139	164.39
	41 and above	85	172.96
	Total	325	

Chi Square				
	Behaviorism	Information processing	Radical Constructivism	Universal Integrated
Chi-Square	.587	1.087	4.645	2.715
df	2	2	2	2
Asymp. Sig.	.746	.581	.098	.257

The observations were independent, because different participants were in each group with no participant being in more than one group. Lastly the distributions in each group of the independent variable have the same shape (which also means the same variability). Kruskal Wallis test were done for all the four psychological domains with three demographic profiles. The rank and the test statistics tables for the independent variables: age group, education background, and teaching experience were in Tables 4.122 to Table 4.124.

Table 4.123

Table of Mean Ranks for Education Background and Teaching Psychology

	Education Background	N	Mean Rank
Behaviorism	Degree	250	158.33
	Masters and PhD	75	178.55
	Total	325	
Information Processing	Degree	250	159.14
	Masters and PhD	75	175.85
	Total	325	
Radical Constructivism	Degree	250	159.66
	Masters and PhD	75	174.14
	Total	325	
Universal Integrated	Degree	250	160.09
	Masters and PhD	75	172.71
	Total	325	

Chi-Square				
	Behaviorism	Information Processing	Radical Constructivism	Universal Integrated
Chi-Square	3.488	2.041	1.799	1.286
df	1	1	1	1
Asymp. Sig.	.062	.153	.180	.257

The education background did not significantly affect all the teaching psychology since all the p values were above 0.05.

Table 4.124

Table of Mean Ranks for Teaching Experience and Teaching Psychology

	Teaching Experience	N	Mean Rank
Behaviorism	Less than 3 years	62	169.44
	3 - 5 years	37	134.55
	6 - 10 years	73	181.16
	11 - 15 years	79	149.79
	More than 15 years	74	168.02
	Total	325	
Information Processing	Less than 3 years	62	170.25
	3 - 5 years	37	131.11
	6 - 10 years	73	182.10
	11 - 15 years	79	155.94
	More than 15 years	74	161.57
	Total	325	
Radical Constructivism	Less than 3 years	62	161.27
	3 - 5 years	37	130.34
	6 - 10 years	73	196.71
	11 - 15 years	79	145.00
	More than 15 years	74	166.74
	Total	325	
Universal Integrated	Less than 3 years	62	162.27
	3 - 5 years	37	142.58
	6 - 10 years	73	164.05
	11 - 15 years	79	164.11
	More than 15 years	74	171.59
	Total	325	

Chi-Square

	Behaviorism	Information Processing	Radical Constructivism	Universal Integrated
Chi-Square	10.682	10.752	22.188	2.949
df	4	4	4	4
Asymp. Sig.	.030	.029	.000	.566

a. Kruskal Wallis Test
6. Grouping Variable: Teaching Experience

The Kruskal-Wallis test revealed that there was a significant mean difference of teaching on behaviourism (p=.030), information processing (p=.029), and radical constructivism (p=.000). However, there was no mean difference between teaching experience and universal integrated (.566). The respondents in age group 6-10 years of teaching experience seemed to have the highest mean for behaviourism (181.16), information processing (182.10) and radical constructivism (196.71). This is followed by those who have below than 3 years of experience where the mean rank for behaviourism was 169.44 and information processing was 170.25. As for radical constructivism, the mean (more than 15 years of experience). The lowest mean came from the group with 3-5 years of experience for behaviourism, information technology, and radical constructivism.

Table 4.125

Summary of Test Statistics for Teaching Psychology with Three Demographic Profiles

		Behaviorism	Information Processing	Radical Constructivism	Universal Integrated
Age Group	Chi-Square Asymp. Sig. df = 2	8.270 .746	3.719 .963	6.740 .098	4.580 .257
Education background	Chi-Square Asymp. Sig. df = 1	3.172 .062	.188 .416	1.747 .180	.991 .257
Teaching Experience	Chi-Square Asymp. Sig df = 4	10.682 .030	10.752 .029	22.188 .000	2.949 .566

The summary of test statistics for four psychological perspectives with three demographic profiles was given in Table 4.125 indicating that the mean difference of age-groups, and education background were not significant since the p-values were all more than .05 with small values of chi-squares. Only the teaching experience was found to have significant difference in the mean with: behaviourist; $\chi2(4,325) = 10.682$, $p = .030$, information processing; $\chi2(4,325) = 10.752$, $p = .029$, and radical constructivist; $\chi2(4,325)$

= 22.188, p = .000. The mean of universal integrated was not statistically significantly different in the mean since $\chi2(4,325) = 2.949$, p = .566.

A significant Kruskal-Wallis test indicated that there was a significant difference between the groups. However, the test did not identify which group have significant difference in mean. Thus, the pairwise comparisons Mann-Whitney U test was used to assess whether two independent groups are significantly different from each other. The dependent variable was the three-teaching psychology which were ordinally scaled and the subjects were not matched across condition. Only four pairs of groups found to be significant (evaluating from the p values) and tabulated.

Table 4.126

Mann Whitney Test for less than 3 years and 3 – 5 years Groups

	Teaching Experience	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Z	Asymp. Sig. (2-tailed)
Behaviourism	Less than 3 years	62	53.91	3342.50			
	3 - 5 years	37	43.45	1607.50	904.500	1.989	.047
	Total	99					
Information Processing	Less than 3 years	62	54.45	3376.00			
	3 - 5 years	37	42.54	1574.00	871.000	2.298	.022
	Total	99					
Radical Constructivism	Less than 3 years	62	53.58	3322.00			
	3 - 5 years	37	44.00	1628.00	925.000	1.832	.067
	Total	99					

The results in Table 4.126 revealed that there was a significant difference between the less than 3 years and 3 – 5 years of experience groups with behaviourist and information processing with the z values being 904.500 and 871.00 and the p values being .047 and .022 respectively. The observed difference in the mean and sum ranks showed that respondents with more years of experience have higher mean and sum ranks than those with less experience.

An examination of the findings in Table 4.5.74 showed that the results of the Mann Whitney U test applied to the teaching psychology with the age groups of 3-5 years and 6-10 years of teaching experience revealed a statistically significant difference at the level of p = .005, U = 963.00 for behaviourists, p = .003, U= 934.000 for information processing, and p = .000, U = 827.500 for radical constructivism.

Table 4.127

Mann Whitney Test for 3 – 5 years and 6 - 10 years Groups

	Teaching Experience	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Z	Asymp. Sig. (2-tailed)
Behaviourism	3 - 5 years	37	45.03	1666.00			
	6 - 10 years	73	60.81	4439.00	963.000	-2.806	.005
	Total	110					
Information Processing	3 - 5 years	37	44.24	1637.00			
	6 - 10 years	73	61.21	4468.00	934.000	-2.989	.003
	Total	110					
Radical Constructivism	3 - 5 years	37	41.36	1530.50			
	6 - 10 years	73	62.66	4574.50	827.500	-3.715	.000
	Total	110					

The result indicated that the rank mean and sum of ranks for the three-teaching psychology showed greater values for the 6 – 10 years than the 3 -5 years.

Table 4.128

Mann Whitney Test for 3 – 5 years and More than 15 years Groups

	Teaching Experience	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Z	Asymp. Sig. (2-tailed)
Behaviourism	3 - 5 years	37	48.36	1789.50			
	More than 15 years	74	59.82	4426.50	1086.500	2.019	.043
	Total	111					
Information Processing	3 - 5 years	37	48.99	1812.50			
	More than 15 years	74	59.51	4403.50	1109.500	1.871	.061
	Total	111					
Radical Constructivism	3 - 5 years	37	47.72	1765.50			
	More than 15 years	74	60.14	4450.50	1062.500	2.178	.029
	Total	111					

The findings in Table 4.128 showed there was a significant difference between the 3-5 years and more than 15 years' experience group. The p values were less than .05 except for the information processing. The mean ranks and sum of ranks were all favouring the group which had more than 15 years of experience. Based on the results obtained, it could be argued that the inclination towards behaviourists and radical constructivist were significantly increased when respondents had more experience.

Table 4.129

Mann Whitney Test for 6 - 10 years and 11- 15 years Groups

	Teaching Experience	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Z	Asymp. Sig. (2-tailed)
Behaviourism	6 - 10 years	73	84.18	6145.00			
	11 - 15 years	79	69.41	5483.00	2323.000	-2.371	.018
	Total	152					
Information Processing	6 - 10 years	73	82.90	6051.50			
	11 - 15 years	79	70.59	5576.50	2416.500	-1.983	.047
	Total	152					
Radical Constructivism	6 - 10 years	73	89.32	6520.00			
	11 - 15 years	79	64.66	5108.00	1948.000	-3.970	.000
	Total	152					

As shown by the results in Table 4.5.75, there was a significant difference between 6 - 10 years and 11- 15 year groups at the level of p = .018, p = .047, p = 000 for behaviourist, information processing and radical constructivists. The mean rank and the sum of rank for the difference scores observed that the difference is in favour those with less number of years. The comparison means for these two groups suggested that those with less number of years were more inclined towards the three-learning psychological. The mean rank analysis study indicated that the more teaching experience one has, the respondents would be more inclined towards the three dimensions of three teaching psychology; behaviourist, information technology and radical constructivism.

Respondents' inclination towards mathematical view. The study is investigating the inclination of the respondents towards the four-main theory of knowledge in conceptualizing the nature of reality of values. The four philosophical perspectives are empiricism, rationalism, pragmatism, and integrated perspective approach. Each of this approach is represented by an item as described in Table 4.5.76. The difference between these philosophical perspectives with five demographic profiles including age group, education background and teaching experience were investigated here.

Table 4.130

Mathematical View and their Value Items

Code	Philosophy	Value Item
NMI2	Empiricism	I always prioritize concrete representation and practical experience in my mathematics classrooms. *Saya sentiasa mengutamakan perwakilan konkrit dan pengalaman praktikal dalam kelas matematik.*
NMI1	Rationalism	I always emphasized on proving of logical ideas in my mathematical classess. *Saya sentiasa mengutamakan pembuktian idea logik dalam kelas matematik.*
NMI3	Pragmatism	I always emphasize on problem solving dan practical experiences in my mathematics classrooms. *Saya sentiasa mengutamakan penyelesaian masalah dan pengalaman praktikal dalam kelas matematik*
NMI4	Universal Integrated perspective	I always stress on continuation, comparison, and formation of meaning in my mathematics classrooms. *Saya sentiasa mengutamakan kesinambungan, perbandingan, dan pembentukan makna dalam kelas matematik*

The frequency graphs of the mathematical views were in Figure 4.21. All the four thoughts showed the same behaviour as majority of the respondents belonging to those who chose “4 = agree” for all the four thoughts, followed by those who picked “5 = Extremely agree”, “3 = Not Sure”, and “2 = Disagree”. None of the respondent answer “1 = Extremely Disagree”. The normal curves showed that the distributions were quite normal for all the four thoughts.

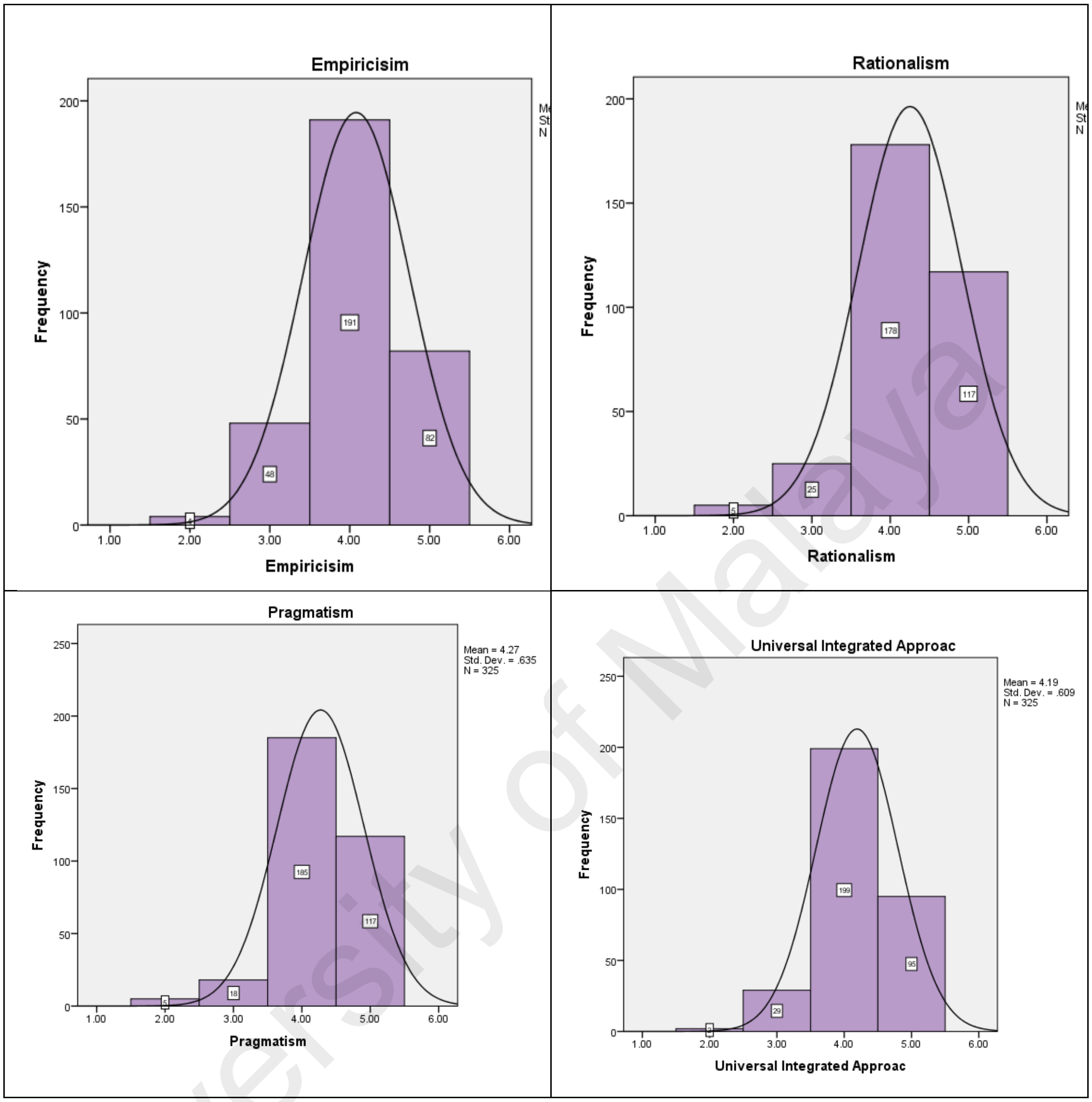

Figure 4.21 Frequencies histograms for the four mathematics views

The statistics of the philosophical perspective includes the mean, standard deviation, skewness, and kurtosis as presented in Table 4.5.77. The means do not differ very much amongst the ideologists. The highest is from pragmatist perspective, followed by rationalism. The rationalist perspective and pragmatist perspective are skewed to the right more than the other two perspectives due to their negative values indicating more respondents on the left end tail. The skew is not that large as it is less than 2. Having values more than 2 is an indication that it is not symmetric. Pragmatist perspective at the same time has the highest peak, compared to the rest. It was noted that all the kurtosis was positive, indicating high instead of flatter peak. The study considered the data not being normal and proceed to using a non-parametric test to

Table 4.131

Statistics for the Mathematics View

Perspectives	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Empiricist	2.00	5.00	4.0800	.66648	-.343	.135	.142	.270
Rationalist	2.00	5.00	4.2523	.66041	-.649	.135	.731	.270
Pragmatist	2.00	5.00	4.2738	.63496	-.667	.135	1.124	.270
Universal Integrated	2.00	5.00	4.1908	.60902	-.289	.135	.295	.270

Kruskal Wallis tests were done for all the four perspectives with three demographic profiles. The data showed that the skewness was mainly to the left, indicating data not being normal for the four-mathematical view.

Table 4.132

Kruskal Wallis Table of Ranks for Age Group and Mathematics View

	Age Group	N	Mean Rank	Chi-Square	df	Asymp. Sig.
Empiricists	30 and Below	101	155.88			
	31 - 40	139	172.03	2.362	2	.307
	41 and above	85	156.69			
	Total	325				
Radical Constructivism	30 and Below	101	150.35	4.645		
	31 - 40	139	173.32		2	.098
	41 and above	85	161.16			
	Total	325				
Pragmatist	30 and Below	101	155.05	2.576		
	31 - 40	139	171.26		2	.276
	41 and above	85	158.94			
	Total	325				
Integrated Perspective	30 and Below	101	149.42	4.594	2	.101
	31 - 40	139	172.45			
	41 and above	85	163.69			
	Total	325				

Thus, Kruskal Wallis test was used to compare the means of the groups within the independent variables: age group, education background, and teaching experience as presented in the tables below. The p values for Kruskal Wallis were all above .5 for the four-mathematics view, implying that age group had no significant mean difference with the four views on mathematics.

Table 4.133

Table of Ranks for Education Background and Mathematics View

	Education Background	N	Mean Rank	Chi-Square	d	Asymp. Sig.
Behaviourism	Degree	250	158.33	3.488	1	.062
	Masters and PhD	75	178.55			
	Total	325				
Information Processor	Degree	250	159.14	2.041	1	.153
	Masters and PhD	75	175.85			
	Total	325				
Radical Constructivis m	Degree	250	159.66	1.799	1	.180
	Masters and PhD	75	174.14			
	Total	325				
Universal Integrated	Degree	250	160.09		1	
	Masters and PhD	75	172.71	1.286		.257
	Total	325				

The p values for all the four mathematical views dimensions were all more than .05, therefore, the difference in the mean between the two different groups of the education background of the respondents were not significantly significant. The Kruskal-Wallis test in Table 4.5.80 also revealed that there was a significant difference in mean of teaching experience with empiricist and integrated perspective with p values of .000 and .037 respectively.

The analysis will proceed to using the Mann Whitney U test to see which group in the teaching experience would contribute significantly to empiricist and universal integrated views.

Table 4.134

Table of Ranks for Teaching Experience and Mathematics View

	Teaching Experience	N	Mean Rank	Chi-Square	df	Asymp. Sig.
Empiricism	Less than 3 years	62	171.92	22.457	4	.000
	3 - 5 years	37	151.22			
	6 - 10 years	73	188.43			
	11 - 15 years	79	129.18			
	More than 15 years	74	172.43			
	Total	325				
Rationalism	Less than 3 years	62	176.44	7.940	4	.094
	3 - 5 years	37	133.86			
	6 - 10 years	73	174.55			
	11 - 15 years	79	157.20			
	More than 15 years	74	161.10			
	Total	325				
Pragmatism	Less than 3 years	62	162.01	2.565	4	.633
	3 - 5 years	37	159.18			
	6 - 10 years	73	173.17			
	11 - 15 years	79	152.77			
	More than 15 years	74	166.64			
	Total	325				
Universal Integrated Approach	Less than 3 years	62	155.57	10.234	4	.037
	3 - 5 years	37	140.32			
	6 - 10 years	73	185.16			
	11 - 15 years	79	153.78			
	More than 15 years	74	168.54			
	Total	325				

Table 4.135 portrayed the Mann Whitney U test for empiricits and the universal integrated approach.

Table 4.135

Mann Whitney U Test for Less than Three years and 11 – 15 years Groups

	Teaching Experience	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Z	Asymp. Sig. (2-tailed)
Empiricism	Less Than 3 years	62	81.05	5025.00	1826.000	-2.939	
	11-15years	79	63.11	4986.00			.003
	Total	141					
Universal Integrated Approach	Less than 3 years	62	71.23	4416.00			
	11-15 years	79	70.82	5595.00	2435.000	-.068	.946
	Total	141					

The Mann Whitney test indicated that the mean difference between the groups less than three years and 11 – 15 years were only significant for empiricism view. That would mean that the lesser number of years in experience the respondents were more inclined towards the empiricim.

Table 4.136

Mann Whitney U Test for 3 -5 years and 6 - 10 years Groups

	Teaching Experience	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Z	Asymp. Sig. (2-tailed)
Empiricism	3 - 5 years	37	46.99	1738.50	1035.500	-2.278	.023
	6 - 10 years	73	59.82	4366.50			
	Total	110					
Universal Integrated Approach	3 - 5 years	37	45.54	1685.00			
	6 - 10 years	73	60.55	4420.00	982.000	-2.651	.008
	Total	110					

The two groups indicated significant difference of mean for both empiricism and universal integrated approach with values of p = .023 and p = .008. Here the findings indicated like before that the more experience one had, he would be more inclined towards both the dimensions of teaching psychology as indicated in Table 4.136.

Table 4.137

Mann Whitney U Test for 6 - 10 and 11 – 15 years Groups

	Teaching Experience	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Z	Asymp. Sig. (2-tailed)
Empiricism	6 - 10 years	73	91.11	6651.00	1817.000	-4.542	.000
	11 - 15 years	79	63.00	4977.00			
	Total	152					
Universal Integrated Approach	6 - 10 years	73	84.33	6156.00			
	11 - 15 years	79	69.27	5472.00	2312.000	-2.473	.013
	Total	152					

Here the two groups demonstrated significant difference of mean. Both the mean and sum of ranks indicated that the respondents were inclined towards empiricism and universal integrated approach as the age group increased.

Table 4.138

Mann Whitney U Test for 11 - 15 years and More than 15 years Groups

	Teaching Experience	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Z	Asymp. Sig. (2-tailed)
Empiricism	11 - 15 years	79	67.13	5303.00	2143.000	-3.277	.001
	More than 15 years	74	87.54	6478.00			
	Total	153					
Universal Integrated Approach	11 - 15 years	79	73.53	5809.00			
	More than 15 years	74	80.70	5972.00	2649.000	-1.223	.221
	Total	153					

Table 4.138 demonstrated that only the mean difference between groups of the teaching experience and empiricism were found to be significant. Again, those with higher teaching experience were found to be more inclined towards both the mathematical views. It can be concluded that those respondents with more experience were inclined toward the two dimensions of mathematics views; empiricism and universal integrated approach.

Conclusion and discussion for the real study. This section summarized the findings from the real study. It included main findings from the focus group interview and experts' assessment of the items. Descriptive statistical analysis of the different variables, analysis of variable interdependence (Cronbach's alpha coefficient, factor analysis of correspondences) and an analysis of the conceptual structure (confirmation factor analysis). This is followed by findings on factors influencing the scores and the profile study on the teaching psychology and the views on mathematics.

This section consists some of the findings from the theory aspect, sub-constructs, instrument's designs, validity, and targeted sample found during the analysis phase. Theory – Different theories were used to suit objectives of the instrument. Amongst the theory used were the social psychology, human values theory, social culture, behavioural cognitive, constructive approach, cognitivism, and expectancy-value theory of achievement motivation.

- Sub-constructs – The number of sub-constructs differ. The sub-constructs range from the sentimental and terminal values, mathematical education values, positivist, mathematical values, nature of mathematical beliefs, interest, general utility, high achievement, ideological, attitudinal, communication, and motivation.
- Instrument Designs – ranges from interview, ranking, Non-symmetric Likert scale, symmetric Likert scale, and survey which were found to be the most preferred.
- Validity – some authors did not share procedures and findings for validity. Some research did the content and construct validity, but the statistical methods vary.

- Targeted Sample: Majority of sample were teachers and students from the primary and secondary schools. None of the researcher has policy makers or education administrator as their sample.

The descriptive and inferential statistics using classical theoretical test are as below:

1. Distribution graphs of the general education values, mathematics education values, mathematics values, and values in mathematics education are mainly skewed to the left.
2. All the items have negative skew values, indicating they are all skewed to the left. Three out of four items which are highly skewed and have high kurtosis values are from the category of general education values. Preakness varies in terms of its flatness from -0.260 to -.069.
3. The construct, sub-constructs, and dimensions were found to be acceptably normal by the skewness and kurtosis analysis and a sample size of more than 200.
4. There were no significant differences of Cronbach's alpha value over the sub-construct, dimensions, and the construct. All values are above 0.6 (.675 to .932), an indication that they are reliable scales as sub construct and construct.
5. The reliability of all the nine dimensions are also encouraging as they are all very high, ranging from .675 to .932, where the lowest is the sociological value and the highest is the basic values.
6. The Cronbach's alpha for the general education, mathematics education, and mathematics values were .918, .882, and .882 respectively and for the values in mathematics classrooms is .952.

7. All the dimensions, sub-constructs, and construct met criterion for inter-item correlation except for one dimension from the general education values which is the basic dimension.

8. All inter-item correlations were found to be positive. There wasn't any case in which the combinations of Cronbach's alpha coefficient value and mean inter-item correlation were both low.

9. The Cronbach's alphas of item if deleted are found to be generally less than the Cronbach's alpha of the respective sub-constructs, dimensions, and the construct with the exceptional of an item from the main values of the general education values (NUU4). The item provides a value of .814 if item is deleted which is higher than the Cronbach's alpha for the main value (.768). This fulfils the minimum requirement of having at least 50% of the retained items correlate with total scores in the range 0.30 to 0.70.

10. The corrected item-total correlation for all the dimensions, sub-constructs, and construct are above .3, indicating items are correlated to the instrument.

11. It was detected that ten items were with noticeable low item-total correlations. Eight of these items are from the general education values and two from the mathematics values.

12. Education background was significantly related to mathematics education, mathematics values, and value in mathematics education. However, it was not significantly related to the general education values. Teaching experience was significantly associated to mathematics education values.

13. Majority of the cross tabulations of the age group, gender, highest education, interest in mathematics, and teaching experience with general education, mathematics

education, mathematics values, and values in mathematics classes showed that the relationships are not significant.

14. The cross tabulations between general education values, mathematics education values, mathematics values, and values in mathematics classes demonstrated that the relationships between them are highly significant except for the relationship between mathematics values education and mathematics values.

15. The first and second order of the Confirmation Factor Analysis showed that the general education values and the mathematics values were not fully a good fit as compared to the mathematics education values, although the loading of the path measurement model sub-constructs and dimensions were all above .5.

Findings from the Rasch analysis:

1. The Rasch analysis indicated a high person and item reliability of .93 and .96 respectively with Cronbach's alpha for the instrument at .95.

2. The separation reliability for both person and items are acceptable at the values of 3.63 and 4.84.

3. Twenty-two out of thirty-six items are outside the fitting area, only four were found to be too far from the fit range. However, there was no items which were outside the required ranges for all the infit mean square, infit z-standard, outfit mean square, and outfit z-standard.

4. The point measure correlation values are all positive, implying that the items are measuring the construct.

5. There are 50 respondents who were outside the acceptable range for MNSQ and ZSTD for input and output. However only 10 has MNSQ values of more than 2.0 and ZSTD value more than 3.0.
6. The value of openness which is in the value of mathematics is found to be the hardest item to endorse by the respondents.
7. The summary of the category structure suggests that all the rating scale are acceptable after considering the three essential criteria from Linacre's (2002).
8. The PCAR results showed the multidimensionality for the general education due to the high eigen values (more than 3.0) for the unexplained variances indicating the existence of a second dimension and possibility of unidimensional for mathematics education values and mathematics values.
9. PCAR test showed that the mathematics education values and mathematics values are both unidimensional.

Factors contributing towards the scores and profiling of respondents

1. Education background was found to be significantly related to mathematics education, mathematics values, and value in mathematics education but not to the general education values. Teaching experience was also found to be significantly associated to mathematics education values.
2. All relationships between construct and sub-constructs were found to be highly significant except for the relationship between mathematics values education and mathematics values. The construct had significant relationships in which respondents with high scores in general education values would have high scores in mathematics

education values and mathematics values. Those with medium scores of mathematics education values would have medium scores of mathematics values.

3. Those with high scores in sub-constructs and construct generally were respondents of 31-40 years of age, with degree, and had 6 – 10 years of teaching experience. Respondents with low scores were those in the age group of 31 – 40, holds a degree, and had 11- 15 years of teaching experience.
4. The Kruskal-Wallis test for the education background with sub-constructs and construct revealed that there were significant mean differences for the mathematics education values, mathematics values, values in mathematics education and education background
5. The mean rank and the sum of rank for the difference scores observed that the difference is in favour those with less number of years. Mean differences for the five groups of age were found to be significant for general education value and values in mathematics classrooms.
6. The Kruskal-Wallis test revealed that there was a significant difference in mean of teaching experience with empiricist and integrated perspective. Those respondents with more experience were inclined toward the two dimensions of mathematics views; empiricism and universal integrated approach.

Conclusion

Chapter Four reported the findings from the five stages of the instrument development. The literature search investigated seven instruments relating to human values and values in mathematics education. Different conceptions of values were used by researchers depending on their area of interests, resulting in variations in the conceptions of values. The prominent definition of values in mathematics classrooms was from the social cultural aspect from Bishop (1996) built from the perspective of the cultural in which mathematics is developed, in this case the western culture. The definition found to be lacking from the spiritual aspect which is the basis of education in Malaysia. Integrated conceptions from Nik Azis (2009), founded on believing in God and having faith was chosen as the base of this research to construct the research questions, research design and research analysis.

The 36 items scale using 5-point Likert scale were used in which the sum of the ratings indicated the perceptions of the respondents on the values in mathematics classrooms. The instrument was also designed in such a way that it could measure the three sub-construct (general education values, mathematics education values, and mathematics values), the nine dimensions (basic, core, main, expanded, teaching, learning, ideology, sentimental, and sociological), the psychological perspective (behaviourist, information processing theory, information processing, and integrated perspective) in teaching, and the philosophical aspects (empiricist, rationalist, pragmatist, and universal integrated perspective) separately. Focus group and experts were referred to verify the content validity. Items were suggested to be shortened, rewritten, replaced, and rephrased. There were also comments made on the language being used and the quality of the translation. The pilot study which was administered to 241 lecturers found that the instrument's validity and reliability were reasonably acceptable. The item-total reliability was also encouraging and there is only one item indicating redundancy. Item and person reliability were both found to be high. However, the number items were increased to 36 after some consideration in making the items under the "basic" dimension clearer by improving the existing and adding two more items. The confirmatory factors analysis indicates acceptable uni dimensionality characteristics.

The findings for the real study were almost similar in terms of validity and reliability. The revised instrument was distributed to 325 respondents for the real study. The findings generally portrayed that the instrument is acceptably reliable and portray an acceptable level of unidimensional with excellent item reliability indices and person separation reliability and reasonable fit to the model. It was found that education and interest in mathematics were significantly associated with the three levels of scores from the three sub-constructs and construct. The data from the real study was used in the profiling of the respondents by comparing the means for several groups of the demographic factors (age group. gender, education, interest in mathematics, and teaching evaluation). Age group, interest in mathematics, and teaching experiences were found to have significant differences of the mean for the three sub-constructs and the construct. On the other hand, interest in mathematics and teaching experiences were the two factors found to have significant difference of mean for the psychological domains and the philosophical views. Item Characteristics Curves study was not done on the data from the real study. This is because not much can be obtained from it, since only two new items were added. Furthermore, information on hardest item to agree for example can be obtained from the study on item-person map.

Findings from this chapter will be further discussed to arrive at the meanings and findings will be interpreted in relation to the theoretical knowledge and practical discussed in Chapter Two. Implications on the theory, education practices in mathematics education, and future study will be discussed and suggestions being made to further improved the knowledge in development of instrument and values development from the perspective of mathematics classrooms.

Chapter 5 Conclusion and Recommendation

Chapter Five discusses the meaning of the results and interprets them in relation to the problem statement, research questions, theoretical framework, conceptual framework, and past research. The presentation is done under the sub-topics: introduction, summary of study, summary of research results, discussions, conclusions, theoretical implications, implications for educational practices, implications for further research, and concluding remarks. The first section is the introduction where main topics of the chapter were stated and later briefly introduced. Next is the summary of the study consisting of a brief comprehensive picture on the research area, problem statement, research questions, background theory, summary of literature review, research design, data collection strategy, research instruments, type of data collected, population, sample, sampling procedures, and data analysis procedures. Summary of research results comprises of compact abstract discussion of the main results.

The discussion section presents interpretation of results from the aspect of theory, research, policy, and previous research by analyzing, explaining, synthesizing, and discussing the results which is done through answering the research questions. In addition, sub-topic on conclusion consists the main results and findings from the study and comparisons with previous studies. Lastly, implications towards theory, education practices, further research and concluding remarks are presented.

Summary of Study

This study is on development of an instrument measuring values in mathematics classrooms. Conceptions of the constructs, definitions of sub-constructs, research questions, research methodology, data collection and data analysis were all based on the universal integrated perspective. Earlier study had shown that little was known on how values were constructed, defended, accommodated, and assisted in handling conflicts and perturbations in teaching and learning mathematics. Conceptions and categorization of values in mathematics education were still in the exploratory stage due to its complex latent construct and were mainly limited to the secularized thoughts from the western culture in which the knowledge of mathematics was developed. In addition, mathematics has always been thought as a value free subject by teachers, students, and individuals involved in the teaching and learning. All these contributed towards the gap in knowledge of values in mathematics classrooms.

In addition, there were minimal number of studies on assessment of values in mathematics classrooms and a very small number of instruments measuring values were found. Thus, it is the intention of this study to develop a holistic instrument covering not only the physical but also the spiritual aspect of values in mathematics classrooms. The research questions focus on: identifying suitable conceptions for sub-constructs, dimensions and values indicators; proposing suitable instrument development model; estimating and accumulating validity and reliability of the instrument, identifying factors which contributed towards values in mathematics classrooms; and profiling in relation to the values in mathematics classrooms and their sub-constructs. Data collected are both in quantitative and qualitative form.

Topics of interests of current researchers were limited to studying the positivist and constructivist dimensions of values in mathematics education, mathematics values, nature and beliefs on teaching and learning mathematics, perceived values on mathematics, achievement and motivation in studying mathematics, and values inculcation in mathematics content delivery. In this study, the development of instrument followed iterative mixed qualitative and quantitative methods which started with the analysis, design, development, and evaluation stage.

Two decades of comprehensive literature were studied for thorough understanding of the critical problems, focused area, unexplored area, unanswered questions, and unsolved issues in relation to instruments measuring values in general and values in mathematics classrooms during the analysis phase of the instrument development. Document analysis protocol was used as a guide to collect necessary information. During this phase, problems and issues relating to the topic were identified, purpose of research and research objectives were formulated, theoretical framework was clarified, latent construct, sub-constructs, dimensions, and indicators of values were conceptualized and defined. The next step is determining the format of the instrument, determining the scales, constructing the items pool, confirming the scoring formula, and having the written instructions for the respondents which is done during the design phase.

The development phase addressed the degree to which items of an instrument sufficiently represented the content through critical interviews and discussions in the focus group. The participants of the focus group were asked to critic the pool of items and the instrument. Areas concerned in relation to the items were clarity, understanding, relevancy and tone of language using the 5-point Likert scale represented by strongly disagree (1), disagree (2), not sure (3), agree (4), and strongly agree (5). Scores were determined by taking the mean of the scores for each of the item. The content validity of instrument was also determined using the viewpoints of the panel of experts. The three panels of experts were assigned to revise the improved items in three different areas using an online survey form which have rating and open ended items. The first area of evaluation was on relevancy, representation of values, quality of the translation and whether the collection of items represents the dimension of the sub construct. The second area was on the difficulty, clarity, and readability level of the items and the third was on the format, presentation, allowance of time, general presentation and suitability of the instrument. Poorly performing items were reviewed again by content expert before the items were established for the pilot study.

The evaluation phase consisted of the pilot and the field study. Construct validity for the pilot study was estimated by studying the reliability using internal consistency coefficient and uni-dimensionality checks which were done by confirmatory factor analysis and standardized residuals variance. Other investigations included the inter-item correlation and item-total correlation for all the dimensions, three sub-constructs, and the construct. The classical index of discrimination was obtained by investigating the Cronbach's alpha for the scale, sub-constructs, and dimensions, inter-item correlation, item-total correlation, and Cronbach's alpha if respected item was deleted. Differences of means among groups in factors from the demographic profile were done to study factors influencing scores of the scales and the sub-constructs together with some profiling studies. Concurrently, the researcher investigated the psychological and philosophical inclination of the respondents towards their teaching approach and view of mathematics.

Empirical evidence collected from the statistical analyses of the internal structure of the instrument include: the goodness fit of the IRT model to the data: item goodness fit (model fitting in IRT), item calibration and ability estimation, separation of item difficulty, person separation reliability, analysis of item fit, analysis of person fit, item characteristic curves, item information function and test information function using the Rasch model. These statistical tests were executed to both the pilot and the real study, with the addition of finding factors influencing the scores of the construct and sub-constructs and the profile study for the real data. An investigation on the preference of teaching psychologies and how respondents view mathematics were also executed.

The researcher is targeting the whole population of 430 mathematics lecturers in 17 colleges, however four colleges did not take part due to policy of college, there is no mathematics lecturer at the college, late responds, and technical problems through e mails. All the respondents were reached out through their heads of departments after getting approval from the Ministry of Education and respective College Directors. The finalized 36-items questionnaires with instructions were mailed to the representatives and the responds were sent back using the Poslaju service.

Summary of the Research Results

This section consists eight main results from the analysis, design, developmental, and evaluation phases of the instrument development.

1. Values was found to be interpreted by researchers to be element from the cognitive or affective domains (Bishop, 2002). Researchers had not form a common operational definition for values and to differentiate it from other affective element such as attitude, beliefs, conceptions, knowledge, interest, and emotion. (Bishop et al., 1999). In addition to that, most researchers were not using a theory which could produce explicit definitions and clear structure on the construct and sub-constructs. For example, there were studies from the science social studies such as the assessment on human values studies by Rokeach (1972) and Schwartz (1992) which used the Human Value Theory. Researchers like Beswick (2005), Bishop (2008), and Dede (2010) were among the few researchers who investigated on values in mathematics classrooms. Their conceptual

definitions on values in mathematics classrooms were mainly based on the western culture in which the knowledge of mathematics developed. All the theories used in the studies of values in mathematics education were anthropocentric, where the sources of knowledge are from rational thinking and empiricism experience which was subjective. This is different than the theory on values in mathematics proposed by Nik Azis (2008 & 2009) which was based on the integrated perspective subscribed to the idea that there were multiple sources of knowledge amongst which were revealed knowledge, ilham, intuition, rational, and empirical. Knowledge is constructed through actively constructed activities and further developed to gain its meaning.

The concept of values to the integrated approach focuses on spiritual, cognitive, affective and behavioral components. It was related to the philosophical, psychological, and sociological aspects and the theory subscribed to the belief that all knowledge was from God where all argument, discussion, and deduction were done parallel to the religion principles and system which were absolute and objective. In pedagogical aspect, teachers were to function as *muaddib*, a person who assisted the students not only in their learning but also development of values and moral. The study revealed that researchers used the individualistic theoretical approach such as radical constructivism, community approach such as the social cultural theory, and the integrated approach which looks within individuals, community, environment, and relationship with the Al mighty.

2. Eight instruments were evaluated from the aspects of theory, conceptions of sub-constructs, instrument designs, validity, and sample target. Two instruments were related to the humanism and another six were instruments related to values in mathematics classrooms. Among the theories used were human value theory, expectancy values theory, cognitivism, and social constructivism theories. The theories were rooted from an

anthropocentric community, a reason why there was no spiritual values mentioned or included. The study found that the conceptions on values in mathematics education were compartmentalized, secularized, and developed within the western culture in which the mathematical knowledge was developed. Among the sub-constructs used were beliefs, motivational, computational, interest, mathematics education values, and mathematics values where integrated studies on the notion of values and values development were not discussed. None of the instrument took into consideration the spiritual aspect when constructing the conceptual framework.

Only Dede's Mathematics Education Value Questionnaire and Luthrell's Mathematics Values Inventory reported the process to enhance face, content, and construct validity. Face and content validity were popular among the researchers where interviews and observation were used as data collection techniques. Construct validity was mainly focused on checking the uni dimensionality using either the exploratory factor analysis or confirmatory factor analysis to demonstrate good data-model fit of theoretical relations between variables. In addition, some of the instruments went through reliability tests such as test retest, predictive validity, and convergent validity.

The instruments measuring mathematics related values were mainly targeted on in-service and pre-service primary and secondary teachers and very few were targeted on students, and education administrators or policy makers. The instruments on human values such as the Schwartz Value Survey and Rokeach Value Survey were used extensively for various levels of people in the society with different backgrounds and culture for different purposes.

Instruments seemed to vary in their designs where survey method seemed to be a popular design for the instrument to measure values in mathematics classrooms, besides ranking, subjective questions, interviews and observation. Some of the instruments were found difficult to handle, for example, Schwartz Value Survey would require respondents to read 30 items before having to rate them. Rokeach's instrument was also found to be unfriendly where 18 items needed to be read before ranking them and respondents were forced to rank between two equivalent values.

3. The focus group agreed that the instrument looks presentable with acceptable layout and readable, with clear instruction and suitable for the targeted respondents. Generally, participants commented on unsuitable terminologies and phrases, three items were thought of being too long and difficult to understand, two were long but quite easy to answer. Twelve items received feedback on suggestions of terminologies which were thought to be more appropriate and clear and long items were shortened. English translations were referred to when participants found difficult to understand the Malay versions and six out of seven participants felt that the English version is easier to understand. Items under general education category were very low in their means on clarity, understanding, language, and relevancy. The items from the general education values category received the highest number of items (17.6%) with scores below 3.5 for evaluation of clarity, understanding, language and relevancy as compared to the other categories.

Out of 34 items, six were suggested to be remained as it is, the rest were corrected to improve on clarity, understanding, language, and relevancy. One item was deleted and replaced with two items in the basic value from the general education value, making the total to 36 items. There was no feedback on the categorization of the sub-construct and their dimensions or suggestions on new sub-constructs, new dimensions, or new items. This is probably because the respondents were not too familiar with the construct being discussed. There were no common definitions or agreed understanding between them during the discussion on the conceptions of the sub constructs. It could be concluded that they agreed with the conceptual definitions and the framework suggested from the researcher.

4. The experts' assessment on the items' relevancy, representation of values, the quality of the translation from Bahasa Malaysia to English, and whether the collection of items represented the dimensions of the sub construct received high average scores except for item 4 and 34. Ten items were identified as loaded and proposed to be broken up to several items. Five items were thought to contain unsuitable terms and the panel provided better alternative terms to be used in the items thought to be confusing to make the items more accurate, comments were also received on the translation work as some of the experts thought that the translation work was not accurate.

There were thirteen items which received mean below 3.5 for either difficulty, clarity, and readability level and seventeen of the items received scores 3.5 and above for all the three categories. Out of the thirteen items, six were from the general education values, three from the mathematics education values, and four were from the mathematics values. Some feedbacks were found to be non-relevant and were not taken into consideration.

5. The pilot study indicated that the instrument and the three sub-constructs did not portray normality. However, since the number of respondents is huge, it will reduce the risk of problems associated with skewness and kurtosis. The Cronbach alpha of the instrument (.939), three sub-constructs (between .870 - .939), and the nine dimensions (.680 to .887) were considered high except for the dimension of "sociology" (.675) in the mathematics values sub-construct. The inter-item correlations for all the sub-constructs

were all acceptable (between .30 and .70) except for the general education values, which have inter-item correlations between .147 and .823. However, 72% of them have correlations between .30 and .70. Only two of the nine dimensions ("basic" and "learning") also contain inter-item correlations outside .30 and .70. However, the two dimensions have at least 50% of the inter-items correlation within the range .30 to .70. All items were found to correlate quite well with the scale (between .4 and .7) suggesting that items are not measuring the same construct and should be kept.

The cross tabulations of academic qualifications with scores of the constructs portrayed that those with master degree were fairly distributed among the four score levels for general education values, mathematics education values, mathematics values, and the values in mathematics classrooms. Cross tabulations of gender and the four levels of total scores indicated that the female respondents were mainly at the two lower scores. The Rasch Model analysis showed that person reliability increased (.91 to .93) while item reliability demonstrated a decrease (.95 to .94) when the extreme cases were eliminated. Item separations indices were between 3.57 and 5.40 which was considered good. The items seemed to show good fit to the model because the infit and outfit mean square (MNSQ) and the standardized fit statistics (ZSTD) fall within the acceptable range of -2 to 2. The Cronbach's Alphas when respective item is deleted for all items were all below the respective Cronbach's Alpha except for an item in the general education values (innovative) and an item from the mathematics education values (theorists). The item total statistics for each dimension when the respective item was deleted were all more than the respective Cronbach's alpha for each dimension except for three items.

The findings of the standardized residual variance for all the sub-constructs indicated the presence of under-representation construct but not suggesting separate construct-irrelevant factors. The five-category rating scales were analyzed and categories "2" and "3" showed possibility to be merged, this is because the rating scale analysis indicated that categories 1, 2, and 3 were not fully utilized.

6. The real study involved 325 where majority of them were in the age group of 41 – 50 years of age and 71.4% were female. Majority of the sample were those who have degree (76.6%) followed by those with masters (22.2%). About the same number of lecturers 73, 79, and 74 were in the 6 – 10, 11 – 15, and more than 15 years of experience. Normality checks indicated that the items, dimensions, sub-constructs and constructs were not ideally symmetric but the kurtosis and the skewness values were not too far from the acceptable range. However, having sample size of more than 200 reduced the problems associated with skewness and kurtosis.

Items of the construct, sub-constructs and nine dimensions were all reliable judging from Cronbach's alpha values (above .70) except for the sociological values (.675). The Cronbach's alpha for the general education, mathematics education, and mathematics values were .918, .882, and .882 respectively and for the values in mathematics classrooms is .952. The Cronbach's alpha when item is deleted was all below the respective Cronbach's alphas of the sub-constructs and dimensions, except for "openness" and "innovativeness". Confirmatory Factor Analysis using AMOS showed that the three sub-constructs and values in mathematics classes have adequate goodness of fit with path coefficients of above .5. The confirmatory factor analysis illustrated the standardized factor loadings, showed good convergent validity indicating that the instrument showed considerable promise in determining the values in mathematics classrooms except for the general education values sub-construct. However, the fit indices such as the CFI and RMSEA indicated marginal values suggesting that the factors did not provide good explanation of the values in mathematics classrooms.

7. Rasch Model analysis was used to confirm some of the inferential statistics and checks on fit of the data to the model and the uni-dimensional. Only 314 out of 325 samples were considered as the rest were extreme cases which were disregard. The person reliability increased to .93 from .92 and the separation index increased to 3.63 from 3.34 for 314 samples. The model was also used to display items difficulties. Three out of five most challenging items came from the items in the general education values. Openness was still found to be the hardest item to endorse both in the pilot and real study.

The inter-item correlations pointed that all items were correlated very well. All inter-item correlations were found to be positive. There wasn't any case in which the combinations of Cronbach's alpha coefficient value and mean inter-item correlation were both low. There were 15 items which did not fulfilled at least one of five the five fitting criteria (infit MNSQ, infit ZSTD, outfit MNSQ, outfit ZSTD, and point measure correlations). The corrected item-total correlation for all the dimensions, sub-constructs, and construct are above .3, indicating items are correlated to the instrument. The Cronbach's alphas of item if deleted were found to be generally less than the Cronbach's alpha of the respective sub-constructs, dimensions, and the construct with one exception from the general education values. The item provides a value of .814 if item is deleted which is higher than the Cronbach's alpha for the main value (.768).

8. The study also involved studying the respondents' inclination towards the four main psychological perspectives in teaching such as behaviorists, information processing, radical constructivists, and integrated perspective. Kruskal Wallis test were used to compare the means of the four psychological domains among the groups in the

demographic profiles. The mean difference of age-groups and education background were not significant. Only the teaching experience was found to have significant difference in the mean with behaviorist, information processing, and radical constructivist. The mean of universal integrated was not statistically significantly different in the mean. The mean rank analysis study indicated that the more teaching experience one has, the respondents would be more inclined towards the three dimensions of three teaching psychology; behaviorist, information technology and radical constructivism.

Only the teaching experience was found to have significant difference in the mean with behaviorist, information processing and radical constructivist. The mean rank analysis using Mann Whitney test indicated that those with higher teaching experience were found to be more inclined towards empiricism and universal integrated approach.

Discussions

This section provides interpretation and description of the significance of the findings and to explain insights about the problem. The discussion is presented following the research questions.

Question One: What are the sub-constructs, dimensions and values items suitable to measure self-perceptions of values in mathematics classrooms of lecturers from matriculation colleges?

Values were related to the norms and ethics of the community including the learning institution, values in mathematics education. These values were developed in the school curriculum, textbooks, syllabus, classrooms practice, and other related values in teaching and learning in accordance to the development of mathematics within certain culture or civilization. In this study values in mathematics classrooms was categorized into the general education values, mathematics education values, and mathematics values. The Hierarchy Categories of Values Model proposed in this research was based on the universal integrated perspective in which the general education values was categorized into basic faith (values as guidance in life), core values (values as necessity in life), main values (values portraying oneself) and expanded values (self-development values). Teaching and learning were the dimensions for the mathematics education values, and ideology, sentimental, and sociology were dimensions for mathematics values. Ideology consisted of items relating to rationalism, empiricism, pragmatism, and integrated values, while the sentimental values had control, development, and civilization. The sociological aspect of mathematics consisted of items describing separated, openness, and integrated values. The pragmatism and integrated approach were added to rationalism and the empiricism in the ideological aspect suggested by Bishop. The value of civilization was added to control and progress of Bishop's sentimental values and the value of integrated was added to the sociological aspects which consisted of mystery and openness. In this matter, the psychological and sociological aspects of the construct were based on the Islamic psychology but the socio-cultural was based on the social constructivism, information processing theory and symbolic interaction. Value was first developed in the aqal, received its true meaning in the qalb and operated in the soul implying that it was inseparable from faith, knowledge, and individual practices.

Conception and categorization of the general education values by Nik Azis (2009) which was not defined explicitly by Bishop (1996) fitted in well with the other two sub-categories. All the three sub-construct and the nine dimensions seemed to have high Cronbach's alpha values. The items which described the values indicators were also showed to have reasonable inter-item and item-total correlation with high alpha values when respective items were deleted. High factor loadings between sub-constructs, dimensions and items indicated that items fit the respective dimensions and sub-constructs. The fit indices for the confirmatory factor analysis for the three sub-constructs indicated that only the mathematics education values which consisted of two dimensions was well supported. On the contrary, the theory that the general education values were made of four dimensions and mathematics values was made up of three dimensions were not supported for this sample.

Question Two: What are the validity and reliability of instrument in measuring values in mathematics classrooms?

The validity of the instrument was established through the content and constructs validity. Content validity consisted of qualitative and quantitative measures of validity and were secured via focus group and three panels of experts who judged the survey's appearance, relevance and representativeness of value items. The focus group included a team of seven lectures, conveniently sampled, teaching preparatory mathematics subjects at a university and have the same education background with the matriculation college's lecturers. While the experts were professors, associate professors, and senior lecturers from several universities in Malaysia in the field of mathematics, education, and mathematics education.

Qualitative data from the focus group included comments on six misspelled words, twelve items which were thought of having unsuitable terms and phrases, and five items thought as being too long. The quantitative data were the mean scores of clarities, understanding, language and relevancy of each item in Bahasa Malaysia and English which were found to be reasonably acceptable as the means for the sub-constructs for both the languages were more than 4.2. When each item was investigated for the four areas in two languages, there were 288 data points to consider (36 × 4 × 2 = 288). Total percentage data with mean of less than 3.5 is 17.6%, 0.07%, and 0.08% for the general education, mathematics education, and mathematics values respectively. All items were carefully considered to be rewritten and revised.

Evaluation on items relevancy found that the items were quite relevant with mean scores of more than 3.5 except for two items. The collection of items seemed to represent the respective dimensions with mean score of 3.5 and above for all dimensions. Evaluation on the quality of translation found unsuitable terms and phrases in the items used during translation of items. The second area was the evaluation on the difficulty, clarity, and readability level of the items and the third was on the format, presentation, allowance of time, general presentation and suitability of the instrument. Ten items were thought to be loaded items and only two receive less than 3.5 of the total average scores of the areas evaluated. The respondents were quite unanimous that format or layout, instrument professional look, instrument looks interesting, instrument demonstrated an overview of values in mathematics classrooms, and instrument is reasonable for mathematics teachers at matriculation colleges were all reasonably acceptable since the means are all greater than 4.

Construct validity provided the researcher with confidence that a survey measured what it was intended to measure. The Cronbach's alphas for the three categories of sub-constructs ranged from .882 to .918 and the Cronbach's alpha for the construct was .952, provided some evidence that they were in the high range of being reliable. The nine dimensions have Cronbach's alpha values ranged between .675 to.932. All the items seemed to contribute reasonably well towards the respective dimensions, sub-constructs, and construct showed little evidence of being redundant. The item-total correlations were generally between .3 and .7 with only five exceptions of items with values greater than .7. The inter-item correlation detected only two (basic and learning) out of the nine dimensions which possibly have redundant items. All inter-item correlations were found to be positive. There wasn't any case in which the combinations of Cronbach's alpha coefficient value and mean inter-item correlation were both low.

The instrument showed high person and item reliability of .93 and .96 respectively, with separation reliability for both person and items are acceptable at the values of 3.63 and 4.84 using the Rasch analysis. This would mean that the items are reliable and can be used on samples of similar characteristics and that the instrument had acceptable number of items to measure what it was supposedly to measure in the underpinning theory.

Although twenty-two out of thirty-six items were outside the fitting area, only four were found to be too far from the fit range and there were no items which were outside the required ranges for all the infit mean square, infit z-standard, outfit mean square, and outfit z-standard. All the point measure correlation values are all positive, implying that the items are measuring the construct. Out of 325 respondents, 50 were outside the acceptable range for MNSQ and ZSTD for input and output. However, only ten items were found to have MNSQ values more than 2.0 and ZSTD value more than 3.0.

A more heterogeneous sample was expected to yield higher reliability estimates as compared to a more homogeneous group and larger sample size may increase the alpha. By increasing number of items, Cronbach's alpha may be increased. In other words, the test length affects the magnitude of Cronbach's alpha. Reliability was sample dependent, implying it will be affected by the characteristics of the sample.

The Chi-square test showed that the associations between all the sub-constructs and the construct were all highly significant, a signal to indicate that they were all significant in measuring values in the mathematics classrooms setting. On the other hand, the factor loadings for the items, dimensions, and sub-categories were of acceptable fit. Even the factor loadings between the sub-constructs demonstrated reasonably fit for them. Although this might not be the best way to classify the construct, the study contributed in offering a practical alternative to ease the discussion on values in mathematics classrooms (Nik Azis, 2009).

Item correlations were determined by inspecting inter-item correlations and corrected item-to-total correlations. Inter-item correlations for items intended to measure the same construct should be moderate but not too high (between .30-.60). The confirmatory factor analysis revealed that the sub-constructs and the constructs have reasonable factor loadings. The analysis of the standardized residual variance does not indicate new factor but there is an indication of the existence of factor which is under represented.

Validity is also related to the efficiency of the rating scales. The study found that rating scales "1" and "2" were not fully utilized, which suggested a possibility of collapsing the rating scale. However, collapsing rating scale will results in losing some probably precious data. However, all the rating scale fulfilled the three essential criteria from Linacre's (2002) which include having at least 10 responses to each category rating, having incremental average measure for all categories, and having a mean square (MNSQ) outfit of < 2.0 for all five categories which reduced any disorder in the measurements to the minimum.

The factor loading of basic, core, and expanded were exceptable with values of .60, .86, 1.01., and .89 respectivley. However, the main dimension has problem with the factor loading of 1.01. This implied that the general education value loaded well on the four dimensions except for the main value. Evaluation of Model Goodness of Fit Indices indicated that the structure of the three sub-constructs were partially acceptable as the indices were not consistently high for the three sub-constructs.

Question Three: What is the suitable research design in developing the instrument?

This research design used ADDIE Model for the instrument development in this study. It was a structured model representing the analysis, design, development and evaluation phases of instrument development. The model was adopted from an approach used by instructional designers and content developers to create instructional course materials due to its flexibility. The four phases were used in the iterative validation process of establishing the validity and reliability of a measurement instrument for values in mathematics classrooms. The analysis phase helped to identify related problems to values in mathematics education; form the research questions; explained the theoretical framework; and supported the conceptualization of the construct and sub-constructs.

Focus group interview determined whether items were readable; sentences were concrete, clear, and simple; phrases, concepts, and items were understandable; items represented the sub-constructs and dimensions; and whether items were bias. The focus group also provided feedback on the clarity of the instruction, suitability of the instrument's format, and the time duration given to respondents. Feedbacks from participants were used to improve the instrument before sending them to the experts who evaluated the face and content validity. Content validity included content relevance, content representation, and content comparability. Content relevance indicated the extent the items represented the sub-constructs and dimensions. Content representation indicated the extent at which the collection of items represented either the sub-constructs or dimensions. Lastly content comparability referred to whether the Bahasa Malaysia and the English version were compatible with each other. Changes were made from the feedback and make necessary changes for improvement.

The fourth stage was the evaluation phase where the validity and reliability of the instrument were determined using data from the pilot and real study. Descriptive statistics involving the mean, variance, standard deviation, missing values, skewness coefficient, kurtosis coefficients, item-total correlations, inter-item correlation, and Cronbach's alpha were used to evaluate the reliability. Confirmatory factor analysis guided by the theoretical framework was done to investigate the relationship between items and dimensions, items and items, items and sub-constructs, sub-constructs with sub-construct. Items found not fit were either being eliminated or corrected. Confirmatory factor analysis proved whether the proposed conceptual framework may assist in assessing values in mathematics classrooms.

Question Four: What are the factors contributing towards the scores of values in mathematics classrooms?

Age group was found to be one of the demographic factors contributing towards the development of values in mathematics classrooms. Lower age group had lower mean for the general education, mathematics education, mathematics values, and values in mathematics classrooms. Higher age group for example 41 – 50, have high score in general education values and values in mathematics classrooms, those in the age group 31 – 40 years have high mean for general education values. This indicates that age was one of the contributors towards the high mean score.

When gender was considered, the male respondents have high mean for all the values categories, while the female students scored low mean for all the values categories. It can be seen that the higher the education status of the respondents the higher the mean score for the values categories.

Those in the 6 -10 years of teaching experience have high means in mathematics education values, mathematics values, and values in mathematics classrooms and those with greater than 15 years of experience have high mean in general education values. A possible explanation was that experiences collected during the respondents teaching years helped them to construct a certain understanding of values from the aspect of general education values with some spiritual aspects within the category. The findings were consistent since the lower number of teaching experience group (3 -5 years) had low mean for general education values, mathematics education values, mathematics values, and values in mathematics classrooms. This indicated that more teaching experience contributed towards high mean for the values categories.

Question Five: What is the profile of the construct and sub-constructs in relation to the respondents' demographic factors.

The profile for the high and low scorers for the three sub-constructs and the construct was not easily obtained for this sample as many of the relationships with age, education background, and teaching experiences were not significant. The group with high score in general education value, mathematics education values, mathematics education, and values in mathematics classes consisted of those between the age of 31 and 40, with degree and have between 6 to 10 years of teaching experience. On the other hand, the low scorers were also those in the age range of 31 – 40, with degrees, and have 11- 15 years of teaching experience. Education background was found to be highly significant with all the three sub-constructs and values in mathematics classrooms and not significant with age while only mathematics education values was found to be significant with teaching experiences.

Other Findings

The study investigated teachers' inclination towards the psychological orientation in learning such as behaviorist, information processing, radical constructivist, and integrated approach. It was found that the education background and age group did not have any significant effect on the teaching psychology. There was a significant mean difference of teaching experience on behaviorism, information processing, and radical constructivism but not universal integrated. It can be concluded those with more experiences were more inclined towards behaviorism, information processing, and radical constructivism.

Investigation on the inclination of the respondents towards the four perspective of knowledge such as empiricism, rationalism, pragmatism, and integrated perspective approach were also studied. Similarly, only teaching experience were seen to have a significant difference in mean with empiricism and integrated perspective. Respondents with more teaching experiences were seen to be more inclined towards empiricism and integrated approach.

Conclusion

This section discussed the five major research findings in this study. Each of the major finding discussed is followed by a brief explanation of the findings and how other researchers were related to the findings.

1. The study produced a valid and reliable instrument to measure values in mathematics classrooms. The instrument consisting 36 items was a self-report survey measuring perceptions on values in mathematics classrooms. The instrument used a 5-point Likert scale. Content validity of the instrument was determined through focus group and panels of expert.

The focus group found that items constructed in the instrument were clear, understandable, written in suitable language, and compatible with the definitions of values indicators. In addition, the panels of experts agree that items were relevant, translated well from Malay language to English language, represent the value indicators and the dimensions. The instruments were found to have clear formats and layouts; clear instructions; allowed enough time for respondents; and suitable for the matriculation teachers. Overall, the study indicated that all items in respective sub constructs received high mean score for level of difficulty, clarity and readability from the experts.

1. This study was compatible with the research done by Rokeach (1973), Schwartz (1992), Dede (2010), Luthrell (2010) and Durmus and Bicak (2006) where focus group was used in verifying content validity. Also, this study is compatible with research done by Durmus and Bicak (2006), Dede (2008) and Luttrel (2010) where panels of experts was used. However, this study did not perform by Dede (2010) where two language experts assisted to translate the instrument from Turkish to English language and back translate.

2. The study found that the instrument is reliable, multidimensional, and have conclusive sub constructs. Instrument was found to have high internal consistency with Cronbach alpha value of .952. Reliability estimates were found to be high at .96 for items and .93 for person and separation reliability for both item and person were at the values of 3.63 and 4.84. The data also demonstrated good fit to the Rasch model as most of the items were found to be within both stated ranges of the MnSq and Zstd indicating no redundant measurement. The study found that raw variance explained by measures is 54.7% closely match to the expected 54.0% revealing a strong measurement of dimension and a low likelihood of additional components being present. In addition, the eigenvalue of unexplained variances in the first contrast were less than 10% indicating uni-dimensionality within each construct.

This study was inconsistent with studies by Durmus and Bicak (2006), Beswick (2005), Luthrell (2010), and Liman et al. (2013) who used principal factor analysis instead of point-measure correlation, fit statistics, and principal confirmation analysis of the standardized residual analysis to confirm unidimensional and to investigate the statistical fit. Durmus and Bicak, Dede, Luttrell, and Liman et al. presented the process in enhancing the validity and reliability of the instruments in their papers. Durmus and Bicak dealt with face and construct validity only while Dede focused on content, construct and predictive validity. Durmus and Bicak for example used the principal component factor analysis to verify the two factor loadings (positivist and constructivist). Internal consistency was estimated by finding the Cronbach's alpha coefficients for the two factors and the instrument as a whole. The instrument designed by Luttrell et al., and Liman et al. demonstrated quite extensive process in enhancing the face, content, structure, criterion and convergence validity and reliability test for their instruments. Generally the instrument's evaluation on content and construct vality used the Central Tendency Theory. The statistics on the inter-item correlation, item-total correlations, cronbach's alpha if items is deleted were not reported by all of the instruments. There are also researchers who did not just focused on the internal consistency, but they also executed the predictive validity test, convergent validity test, and also the test retest validity.

3. The conceptions of construct, sub constructs, and dimensions were based on the integrated perspective. Only mathematics education values were found to have a good fit as compared to the other two sub-constructs, implying that the theory in which mathematics education can be explained by the two dimensions was well supported.

The study showed that the general education, mathematics education, and mathematics values have coefficients of Cronbach's alpha of .918, .882, and .882 respectively, while the Cronbach's alpha coefficients for the nine dimensions ranged from .675 to .932 indicating of good reliability. In addition, the reliability of the instrument was .952. The study showed strong individual factor loadings values which were above .5 within each dimension demonstrating a possibility of acceptable model fit. Although this research is an initial study, it has produced some encouraging findings. However, more work must be done especially for the general education since one of its sub-construct (main value) received a factor loading of 1.01 to improve the value.

General education values were shown to be multidimensional as compared to the other two sub-constructs due to the high eigen values for the unexplained variances in the principal component analysis of the residuals (PCAR) study. The confirmation factor analysis (CFA) model fit index showed acceptable though not ideal model fit for the three sub constructs since not all indices were optimal. In addition, it was found that the comparative fit index such as chi square/df, Goodness of Fit Index (GFI), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Normed Fix Index (NFI) and Root Mean Square Error of Approximation (RMSEA) were found not far from the acceptable range for only the mathematics education values.

The study categorized the values in mathematics classrooms into three sub constructs following Bishop's conceptions of mathematics education values except for the concept of general education values. In this study, the general education value was categorized into four dimensions while Bishop's did not provide a detail dimensions of the general education values. The categorization of mathematics education values in this study is incompatible with Bishop, where this study categorized mathematics education values into teaching and learning with eight values indicators, while Bishop used five complementary pairs of values indicators. In this study, the mathematics value was categorized into three dimensions which is like Bishop's except he used three complementary pairs.

However, the instrument in this study was not compatible with instruments developed by Rokeach (1973), Schwartz (1992), Bishop (2008), Dede (2010), Durmus and Bicak (2006), Beswick (2005) since they did not include spiritual aspect. In this study, Confirmatory Factor Analysis was used instead of Principal Component Analysis because the instrument was constructed based on a specific theory. The study was not compatible with Liman et al. (2013) and Luttrell (2010) since the later used both the Principal Component Analysis and Confirmatory Factor Analysis. Beswick (2005) and Durmus and Bicak (2006) on the other hand used only Principal Component Analysis while Dede (2010) was the only who used Exploratory Analysis. In addition, almost all the researchers used alpha Cronbach values to determine the internal consistency of the instrument.

4. The study indicated that factors such as age group, education background, and years of teaching experiences were among the contributing factors towards values in mathematics classrooms. Profile of respondents on general education values, mathematics education values, and mathematics values of the respondents on values in mathematics classroom involved several demographic profiles.

This study found that there was no mean significant difference for age groups. However, there were significant means between mathematics education values, mathematics values, values in mathematics education and education background where those with masters were seen to have higher mean values. More teaching experiences were seen to contribute towards the score of mathematics education values.

The study indicated that the profile for the high and low scores were almost the same for the three sub constructs and the values in mathematics classrooms. Both high and low scorers came from respondents in the age group of 31 – 40 and have a first degree instead of master degree. The high score respondents were with 6 – 10 years of experience while the low scores were with 11 – 15 years of teaching experience.

This study was incompatible with the studies done by Bishop, Dede, Durmus and Bicak (2006), and Beswick, where the later did not construct the profile of respondents. However, Luttrel (2010) indicated that those with higher mathematics values scores had completed more mathematics courses as compared to those with lower values and the scores of mathematics education values did not differ by gender.

5. The study found that the items within the scale have strong item correlation with the respective sub-constructs and dimensions and did not portray item redundancy. The sub construct had eighteen, eight, and ten items for the general education, mathematics education, and mathematics values respectively.

The efficacy of each individual items was detected from the corrected item-total correlation and Cronbach's Alpha if an item were deleted. The corrected item-total correlation for all the dimensions, sub-constructs, and construct were above .3, indicating items were correlated to the instrument. It was shown that for all the items, the overall reliability would drop significantly if the items were deleted from the scale. Thus, none of the items was deleted. The inter item correlations indicated that only 6 correlations were found to be within .3 and .7 indicating that they did not have the possibility of being redundant.

Theoretical Implications

In this study, the universal integrated perspective is used as a background theory to conceptualize the construct and sub constructs, identify research question and research design. The instrument has specific conceptual structure, format, items pool, formula for the scale, and instructions for respondents with specific concepts, vocabularies, and terminologies used.

The instrument developed in this study is to assess the values in the field of mathematics without focusing on specifying branches of mathematics such as arithmetic, algebra, geometry, calculus, trigonometry, probability, statistics, measurement, and discrete mathematics. Additional information can be obtained if the instrument is modified in terms of the concepts and terms so that it can be used to measure values in specific branches of mathematics.

The integrated perspective which was used as a background theory provides the guidelines to carry out the analysis, design, development, and evaluation phases in for the instrument developmental design. It helps the researcher to collect, analyze and interpret the data in a balanced and comprehensive way throughout the development process. This is because the nature of the items in the instrument involved both physical and the spiritual aspects. There is also room for improvement on the conceptual framework constructed for this study such as adding new values indicators or reducing values indicators to respective dimensions and revising relevant terms in the items. The conceptual framework can be further extended by adding new values indicators to the existing sentimental values dimensions. Furthermore, each existing value indicator can be decomposed into relevant sub indicators such as the behaviorism values indicator can be broken down into relevant sub-indicators involving radical and classical behaviorism.

The instrument developed in this study was targeted to measure values in mathematics classrooms of matriculation lecturers. It can be used on different respondents such as primary schools' teachers, secondary schools' teachers, universities lecturers, and students if relevant modifications are made to the vocabularies, concepts, and terms in accordance to the intellectual abilities of the respondents. The instrument can also be utilized for other discipline of knowledge such as science and geography if some modifications were done on the dimensions or some of the relevant value indicators to suit the nature of the discipline.

The discussion of the focus group in this study was focused on practical questions like the clarity, relevancy, and their understandings but did not touch on the theoretical aspect. This is also true for the panels of experts in which none of them are experts of the universal integrated perspective. By having participants who are not experts in the theory used in this study, the feedback obtained may not be compatible with the study. In other words, experts with deeper understanding of the theory may be able to provide related and meaningful feedbacks on theoretical perspective.

Implications for Educational Practices

The results of this study suggest several implications on the educational practices in teaching and learning of mathematics. Firstly, the instrument which was developed to measure values in mathematics classrooms can be extended to be used by teachers, lecturers and students of education faculty. The instrument can provide separate scores for general education values, mathematics education values, and mathematics values. These scores on the perceptions of the teachers on values in mathematics classrooms can be interpreted and assisted in decision making by policy maker to design professional developments programs, construct better quality of mathematics curriculum and textbooks which are balanced form both the physical and meta-physics aspects.

Secondly, the instrument could identify factors contributing towards the scores of the values construct and sub constructs. The study found that age, teaching experiences, and interest in mathematics affected the scores. The information can be used by the curriculum developer to design a balanced and user oriented mathematics curriculum which could contribute towards the development of values in mathematics classrooms and improve the quality of teaching and learning. Educators can use the findings from the instrument to make necessary adjustment to improve the quality of teaching.

Thirdly, in this study the instrument was also used to identify the inclination towards the view of teaching approach and how mathematics knowledge was viewed. Students from the education faculty may use the instrument to see their preference in teaching approach and how they view the nature of mathematics. This knowledge can be used to help teachers and lecturers to adjust their teaching approaches and evaluations with the students' understanding and views. The information can also contribute towards the success of a newly implemented policy in teaching and learning mathematics such as the policy on teaching of science and mathematics in English and the implementation of higher order thinking in mathematics. This is because the success of such policies is related towards the values that the teachers brought to their mathematics classrooms.

Implications for Further Research

Based on the findings of this study, several further research may be done to expand the research from the aspect of the research respondents, instrumentation, validity and reliability, and area of mathematics. The study which was done on mathematics lecturers from matriculation colleges was a homogeneous sample which can be expanded to lecturers in higher learning institution, mathematics teachers in primary and secondary schools, and pre-service teachers. Different set of findings may be obtained from a heterogeneous sample since the research subjects come from different demographic background. The studies might give clearer idea on the influence of demographic factors on subjects' perceptions of values in mathematics classrooms.

This study involves lecturers' view on values in mathematics classrooms which only focuses on their perceptions of those values. If a deeper understanding of values is required a further study may be done on lecturers' conception. A further study using a mixed method using a combination of survey method and clinical interview can be carried out to obtain more information on both perceptions and conceptions of values of the lecturers.

The instrument was developed to measure values specifically in mathematics classrooms which can be further implemented on mathematics topics related to different branches mathematics. This will provide information on various values involving specific topic on mathematics which may contribute towards improving the teaching and learning the topic.

During the focus group interview and getting feedback from panels of experts, the transparency and the trustworthy of building up those items and instruments may be improved by carrying out an audit trail and reviewed by peers.

The study involved only 325 respondents from the population of matriculation teachers which was considered small for validating instrument where usually a larger sample around 1000 or more usually are needed to test the validity and reliability of an instrument. If extensive information was required, then a future study may be carried in a large scale involving bigger sample size.

This study is an initial effort in measuring values with spiritual aspects being included. The findings indicated that values indicators can be improved in order to obtain a valid uni-dimension instrument with statistically proven and highly acceptable conceptual framework.

Concluding Remarks

The study produced a survey instrument to measure values in mathematics classrooms based on faith and belief in God. The integrated theory provided the instrument with holistic, balanced, and integrated conceptions of values. This helps in reducing the issues on volatility, uncertainty, complexity and ambiguity in values discussions. In addition, the general education value which consisted of values related to the spiritual domain was categorized into four sub-constructs which were in hierarchal order. This has never been done within the western education.

This theoretical based instrument provided empirical findings for more research on the values indicators. As an example, researchers can go deeper in identifying better or more values indicators for the basic values and to have a meaningful understanding of dimensions in mathematics classrooms based on the integrated perspective.

This instrument can contribute in building up the profiling of respondents on values in mathematics classrooms, general education values, mathematics education values, and mathematical values which may provide information to design better programs for values development of educators and designing suitable curriculum involving values development.

The researcher faced some challenges in using universal integrated approach as a background theory in developing the instrument measuring values in mathematics teaching and learning since there is limited research done on the topic. However, it was a worthwhile academic journey as the instrument may contribute more knowledge in development of values in mathematics learning and teaching.

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