IMPACT OF LEARNING SUPPORT INTERVENTION ON PRECLINICAL STUDENTS' CONCEPTION OF SELF-REGULATED LEARNING: A QUASI-EXPERIMENTAL STUDY BASED ON THE MOTIVATED STRATEGIES FOR LEARNING QUESTIONNAIRE

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ABSTRACT

Self-regulated learning (SRL), which includes the ability to regulate motivational, cognitive and metacognitive strategies based on the contextual and task demand, is recognized as a critical element for lifelong learning. However, past literature indicate a deficit in undergraduate medical students' capabilities to self-regulate their learning and shortcoming of implicit methods to develop students' SRL in medical schools. Thus, the objectives of this research were to analyse (i) the baseline level of the preclinical students' SRL and (ii) the impact of the learning support intervention on the students' conception of SRL. These objectives were approached from the perspectives of the students' motivation orientation and learning strategies. Understanding the impact of this intervention on the students' SRL conception will enable opportunities for medical teachers to plan and design effective learning support programmes that will enrich the students' lifelong learning skills. In this one-group pretest-posttest quasi-experimental research involving explicit training on SRL strategies, the Motivated Strategies for Learning Questionnaire (MSLQ) was administered to the first-year, and second-year undergraduate medical students at the Perdana University-RCSI School of Medicine, Malaysia. A total of 53 students participated in this research. The baseline level of the preclinical students' motivation and learning strategies for SRL were determined based on the descriptive statistics analysis of the pre-test MSLQ data. The findings revealed that the preclinical students had high task value and control beliefs. However, they were extrinsically motivated and reported low self-efficacy beliefs. Although the data showed that the students do use some higher-order cognitive learning strategies such as organization and elaboration, the high dependence of surface learning strategies such as rehearsal, and the deficits in critical thinking, metacognitive self-regulation, and resource management strategies were indicative of inefficient self-regulation of learning among

the preclinical students. The independent *t*-test and the Mann-Whitney test showed no significant difference in the baseline level of SRL between the first-year and second-year students. The paired-sample t-test and Wilcoxon signed-rank test revealed that the intervention significantly reduced students' test anxiety and significantly increased the post-test mean scores for all subscales, except effort regulation and extrinsic motivation. Notably, the explicit SRL teaching favourably enhanced the students' self-efficacy beliefs and extrinsic motivation to self-regulate their learning. Hence, medical schools should take serious consideration on imparting explicit learning skills instruction as it can positively impact the students' motivation and learning strategies to effectively self-regulate their learning.

ABSTRAK

Pembelajaran kendiri-terkawal (SRL), yang merangkumi kemampuan untuk mengatur strategi motivasi, kognitif dan metakognitif berdasarkan permintaan kontekstual dan tugasan, telah diiktiraf sebagai elemen penting untuk pembelajaran sepanjang hayat. Walau bagaimanapun, sorotan literatur menunjukkan defisit keupayaan di kalangan pelajarr perubatan pra-sarjana untuk mengawal pembelajaran sendiri serta kelemahan kaedah tersirat dalam membantu perkembangan SRL pelajar di sekolah perubatan. Oleh yang demikian, objektif kajian ini adalah untuk menganalisis (i) tahap asas SRL pelajar pra-klinikal dan (ii) kesan intervensi bantuan pembelajaran terhadap konsepsi SRL di kalangan pelajar. Objektif kajian ini telah didekati dari perspektif strategi motivasi dan strategi pembelajaran pelajar. Pemahaman impak intervensi ini terhadap konsepsi SRL pelajar akan memberi peluang kepada guru perubatan untuk merancang dan mereka-bentuk program sokongan pembelajaran yang berkesan bagi memperkayakan kemahiran pelajar untuk melibatkan diri dalam pembelajaran sepanjang hayat. Dalam kajian kuasi-eksperimen pra-ujian-pasca-ujian bagi satu kumpulan ini yang melibatkan pengajaran explisit mengenai strategi SRL, borang soal-selidik strategi motivasi untuk pembelajaran (MSLQ) telah diagihkan kepada pelajar perubatan pra-sarjana tahun satu dan tahun dua di sekolah perubatan Perdana Universiti-RCSI, Malaysia. Seramai 53 orang pelajar telah mengambil bahagian dalam penyelidikan ini. Tahap asas strategi motivasi dan pembelajaran SRL pelajar pra-klinikal telah ditentukan berdasarkan analisis statistik deskriptif bagi data MSLQ pra-ujian. Hasil kajian ini menunjukkan bahawa pelajar pra-klinikal mempunyai nilai tugas dan kepercayaan kawalan yang tinggi. Namun, mereka mempunyai motivasi ekstrinsik dan telah melaporkan kepercayaan efikasi diri yang rendah. Walaupun data menunjukkan bahawa para pelajar menggunakan beberapa strategi pembelajaran kognitif yang tinggi seperti organisasi dan penjelasan,

pergantungan tinggi terhadap strategi pembelajaran permukaan seperti pengulangan, dan kelemahan mereka dalam pemikiran kritis, pengawalan-kendiri metakognitif, dan strategi pengurusan sumber mencadangkan bahawa keupayaan pengawalan-kendiri pembelajaran pelajar pra-klinikal adalah tidak cekap. Analisis 'independent *t*-test' dan 'Mann-Whitney' tidak menunjukkan sebarang perbezaan yang signifikan dalam tahap asas SRL antara pelajar tahun satu dan tahun dua. Analisis 'paired-sample t-test' and 'Wilcoxon signed-rank test' menunjukan bahawa intervensi ini telah mengurangkan kecemasan ujian dikalangan pelajar dan meningkatkan skor min ujian pasca untuk semua subskala, kecuali peraturan usaha dan motivasi ekstrinsik. Pengamatan yang ketara dari pengajaran SRL eksplisit di kajian ini adalah peningkatan kepercayaan efikasi diri pelajar dan motivasi ekstrinsik untuk mengatur pembelajaran mereka sendiri yang merangsangkan. Oleh itu, sekolah-sekolah perubatan harus mengambil pertimbangan serius terhadap kaedah menyampaikan arahan kemahiran belajar secara eksplisit kerana ia dapat memberi kesan positif kepada motivasi dan strategi pembelajaran pelajar untuk mengatur pembelajaran mereka secara berkesan.

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TABLE OF CONTENT

CHAPTER 4: METHODOLOGY

CHAPTER 5: RESULTS AND DISCUSSION

LIST OF FIGURES

LIST OF TABLES

LIST OF SYMBOLS AND ABBREVIATIONS

CBSE	Comprehensive Basic Science Exam
CRL	Co-regulated learning
IQR	Interquartile Range
LASSI	Learning and Study Strategies Inventory
M	Mean
Mdn	Median
MSLQ	Motivated Strategies for Learning Questionnaire
NBME	National Board of Medical Examiners
NUS	National University of Singapore
PBL	Problem-based Learning
PSS-14	Perceived Stress Scale -14
PU-RCSI	Perdana University – Royal College of Surgeons in Ireland
RCSI	Royal College of Surgeons in Ireland
SD	Standard Deviation
SDT	Self-determination Theory
SPBL	Self-efficacy for PBL Scale
SRL	Self-regulated Learning
SRLP	Self-regulated Learning Perception
TES	Tutor Evaluation Scale
UM	University of Malaya

LIST OF APPENDICES

CHAPTER 1: INTRODUCTION

1.1   Introduction

The transformation in the concept of learning, from knowledge absorption to knowledge construction, has brought a tremendous paradigm shift in the medical education landscape over the past decades (Williamson, 2015). As a consequence, the pedagogical knowledge and approaches have evolved remarkably, demanding for learning to occur outside of the formal educational settings (Bjork, Dunlosky, & Kornell, 2013). This changes also mark the increasing needs for the medical students to self-regulate their learning.

Self-regulated learning (SRL) underlines the active and constructive learning process in which the learners' cognition, motivation and behaviour are systematically oriented towards the attainment of academic goals (Schunk, 2005; Schunk & Zimmerman, 2012). The SRL is broadly, regarded as a cyclical process that involves persistent modification of strategies to achieve optimal academic functioning (Panadero, 2017; Puustinen & Pulkkinen, 2001; Sandars & Cleary, 2011; Williamson, 2015). According to the Pintrich SRL model, the cycle constitutes four phases, each of which involves the regulation of motivation or affective, cognition, behaviour and context (Pintrich, 2000). These four phases include (1) forethought, planning and activation, (2) monitoring, (3) control, and (4) reaction and reflection (Pintrich, 2000).

Self-regulated students are, therefore, adept in planning, monitoring, regulating and evaluating their actions to tackle academic challenges. Multiple studies have reported the significant positive effects of SRL on academic success (Kaiser, Reppold, Hutz, & Almeida, 2019; Kosnin, 2007; Wolters & Hussain, 2015). In these studies, students that

were able to self-regulate their learning were characterized as more efficient, strategic and gritty during learning. The roles of SRL in medical education are discussed further in Chapter 2 (Page 20).

Besides the Pintrich's SRL model (Pintrich, 2000), several other theoretical SRL have made a considerable contribution in our understanding how students engage in learning for self-improvement, in expanding expertise or in acquiring information (Panadero, 2017; Stolp & Zabrucky, 2009). Some examples of these theoretical models include the Cyclical Phases model (Zimmerman, 2002), Dual Processing Self-regulation model (Boekaerts, 2011), Metacognition and Affective Model of Self-regulated Learning Model (Efklides, 2011), and Socially Shared Regulated Learning Model (Järvelä & Hadwin, 2013). The common elements that were consistently identified in these models were metacognition, motivation and emotion (Panadero, 2017). Although each model places a different level of emphasis for these elements, it is generally conceded that all three elements are integral to SRL (Greene & Schunk, 2018).

The concept of metacognition describes the meta-level skills that the self-regulated students employ to consciously and deliberately monitor, regulate, evaluate and manipulate their cognitive strategies and processes (Flavell, 1979; Kuhn, 2000). There are two facets to the metacognitive skills (Baker, Millman, & Trakhman, 2020). First is the metacognitive knowledge which relates to the awareness about one's cognitive strategies and processes. This includes insight into approaches to manage those strategies and processes to maximize learning (Stolp & Zabrucky, 2009). Second is the metacognitive regulation that represents the cognitive processes which are used to evaluate and regulate the cognitive activities in order to accomplish the task (Stolp & Zabrucky, 2009). In applied terms, the metacognitive skills in health professional

education have been linked to critical thinking and prevention of medical errors in clinical settings (Medina, Castleberry, & Persky, 2017).

However, metacognition skills alone are not sufficient to promote SRL (Pintrich & De Groot, 1990). Metacognition is fuelled by the students' motivation and emotion, which are influenced by the salient beliefs about the academic task and control over the learning environment (Boekaerts, 2011; Efklides, 2011; Muwonge, Schiefele, Ssenyonga, & Kibedi, 2017). It was shown that persistent efforts to perform learning behaviours are exerted when positive epistemic beliefs, as well as psychology, are perceived (Kaiser et al., 2019). Students with the capability to self-regulate their learning believe that intelligence is not inherent, and attribute their success and failure to factors within their control (Paris & Paris, 2001). Nevertheless, some studies have suggested that the connection between motivation and metacognition functions bi-directionally. It was shown that metacognitive adeptness could also stimulate students' motivation to self-regulate their learning (Ata & Abdelwahid, 2019; Zepeda, Richey, Ronevich, & Nokes-Malach, 2015).

On another note, the SRL models also advocate that the learning behaviour operates based on the nature of goal or criterion set by students for themselves (Boekaerts & Corno, 2005). Based on the achievement goal theory, there are two general paths to achievement that determines the students' learning behaviour (Dweck & Leggett, 1988). The first is the mastery goal which has been associated with intrinsic motivation. This goal orientation drives students towards deep learning and self-improvement (Vrugt & Oort, 2008). The second is the performance goal which has been associated with extrinsic motivation. The performance goal motivates students towards gaining recognition and up-holding self-worth (Vrugt & Oort, 2008). Collectively, these pieces of evidences

depict the complexity of the framework that operationalizes SRL behaviour. Due to this complexity, there are diverse instruments and measurement methods of SRL that exist (Panadero, 2017). Among these, the Motivated Strategies for Learning Questionnaire (MSLQ) is one of the most widely used instrument in the empirical investigation of SRL (Roth, Ogrin, & Schmitz, 2016).

The MSLQ was developed in 1991 by Paul R. Pintrich and colleagues using a social-cognitive theoretical view of motivation and learning strategies (Duncan & McKeachie, 2005; Pintrich, Garcia, McKeachie, & Smith, 1991) which are widely used for educational and behavioural studies. This theoretical framework assumes that the motivation and learning strategies are not fixed traits of the learner. It suggests motivation is dynamic and contextually bound, and that the learning strategies can be learned and controlled (Duncan & McKeachie, 2005). The MSLQ has been used extensively in the field of SRL research, as is described in more detail in the subsequent chapters. In the next section, the rationale behind this study is discussed.

1.2 Rationale of the Study

Educational psychologists have two divergent views on how students can learn to be self-regulated learners. The transmission view necessitates the role of educators in imparting explicit information about effective SRL strategies and construct opportunities within the learning environment to practice and master the strategies (Lucieer, Jonker, Visscher, Rikers, & Themmen, 2016; Paris & Paris, 2001). On the contrary, the developmental view identifies the SRL as a coherent behaviour that is moulded as students adapt and mature in their unique learning environment (Matsuyama et al., 2019; Paris & Paris, 2001). This view advocates that educators should recognize and understand

the students' SRL behaviours and aspired identities in order to promote the development of their SRL through the 'zone of proximal development' (Paris & Paris, 2001).

The medical educators at Perdana University – Royal College of Surgeons in Ireland (PU-RCSI) School of Medicine believe that both approaches are crucial to support students in becoming more adept, effortful and independent in their academic pursuits. Shreds of evidences from past studies indicate that students' SRL proficiency varies considerably, especially during transition stages (Bjork et al., 2013; Bowman, 2017). Therefore, both approaches are assumed to be essential for medical education as they play an exclusive function in the development of students' SRL competence.

The PU-RCSI School of Medicine works alongside with the Royal College of Surgeons in Ireland (RCSI) to deliver the RSCI 5-year undergraduate medical programme in Malaysia. The preclinical years of the curriculum are delivered mainly through lectures, small group teaching, laboratory-based teaching, early patient contact, seminars and projects. While the curriculum is not entirely student-centred, some key features of SRL such as self-motivating, self-processing of knowledge, personal learning responsibilities and reflecting thinking are integrated and interspersed in the programme to engage the students in SRL (Siddaiah-Subramanya, Nyandowe, & Zubair, 2017). For instance, all learning materials are made available to students in advance through the Moodle™ learning management system, and thus, they are expected to initiate and manage their learning proactively. Besides, the self-paced online quizzes, anatomy and clinical skills sessions, projects and seminars provide students opportunities to plan, monitor and evaluate their progress.

The crux of the present research is the explicit teaching of SRL strategies to the preclinical students. Many studies supported the notion that students often arrive at university with inadequate strategies for independent learning (Ainscough, Stewart, Colthorpe, & Zimbardi, 2018; Bowman, 2017; Pintrich, McKeachie, & Lin, 1987). This also holds true for medical students even though that they are selected based on their perfect grades in their pre-university educations. This is primarily seen as a repercussion of the heavily teacher-centred pre-university education system that concentrates on linear learning, textbooks, and teacher-monitored comprehensions. Therefore, students endure many learning challenges in the early transition phase and failures could attribute to the development of negative beliefs about their capabilities to be successful in medical school, especially when intelligence is seen as inherent aptitude (Ainscough et al., 2018; Bowman, 2017; Hofer & Yu, 2003). Hence, these students could benefit from explicit instruction on learning strategies to address challenges and learning strategies deficits.

In this study, a learning support workshop was carried out at the beginning of the academic year in September 2019. This workshop was designed to provide "conditional knowledge", which refers to the knowledge of when, and why to use the learning strategies. Therefore, students were not only were taught the cognitive and metacognitive learning strategies but also were exposed to relevant learning theories such as the Atkinson and Shiffrin's information processing theory (1986) and Albert Bandura's social learning theory (1977). Studies have shown that interventions which are based on conditional knowledge were able to promote active and independent learning as compared to those that focused on declarative knowledge (what strategies are available) and procedural knowledge (how to use the strategies) (Hofer & Yu, 2003; Pintrich et al., 1987; Simpson, Stahl, & Francis, 2004; Weinstein, Husman, & Dierking, 2000).

1.3 Problem Statement

Previous sections have depicted the gravity of SRL in influencing students' success in medical school and beyond, and that the SRL comprises a set of skills that can be learnt. A recent systematic review on learning support intervention for first-year medical student underlined four areas support programmes tailored to facilitate the students' personal and professional growth (Kebaetse et al., 2018). These areas include basic content knowledge learning and study skills that address SRL and metacognition development, personal and professional skills, and program expectation-related elements (Kebaetse et al., 2018). However, there is a lack of evidence in published literature in medical education to understand the role of explicit teaching of SRL in medical education specifically.

Most of the SRL support interventions in medical education pursues the developmental view in enhancing the students' SRL skills, whereby the instructions are embedded in the curriculum and are implicit (Demirören, Turan, & Öztuna, 2016). Problem-based learning has been identified as the most common approach in medical education to encourage and develop SRL skills (Demirören et al., 2016). However, a recent finding seems to suggest that SRL skill did not develop during medical school when it was made implicit, regardless the type of curriculum (Lucieer, van der Geest, et al., 2016).

Multiple studies have reported the deficits in the preclinical students' motivated learning strategies that are appropriate with the demands of higher education (Grafton-Clarke & Garner, 2018; Hamid & Singaram, 2016; Miller, 2014; West & Sadoski, 2011; Zhou, Graham, & West, 2016). While the admission of medical students to PU-RCSI School of Medicine is purely based on students' excellent academic performance in their pre-university educations, more often, their early academic performance in the medical school is more mediocre than expected. The reality of learning in medical school is more

challenging than the pre-university education. In medical school, the learning is less structured, learning material is voluminous and time for processing is minimal (Grafton-Clarke & Garner, 2018). Many students reported that they tend to get demotivated easily and use surface learning approaches. Interviews with students at risk revealed that they are highly dependent on the lecture notes and used rote learning strategies like passive rehearsing and re-writing notes (Students' Progress Committee Meetings, Perdana University). Unless these students come to a better understanding of SRL strategies and start engaging in enduring and meaningful learning, they will not be able to function effectively in the clinical years (Cho, Marjadi, Langendyk, & Hu, 2017a).

Moreover, the literature on SRL in medical education revealed that the most studies in this field are concentrated on the students in the clinical years or residents in speciality training (Berkhout et al., 2015b; Berkhout, Helmich, Teunissen, van der Vleuten, & Jaarsma, 2017; Cho et al., 2017a; Cho, Marjadi, Langendyk, & Hu, 2017b; Turan & Konan, 2012; van Houten-schat, Berkhout, Dijk, & Endedijk, 2018). The emphasis on strategies to cultivate and support SRL in the pre-clinical years for some reason is limited (Lee et al., 2019). Some studies have suggested that SRL development occurs more effectively in the workplace rather than the classroom (Berkhout, Helmich, Teunissen, van der Vleuten, & Jaarsma, 2018; van Houten-schat et al., 2018). It is believed that the less-structured instructions and dynamic nature of the learning environment during the clinical phase provide the learner with more autonomy and control over their learning processes (Lee et al., 2019). Yet, studies have revealed that most physician themselves are unprepared to effectively self-regulate their learning (Artino et al., 2012).

1.4 Research Objectives

Based on the problem statement above, the present study was aimed to impart explicit instruction on SRL strategies to the preclinical students and evaluate the impact of this intervention on their conception of SRL, as compared to their baseline level of SRL. The specific objectives of this study were;

1. To analyse the baseline level of the preclinical students' SRL from the;
   a) motivation orientation dimension;
   b) learning strategies dimension.

2. To analyse the impact of the learning support intervention on the preclinical students' conception of SRL from the;
   a) motivation orientation dimension;
   b) learning strategies dimensions.

1.5 Research Questions

Four important research questions emerged from the research objectives stated in the section above. These research questions were;

1. What is the baseline level of the preclinical students' self-regulated learning from the dimensions of;
   a. motivation orientation
   b. learning strategies

2. Is there a significant difference between the first-year and second-year medical students' self-regulated learning from the dimensions of;

a. motivation orientation

b. learning strategies

3. Did the learning support intervention bring about a significant change in the preclinical students' conception self-regulated learning from the dimensions of;

a. motivation orientation

b. learning strategies

4. Is there a significant difference in the preclinical students' conception of SRL induced by the intervention between the first-year and second-year medical students from the dimensions of;

a. motivation orientation

b. learning strategies

1.6   Significance of the Study

The problem statement of the present study has depicted the skewed focus of SRL research towards the students in clinical training. Despite the extensive investigation and initiatives put in place to promote SRL in clinical training, research still suggests that most physicians feel incompetent to self-regulate their learning (Artino et al., 2012). Several studies have revealed that the deficiency of initiatives in the early years of the medical education has left many students to struggle during transitions from non-clinical to clinical training and later into residency training (Teunissen & Westerman, 2011; C.B. White, 2007). This could be due to the general assumption that most people make on learning, which is learning develops naturally, and it is an inherent ability that it need not be taught (Bjork et al., 2013). Some studies in medical education suggest that medical students will gradually develop SRL as they progress through the curriculum (Loyens,

Magda, & Rikers, 2008). Nonetheless, contrasting evidence revealed that the medical students SRL skills did not differ between the first and third year in medical school (Lucieer, Jonker, et al., 2016).

As an implication, interventions to foster SRL in the preclinical stage is seen crucial to equip students with a repertoire of strategies at their disposal during the transitions and thus promote lifelong learning (Cho et al., 2017a). Therefore, the present study will provide an insight into the impact of teaching of SRL strategies explicitly to the preclinical students on their conception of SRL. In this study, the preclinical students' actual SRL level was not measured after the intervention in order to reduce the effect of confounding variables. Nevertheless, the findings of this study will enhance our understanding of how the explicit teaching of SRL strategies impacts the students' conception of self-regulating their learning. Literature evidence suggests that students' use of learning strategies is determined by their conceptions of learning (Gravoso, Pasa, & Mori, 2002; Purdie, Hattie, & Douglas, 1996). Hence the findings of this study could enable opportunities for medical teachers to plan and design a more effective learning support intervention that aligns to the needs of the preclinical students. By optimising the learning support from the early stage of medical school, medical students will transition more smoothly to medical school while enriching their learning skills.

1.7   Operational Definitions

In this section, SRL, conception, learning support intervention, baseline level and preclinical students are defined based on the context of this study.

1.7.1 Self-Regulated Learning

The conceptual framework of SRL includes the behavioural, motivational, cognitive, metacognitive, and affective aspects of learning (Panadero, 2017; Zimmerman, 2002). A self-regulated learner, therefore, can actively control and coordinate these aspects to attaining the self-determined learning goal (Pintrich, 2000; Schunk & Zimmerman, 2012). In the context of the present study, the SRL measures were circumscribed to the social-cognitive framework underpinning to the MSLQ (Duncan & McKeachie, 2005). The MSLQ views SRL from two dimensions; (1) motivation orientation and (2) learning strategies (Pintrich et al., 1991). The theoretical constructs of these dimensions and the relevant subscales are elucidated in the subsequent sections below.

1.7.1.1 Motivation Orientation

The motivation orientation dimension was based on the three theoretical constructs of motivation, including value beliefs, expectancy and affects (Duncan & McKeachie, 2005). The first construct, value beliefs, was founded on two theories; the achievement goal theory and expectancy-value theory. This construct, therefore, focuses on the students' rationales for engaging in an academic task. The MSLQ constitutes three subscales that measure the value beliefs construct including;

a) intrinsic goal orientation, which refers to students' motivation that is driven by internal rewards and their efforts are directed towards learning and mastery;

b) extrinsic goal orientation, which refers to students' motivation that is driven by external factors and rewards;

c) task value beliefs, which concerns students' judgements about the importance, usefulness and attractiveness of the task.

The second construct, expectancy, concerns the degree to which the students believe that they can accomplish a task. Two subscales measure this construct in the MSLQ, including;

a) self-efficacy, which refers to students' confidence in their ability to perform a given task;

b) learning control beliefs, which refers to students' perception of control over performance outcomes.

The third motivational construct, affect, is captured by the test anxiety subscale. This subscale taps into students' experience of concerns and fear of taking exams.

1.7.1.2 Learning Strategies

The learning strategies dimension in the MSLQ is based on three theoretical styles of learning strategies. These include cognition, metacognition and resource management strategies (Duncan & McKeachie, 2005; Pintrich et al., 1991). First construct, cognitive strategies focus on the student's use of various strategies, ranging from basic to more sophisticated approaches, for processing information. Four subscales measure the cognitive strategies in the MSLQ including;

a) rehearsal, which is the most basic cognitive strategy, refers to the repetition of information to oneself;

b) elaboration, which refers to paraphrasing and summarizing information;

c) organization, which refers to assembling information in a systematic order;

d) critical thinking, which refers to the ability to evaluate new ideas and applying them in unique circumstances.

The second construct, metacognitive strategies, is measured by a single subscale. This construct attempts to capture the students' ability to plan and set goals, monitor their comprehension of knowledge and regulate their cognitive processes.

The third construct, resource management, concerns the students' regulatory strategies for controlling resources other than their cognition. Four subscales measure this construct in the MSLQ, including;

a) time and study environment management, which refers to students' appropriate use of time, skills and resources;

b) effort regulation, which refers to students' persistence and grit in learning when faced with difficulties;

c) peer learning, which refers to collaborative learning strategies;

d) help-seeking, which refers to seeking assistance from peers or instructors when needed.

1.7.2 Conception

Research on the conception of learning tracks back to over than 50 years ago. Much of the early research in this field came from the work of William Perry, who investigated the epistemological belief of undergraduate students (Purdie et al., 1996). Evidence from his research revealed the link between epistemological beliefs and reformation in learning approaches (Cano & Cardelle-Elawar, 2004). It was shown that the learning conception is dynamic in nature and the students' past experiences mould their learning conception and influence their deployment of different modes of cognitive strategies (Gravoso et al., 2002).

Jan D. Vermunt and colleague (2004), defined conception of learning as "a coherent system of knowledge and beliefs about learning and related phenomena". This system of knowledge and beliefs were suggested to include awareness about oneself as an active agent of his/hers own learning, learning objectives, learning task, learning strategies, and managing learning resources (Vermunt & Vermetten, 2004). In the context of this study, conception refers to the preclinical students' construction of knowledge and beliefs about the potential regulation processes of both, motivation and cognition, as well as learning strategies that will facilitate their ability to be an effective learner.

1.7.3 Learning Support Intervention

Efforts to enhance students learning through programmes outside the normal teaching context are universally termed as learning support intervention (Hattie, Biggs, & Purdie, 1996). The learning support intervention in the context of this study refers to the 4-hours workshop that was conducted as a supplementary to the standard medical curriculum. This intervention involved direct instruction that focused on learning how to learn. The workshop content consisted of topics and activities related to mindset, socio-affective, cognitive and metacognitive learning strategies and deep learning study cycle based on Saundra McGuire's book: Teach Students How to Learn (McGuire, 2015) and Donna Wilson's book: Teaching Students to Drive Their Brains (Wilson & Conyers, 2016). As the intervention was designed to provide conditional knowledge, the relevant learning theories and concepts including Atkinson and Shiffrin's information processing theory (1986) and Albert Bandura's social learning theory (1977) were also incorporated.

1.7.4 Baseline Level of Self-Regulated Learning

The baseline level refers to the preclinical students' initial level of SRL as measured by the MSLQ (Pintrich et al., 1991), before the learning support intervention. These data

serve as the basis to which the impact of the learning support intervention on the students' SRL conception will be measured after the implementation of the intervention.

1.7.5 Preclinical Students

From the perspective of this study, the preclinical students refer to the undergraduate medical students who were commencing their first and second year of the RCSI medical programme in September 2019 at PU-RCSI School of Medicine, Malaysia.

1.8 Scope of the Study

The scope of this study only encompassed the undergraduate medical students for the RCSI medical program at PU-RCSI School of Medicine. The research included only the first-year and second-year medical students who were in the transition phase at the medical school. These students have attended the SRL learning support workshop conducted in September 2019. The measure of the students' baseline level of SRL before the intervention and their post-intervention conception of SRL was based on the MSLQ motivation orientation and learning strategies dimensions.

1.9 Limitation of Study

Given the present study was based on a quasi-experimental design, the findings were not without limitation. First, this study deployed one-group pre-test–post-test. Although this design has been criticized mainly due to the lack of a control group, it was still being used in some disciplines such as nursing, medicine, and public health (Knapp, 2016). The reason for using this design in the present study was that the students could not be randomly assigned to a control group without a learning support intervention as it would be a disadvantage to these students. The second limitation was that the MSLQ is a self-reported questionnaire. Thus, the instrument is highly dependent on often flawed self-

reporting. Although this study sought to draw a genuine and precise response from the students, the students could have subconsciously responded based on what they considered as more acceptable or would reflect better on them. The third limitation was that the interpretation of this study findings was restricted to the PU-RCSI School of Medicine's preclinical students

1.10 Chapter Summary

Literature in medical education has well documented the significance of being a self-regulated learner for both, academic success and to provide best possible care to patients. The core conceptual aspects of learning that defines SRL includes behaviour, motivation, and metacognition. In relation to these three aspects, Paul R. Pintrich depicted three central characteristics of the SRL. First, self-regulated learners consider their selves as an active agent in the learning process and hence, engages actively in the task. Second, they set goals that provide the standards to monitor their performance. The final characteristic is that the learners regulate and adapt their behaviour, motivation and cognition to meet the demands of the task. Evidence from studies highlighted that undergraduate medical students often struggle to self-regulate their learning. Based on the assumption that SRL can be learned, the present study focused on imparting direct instruction of SRL strategies to the preclinical students in facilitating their transition into medical school and to enrich their learning strategies.

As most SRL studies are focused on the clinical years and the empirical evidence on the effect of direct instruction of SRL strategies on the preclinical students' SRL is lacking, this study was devised to evaluate the impact of the direct SRL instruction on the preclinical students' conception of SRL. The findings of this study will provide better insight into the importance of supporting and establishing the preclinical students' ability

to self-regulate their learning, primarily through direct instructions. The empirical investigation of SRL in this study was done using MSLQ, which is one of the most commonly used instruments in this field. The scope of this study was confined to the first-year, and second-year medical students enrolled in PU-RCSI School of Medicine. This chapter also includes the operational definition of several terms and the limitations of the study. In the next chapter, a literature review on past research is discussed.

CHAPTER 2: LITERATURE REVIEW

2.1   Introduction

Over the past four decades, educational psychologists have extensively researched the domain of self-regulated learning (SRL) (Panadero, 2017). These studies have contributed considerably in understanding the role and significance of SRL mechanisms in establishing the lifelong learning behaviour (Hauer et al., 2018; Naeimi et al., 2019; Skinner et al., 2015; Zimmerman, 2002). Much of the earlier works in the SRL field were anchored on Albert Bandura's social cognitive theory of self-regulation, which assumes that self-regulatory mechanism was driven by the cognitive beliefs as well as the environmental and behavioural variables (Bandura, 1991). Paul R. Pintrich later emerged as the leading figure in the field of SRL, where many of his work contributed significantly towards enlightenment of the SRL conceptual framework and the role of motivation in SRL (Schunk, 2005). One of his prominent contribution in this field was the development of the Motivated Strategies for Learning Questionnaire (MSLQ), which continued to be one of the most widely used instrument in the empirical exploration of SRL (Roth et al., 2016). Hitherto, several theoretical SRL models been established to understand the underlying factors and functioning of the SRL mechanism (Panadero, 2017).

As introduced in Chapter 1, the conceptual framework of SRL entails the effective regulation and alignment of the behavioural, motivational, cognitive and metacognitive aspects of learning towards the accomplishment of the self-determined learning goals (Pintrich, 2000; Schunk & Zimmerman, 2012; Zimmerman, 2002). This conceptual framework was underpinned by four elementary SRL assumptions that form the foundation of all the SRL models (Pintrich, 2000). The first assumption defines the learners as active agents that construct their meanings of the external and internal

environments. The second assumption articulates that certain aspects of cognition, motivation, behaviour, and the environment can be potentially controlled and regulated by the learner. According to Pintrich's SRL model (2000), the regulation of these aspects occurs at different levels in each of the four phases of SRL, including the forethought and planning, monitoring, control, and reaction and reflection phase. The third assumption states that some reference values are imperative for learners to monitor their progress and to make the necessary adaptation in the learning process. The final assumption illustrates the mediating role of the SRL processes between the personal and contextual attributes and outcomes such as achievement or performance.

In higher education, where students are more often expected to take responsibility for their learning, the ability to self-regulate their learning has been identified as the key predictor of academic achievement (Kosnin, 2007). Multiple past studies have reported that high achievers are more of self-regulated learners than those than perform poorly (Agustiani, Cahyad, & Musa, 2016; Broadbent & Poon, 2015; Kassab, Al-Shafei, Salem, & Otoom, 2015). Several studies have also shown that first-year students who can self-initiate and regulate their learning and equipped with multiple learning strategies at their disposal make a more successful academic transition into university (Cazan, 2012). However, not many students arrive at the university with the adequate vital cognitive strategies and academic behaviours that will enable them to meet the demands and expectation of higher education (Ainscough et al., 2018; Bowman, 2017; Conley, 2008).

Since SRL was not considered as an inherent trait but more of selective use of specific processes to regulate cognition, motivation and behaviour, students can learn to self-regulate their learning (Zimmerman, 2002). Learning to self-regulate, however, requires students to have a greater awareness of their behaviour, motivation and cognition

(Zimmerman, 2002). This awareness will enable them to regulate their SRL processes more effectively to enhance learning. Therefore, facilitation was deemed necessary to encourage fostering of SRL processes among the undergraduate students (Berkhout et al., 2015a; Schunk & Zimmerman, 2012). The urgency for facilitating students' SRL development has drawn the attention of medical educationist, in recent years, towards unravelling the approaches that will nurture and enhance students' SRL competency. This was particularly evident in the field of medicine, which is regarded as a self-regulating profession (Hauer et al., 2018).

2.2　　Self-Regulated Learning in Medical Education and Academic Outcomes

Being a part of the profession which very much requires self-regulation, medical professionals are expected to persistently meet the high standards of practice for the optimal patient care (Brydges & Butler, 2012; Lucieer, Jonker, et al., 2016). It is thus, critical for physicians to continually identify the paucity in their competencies and deliberately participate in professional development activities to sustain their area of expertise (Artino, Jr. et al., 2012). Upholding high standards of competency while confronting challenges of workload, stress, and conflicting priorities of service and patient care would require a physician to be highly adept in self-regulating their learning (Vilppu, Laakkonen, Mikkilä-Erdmann, & Kääpä, 2019). The proficiency in SRL, which is the ability to regulate motivation and to deploy appropriate learning strategies based on the contextual and task demand, is recognized as the key element for lifelong learning (Barbosa, Silva, Ferreira, & Severo, 2018; Cho et al., 2017a). Research however, suggests that most physicians feel incompetent to self-regulate their learning (A. R. Artino, Jr. et al., 2012). As indicated by Zimmerman (2002), SRL development is a long-term process, and hence, it is crucial that nurturing of SRL skills and strategies starts at the undergraduate level of medical education (Sandars & Cleary, 2011).

The association between SRL and academic outcome in medical education has been well documented. Many studies have identified that the ability to self-regulated learning is the fundamental determinant of academic success in medical education (Gandomkar et al., 2016; Kassab et al., 2015; Zheng & Zhang, 2020). Students who developed SRL skills much earlier in medical school will be less likely to struggle and have a higher academic achievement (Andrews, Kelly, & DeZee, 2018; Barbosa et al., 2018; Gandomkar et al., 2016; Kassab et al., 2015; Zheng & Zhang, 2020). A multi-centre randomized controlled trial conducted at the US medical schools associated attrition of medical students with lack of SRL skills (Kalet et al., 2013).

While a large body of literature in medical education was focused on the cognitive aspect of SRL, some studies have also investigated the influence of motivational beliefs and emotions on SRL and academic outcomes in medical education. The studies have shown that the medical students' autonomous motivation and high self-efficacy beliefs resulted in the positive academic outcome (Demirören, Turan, & Taşdelen Teker, 2020; Feri, Soemantri, & Jusuf, 2016; Hayat, Shateri, Amini, & Shokrpour, 2020). A longitudinal study which investigated students motivation during the transition from secondary school to the medical school revealed that decreased motivation is an essential indicator of academic failure during first-year medical education (Barbosa et al., 2018).

In the clinical context, several studies have reported the correlation between medical students' SRL skill and enhanced clinical performance. Students with a higher level of self-efficacy (Turan & Konan, 2012), and metacognitive skills such as reflective and strategic thinking (Cleary & Sandars, 2011; Sobral, 2000) were shown to learn and prevail better even in the constraining circumstances of the clinical settings. The ability to self-regulate learning in the clinical setting has also been associated with positive mental

health (Van Nguyen, Laohasiriwong, Saengsuwan, Thinkhamrop, & Wright, 2015). Van Nguyen et al. (2015) found that students who lacked SRL strategies were exposed to a higher risk of experiencing depression in medical school due to the academic burden and lack of leisure time.

Taken together, these studies indirectly highlight the varying level of SRL adeptness among medical students. The deficit in the undergraduate medical students' ability to self-regulate their learning in both preclinical and clinical years have been reported and associated with poor performance (Lee et al., 2019; Lucieer, van der Geest, et al., 2016). Most undergraduate medical students reported paucity in vital SRL strategies, including metacognition and critical thinking (Lee et al., 2019). A study on the clinical students SRL level showed that although students with higher-level SRL experienced smoother transitioned into the clinical environment, they still lacked critical thinking skills (Nicole N Woods, Maria Mylopoulos, & Ryan Brydges, 2011). Nevertheless, it has been indicated that many students struggle with SRL when they transition to the clinical years (Cho et al., 2017a). Furthermore, SRL strategies for sophisticated clinical setting was shown to differ from what was required in preclinical years (van Houten-schat et al., 2018).

2.3   Factors Affecting Medical Students' Self-Regulated Learning

Several qualitative research in medical education explored the factors affecting the undergraduate students' SRL. These studies identified three key attributes, including personal, contextual and social attributes, to exert imperative influences the medical students' SRL. In terms of personal attributes, the unawareness of own learning processes (Berkhout et al., 2015a), inappropriate selection of learning strategies, lack of motivation as well as initiative to seek help, and maladaptive strategies for coping with failure have

been shown to negatively affect students SRL (Patel, Tarrant, Bonas, Yates, & Sandars, 2015). Patel et al. (2015) also reported that the inadequacy in self-reflection led these students to attribute their failure to external factors beyond their control.

With regards to contextual attributes, several studies highlighted that students-centred learning models such as the problem-based learning (PBL) curriculum strengthened students' SRL skills and led to a smooth transition in the clinical environment (Berkhout, Helmich, et al., 2017; White, 2007). However, the role of PBL in enhancing students' SRL is still ambiguous as Lucieer et al. (2016) showed that the SRL level of students transitioning into the clinical environment was generally low, irrespective of the type of curriculum that they attended. The shortfall in flexibility and autonomy in the clinical environment was found to impede students SRL (Berkhout et al., 2015a; Lyons-Warren, Kirby, & Larsen, 2016).

In the perspective of social attributes, relationships pertaining to peers, hospital staffs and teachers have been shown to influence students' SRL in the clinical setting (Berkhout et al., 2015a; Bransen, Govaerts, Sluijsmans, & Driessen, 2020; Demirören et al., 2020; Jouhari, Haghani, & Changiz, 2015). Demirören et al. (2020), stated that tutor's coaching skills played a significant role in enhancing students' SRL in the PBL context. One study reported that the support and encouragement of family members influence students SRL (Jouhari et al., 2015). Lee et al., (2019) underlined that the inadequacy of SRL support from the teachers in the early year resulted in the difficulties for students to self-regulate their learning in the clinical environment.

2.4   Self-Regulated Learning Research Methodologies in Medical Education

Within the literature of higher education, numerous instruments have been and used to measure the SRL among students. Among these instruments, the self- questionnaires have been identified as the most frequently used instrument in the field of SRL (Roth et al., 2016). According to Winne and Perry (2000), the development of SRL instruments were greatly influenced by the way that SRL was conceptualised. Therefore, there are two major categories of SRL instruments; component-oriented approach and process-oriented approach (Winne & Perry, 2000). Instruments that are based on the component-oriented approach, viewed SRL as the learners'attributes or predisposition to engage proactively in learning, irrespective of the different stages in the learning process. In contrast, instruments based on process-oriented approach focuses on defining the learning progress through the lens of distinct SRL stages. The Pintrich's SRL model (2000), for instance, distinguishes SRL process into four different phases, including forethought/planning, monitoring, control, and reaction/reflection phase.

The SRL research methodologies within medical education are summarised in Table 2.1 (Page 27). The summary shows that three types of study designs, including quantitative (Cho et al., 2017a; Demirören et al., 2020; Khalil, Williams, & Gregory Hawkins, 2018; Siddiqui & Khan, 2020; Soemantri, McColl, & Dodds, 2018), qualitative (Bransen et al., 2020; Matsuyama et al., 2019; Zheng, Ward, & Stanulis, 2020) and mixed methods (Gandomkar et al., 2020; Lee et al., 2019; Zheng & Zhang, 2020) have been commonly used in the past studies. While a vast majority of the studies were focused on the component-oriented approach to elucidate the undergraduate medical students' SRL, only one study in the past four years applied the process-oriented approach (Zheng et al., 2020). Zheng et al. (2020) used a semi-structured interview to evaluate the medical students use of SRL strategies in the planning, monitoring and reflection phase of

learning. In that study, it was shown that the students' used of SRL learning strategies more regularly in the planning and reflection phase as compared to the monitoring phase.

The review of SRL research methodologies also identified four different instruments, including MSLQ, Self-regulated Learning Perception (SRLP), microanalytic measure, and the Learning and Study Strategies Inventory (LASSI), that were used to measure students' SRL levels. Among these instruments, the MSLQ appeared as the most popular instrument used in the medical education field. In fact, the MSLQ has been reported as the most widely used instrument of SRL measure in higher education (Roth et al., 2016). This instrument is based on the component-oriented approach that measures the students' motivation orientation and learning strategies.

As the research questions of the present study were the component-oriented, the MSLQ was chosen to profile the preclinical students' motivation and learning strategies before and after the SRL learning support intervention workshop. Furthermore, the reliability and predictive validity of MSLQ has been verified by multiple studies (Lee et al., 2019).

Table 2.1: Summary of Self-Regulated Learning Research Methodologies in Medical Education

Citation	Research	Study Design	Instrument and Analysis	SRL Measure Approach	Outcome
Zheng & Zhang, 2020	Self-regulated learning: the effect on medical student learning outcomes in a flipped classroom environment	Mixed-methods	A modified version of the MSLQ with 56 items and 5-open ended questions on students' perception on flipped classroom was used. Multiple regression analysis was used to explore the self-regulated learning skills that affect preclinical students' performance in the National Board of Medical Examiners (NBME) and the Comprehensive Basic Science Exam (CBSE). Qualitative data was analysed using conventional content analysis.	Component-oriented	In the flipped-classroom environment, peer learning and help-seeking positively affected the performance of the first and second-year students respectively, while use of rehearsal had a negative effect on learning outcome. The qualitative analysis showed that peer learning helped students to stay engaged and exposed to new ways of thinking.
Siddiqui & Khan, 2020	Correlation between stress scores and self-regulated learning perception scores in Pakistani students	Quantitative correlational study	Perceived Stress Scale-14 (PSS-14) and Self-regulated Learning Perception (SRLP) scale was used. Pearson's correlation was used to examine the relationship between the students' stress levels and the self-regulated learning skills	Component-oriented	A moderate positive correlation between stress and self-regulated learning skills was observed among the medical student (first to fifth year). It was suggested that mild stress can direct students towards self-regulation.

Table 2.1: Summary of Self-Regulated Learning Research Methodologies in Medical Education (Continued)

Citation	Research	Study Design	Instrument and Analysis	SRL Measure Approach	Outcome
Demirören, Turan, & Teker, 2020	Determinants of self-regulated learning skills: the roles of tutors and students	Quantitative cross-sectional study	The study used SRLP scale, self-efficacy for PBL scale (SPBL), tutor evaluation scale (TES). Pearson product-moment correlation was used to analyse relationship between the students' SRLP, SPBL, TES, and achievement scores. Multiple linear regression was performed to examine the students' self-regulated learning abilities, based on their SPBL levels, tutor evaluations, and academic achievement.	Component-oriented	No significant relationship between SRLP and achievement in PBL was observed among third year students. However, a significant positive relationships between SRLP and SPBL, and TES was observed suggesting that self-efficacy scores increased as the SRL skills score rose. Students also perceived that tutor's skills were important in developing their SRL skills and self-efficacy.
Zheng, Ward, & Stanulis, 2020	Self-regulated learning in a competency-based and flipped learning environment: learning strategies across achievement levels and years	Qualitative	Preclinical students were divided as high achieving, struggling, and students who made a jump in achievement across the year. A semi-structures interview was conducted to examine students' process for studying for a typical week. For content analysis, planning, monitoring and reflecting was used as coding scheme to analyse students learning strategies.	Process-oriented	The students use strategies in the stages of planning and reflection, but less frequently during the monitoring phase. Students who perceived themselves as high achieving, and those in second year use more learning strategies during the monitoring stage than their counterparts. More explicit instruction in how to monitor learning is required

28

Table 2.1: Summary of Self-Regulated Learning Research Methodologies in Medical Education (Continued)

Citation	Research	Study Design	Instrument and Analysis	SRL Measure Approach	Outcome
Gandomkar, Yazdani, Fata, Mehrdad, Mirzazadeh, Jalili, & Sandars, 2020	Using multiple self-regulated learning measures to understand medical students' biomedical science learning	Mixed-methods	A microanalytic measures were administered before (self-efficacy, goal setting and strategic planning), during (metacognitive monitoring) and after (causal attributions and adaptive inferences) a biomedical science learning task. Students written materials were collected as SRL trace data to capture students' use of learning strategies. A full version of MSLQ was also administered. Performance outcome was measured as score on examination at end of course. Correlation analyses were used to determine the correlations between the three SRL assessment measures. Bivariate and multiple analyses were conducted to compare participants on different course or task performance	Component-oriented	Microanalytic metacognitive monitoring, causal attributions and adaptive inferences, and SRL trace strategy use had significant associations with task performance. Microanalytic self-efficacy, metacognitive monitoring and causal attributions and SRL trace strategy use and MSLQ self-efficacy had significant associations with course performance.

Table 2.1: Summary of Self-Regulated Learning Research Methodologies in Medical Education (Continued)

Citation	Research	Study Design	Instrument and Analysis	SRL Measure Approach	Outcome
Bransen, Govaerts, Sluijsmans, & Driessen, 2019	Beyond the self: The role of co-regulation in medical students' self-regulated learning	Qualitative	The study involved semi-structured interviews with 11 purposively sampled clinical students. Data analysis followed stages of open, axial and selective coding	Component-oriented	Co-regulated learning (CRL) in the clinical setting is an important factor influencing students SRL skills development. Three major shifts were observed; (1) selection of CRL partner from peers to clinical role models, (2) SRL behaviour, from external to internal motivation, and (3) regulatory focus from task-orientation to professional competence.
Matsuyama, Nakaya, Okazaki, Lebowitz, Leppink, & van der Vleuten C, 2019	Does changing from a teacher-centered to a learner-centered context promote self-regulated learning: a qualitative study in a Japanese undergraduate setting	Qualitative	Three focus groups analysis that examined 13 Japanese medical students who moved from traditional curriculum to learner-centred 7-months elective course.	Component-oriented	The learner-centred course resulted in diversification of learning strategies

Table 2.1: Summary of Self-Regulated Learning Research Methodologies in Medical Education (Continued)

Citation	Research	Study Design	Instrument and Analysis	SRL Measure Approach	Outcome
Lee, Samarasekera, Sim, Hong, Foong, Pallath, & Vadivelu, 2019.	Exploring the Cultivation of Self-Regulated Learning (SRL) Strategies Among Pre-Clinical Medical Students in Two Medical Schools	Mixed-methods	MSLQ was used to examine the SRL strategies among pre-clinical students in two medical schools. Data on the approaches that promote SRL was collected using semi-structured interviews with faculty members and focus group discussions with students. Descriptive statistics and thematic analysis were used to analyse the data.	Component-oriented	Students from both institutions have high task value and are intrinsically motivated. They reported to use elaboration and organisation strategies the most. Three themes were identified from the qualitative analysis, including characteristics of strategies that promote SRL, hindrance in promoting SRL, and opportunities in promoting SRL.
Khalil, Williams, Hawkins, 2018	Learning and study strategies correlate with medical students' performance in anatomical sciences	Quantitative	This study used Learning and Study Strategies Inventory (LASSI) scores in relation to the preclinical student's performance in the anatomical sciences and USMLE Step 1 examinations. Descriptive statistics were used to analyse students' performance score and Pearson Product-Moment correlation was performed to evaluate strength of association and correlation between LASSI ten-subscale scores and these measures of students' performance	Component-oriented	Five of the ten LASSI subscales, including anxiety, information processing, motivation, selecting main idea, and test strategies were associated with students' performance in the anatomical sciences and USMLE Step 1 examinations.

Table 2.1: Summary of Self-Regulated Learning Research Methodologies in Medical Education (Continued)

Citation	Research	Study Design	Instrument and Analysis	SRL Measure Approach	Outcome
Soemantri, Mccoll, & Dodds, 2018	Measuring medical students' reflection on their learning: modification and validation of the motivated strategies for learning questionnaire (MSLQ)	Quantitative	A systematic search identified MSQL as the most suitable instrument to measure students' reflection on their learning. Original MSLQ was modified and factor analysis was performed using rating by preclinical and final year medical students.	Component-oriented	The Modified MSLQ provides means to evaluate individual medical students' reflections on their learning.
Cho, Marjadi, Langendyk, & Hu, 2017	Medical student changes in self-regulated learning during the transition to the clinical environment	Quantitative	The MSLQ was administered at commencement of the third-year students' first clinical placement (T0), and 10 weeks later (T1). MSLQ, the data were categorized into 3 categories: low scores (1.0 to <2.5), medium scores (2.5 to <5), and high scores (5 to <7). The differences of MSLQ subscales between T0 and T1 was assessed using The Marginal Homogeneity Test. The influence of dependent variables on MSLQ subscale changes were analysed using ordinal logistic regression and multiple logistic regression.	Component-oriented	At T1, the students' extrinsic goal orientation increased while their metacognitive regulation decreased. The study suggests that interventions to promote metacognition before the clinical immersion may possibly preserve students' SRL during the transition

2.5   Motivation Aspects of Self-Regulated Learning

Motivation is an essential psychological concept in education (Tanaka, Fukuda, Mizuno, Kuratsune, & Watanabe, 2009). It is described as the internal state that impels and sustains actions and behaviours (Garcia & Pintrich, 1993). When a learning task is encountered, self-regulated learners immerse not only in cognitive and metacognitive strategies but also motivational strategies. The motivational strategies are affect-related processes that influence the effort investment in the learning task (Garcia & Pintrich, 1993).

While there were many models of motivation pertaining to learning (Pintrich & Schunk, 1996), the focus of the current study was limited to three general types of motivational constructs relevant to the MSLQ including (i) value beliefs, (ii) expectancy and (iii) affect. The value construct refers to the reasons for students to engage in learning task and how students perceive the importance or relevance of task to their need (Duncan & McKeachie, 2005). There are three subscales in the MSLQ that measures this construct; (1) intrinsic goal orientation, (2) extrinsic goal orientation, and (3) task value. The expectancy construct concerns the students' judgement on their abilities to perform and control the outcome of the task (Duncan & McKeachie, 2005). This construct is measured based on two subscales; (1) control beliefs, and (2) self-efficacy. The affect construct measures student's test anxiety. In the next sub-sections, the effect of these motivational subscales on students' SRL and the academic outcome is reviewed.

2.5.1   Intrinsic and Extrinsic Goal Orientation

The achievement goal theory has been found useful to explain students' motivation to engage in learning (Kaplan & Maehr, 2007). This theory posits that students' achievement goals can orientate and influence their learning behaviour. There are two distinct types of

learning goal orientations, which is the intrinsic or mastery goal orientation and extrinsic or performance goal orientation. The intrinsic goal orientation, which relates to the intention to engage in learning for its inherent satisfaction autonomously, results in high-quality learning (Pelaccia & Viau, 2017). On the contrary, extrinsic goal orientation, which relies on external impetus such as rewards, praise, and grades, results in surface learning strategies (Pelaccia & Viau, 2017). According to Pintrich and De Groot (1996), intrinsic goal orientation influenced students' choice to become more cognitively engaged in deep learning rather than the academic outcome. This goal orientation was strongly related to the use of a higher level of cognitive and metacognitive strategies and not associated with self-efficacy and test anxiety (Pintrich & De Groot, 1990). Furthermore, Pintrich and De Groot (1996) suggested that intrinsically oriented students persisted on their academic work. Within the medical education literature, several studies have reported that a positive and significant correlation between intrinsic motivation and high academic performance (Hayat et al., 2020; Schutte et al., 2017). Both intrinsic motivation (Roohi et al., 2013) and extrinsic motivation (Wu, Li, Zheng, & Guo, 2020) have been positively associated with self-efficacy and meaningful cognitive engagement.

2.5.2   Task Value

The task value beliefs in the MSLQ is rooted in the expectancy-value theory (Duncan & McKeachie, 2005). The Eccles et al. expectancy-value model of achievement (1983) postulated that there are the four components to task value (Eccles & Wigfield, 2002). These components include the (1) attainment value, which pertains to perception on the self-worth of performing a task well, (2) intrinsic value, which relates to the interest one may have over the task or the perception about the contentment in performing the task, (3) utility value, which relates to how well a task may facilitate the critical current or future goals, and (4) cost, which is conceptualised as anxiety or fear of failure, lost

opportunities form choosing task over another, and amount of effort investment required (Eccles & Wigfield, 2002).

Therefore, students with higher task value beliefs were more likely to engage in SRL (Artino Jr & Stephens, 2009). Research findings among students in higher education showed that the task value beliefs correlate positively with the use of cognitive strategies such as the rehearsal, elaboration, and organisational strategy use among (Pintrich, 1999). Pintrich (1999) hypothesised that students with high task value belief have a greater tendency to use more metacognitive regulation. His researches also suggested that task value beliefs are positively correlated with academic outcomes. A study among second-year medical students showed that the task value beliefs were positively associated with course-related enjoyment and were negatively related to boredom (A. R. Artino, La Rochelle, & Durning, 2010).

2.5.3   Control Beliefs

Control beliefs refer to the students' perceptions of the likelihood that their actions will lead to specific outcomes. A study among Japanese high school students showed that the use of cognitive and metacognitive strategies positively correlated with control beliefs (Yamauchi, Kumagai, & Kawasaki, 1999). In another study among the North American high school students, it was shown that students control beliefs can be escalated by some social factors within the educational setting, such as cooperation and autonomy-supportive teachers (Rousseau & Vallerand, 2000).

2.5.4   Self-Efficacy

Self-efficacy is one of the most studied motivational beliefs in relation to self-regulated learning and academic performance. Self-efficacy belief was defined as

students' judgement of in their capabilities to perform tasks at a defined level (Turan, Valcke, Aper, Koole, & Derese, 2013). A critical review of 74 research articles on the self-efficacy beliefs of medical students confirmed that this motivational belief facilitated learning and development of medical students (Klassen & Klassen, 2018). Research findings showed that the increased self-efficacy lead not only to more use of cognitive and metacognitive strategies but also boosted students grit to endure difficult or uninteresting academic tasks (Pintrich & De Groot, 1990). Dempsey and Kauffman (2017) demonstrated that role models are influential in developing medical students'self-efficacy beliefs. In a separate study, self-efficacy beliefs were negatively associated with course-related anxiety only (Artino et al., 2010).

2.5.5 Test Anxiety

Test anxiety taps into the students' worries and fears about their capabilities to perform in exams (Duncan & McKeachie, 2005). Research evidence suggests that test-anxiety does not mean that the students have inadequate cognitive skills for encoding or organizing course material (Naveh-Benjamin, McKeachie, & Lin, 1987). Instead, this emotion has been linked to information retrieval issues at the time of testing and interferes with effective performance (Pintrich & De Groot, 1990). A recent study among second-year medical students reported that test-anxiety did not impact academic performance (Hahn, Kropp, Kirschstein, Rücker, & Müller-Hilke, 2017).

2.6 Cognitive and Metacognitive Strategies of Self-Regulated Learning

Self-regulated learning skills generally entails the exploitation of a range of cognitive strategies and most importantly, the regulation of cognition with metacognitive strategies (Garcia & Pintrich, 1993). A self-regulated learner has a repertoire of learning strategies that they can mindfully select and use to approach different tasks (Weinstein & van Mater

Stone, 1993). The MSLQ measures four cognitive strategies commonly used by students including rehearsal, elaboration, organization and critical thinking. The metacognitive strategies, including planning, monitoring and regulating, formed a single construct in the MSLQ (Duncan & McKeachie, 2005). In the next sub-sections, the effect of these cognitive and metacognitive subscales on students' SRL and the academic outcome is reviewed.

2.6.1   Rehearsal, Elaboration, Organization and Critical Thinking

The most basic cognitive strategy is the rehearsal. Rehearsal involves learning through repetition of information as an attempt to memorize material (Duncan & McKeachie, 2005; Garcia & Pintrich, 1993). This strategy involves shallow processing and leads to the acquisition of knowledge at the surface level (Broadbent & Poon, 2015; Wolters, Pintrich, & Karabenick, 2005). Elaboration and organization are more complex strategies that lead to a deeper processing of information (Duncan & McKeachie, 2005; Wolters et al., 2005). Elaboration refers to the students' ability to paraphrase and summarize information to make learning more meaningful (Duncan & McKeachie, 2005). Some example of the elaboration strategies includes using imagery, mnemonics, questioning, and note taking (Schunk & Zimmerman, 2012). Organization pertains to students' ability to assembling the information in a systematic order by creating mind-maps or tables (Duncan & McKeachie, 2005). Critical thinking involves a more deeper processing than elaboration and organization, where students will have the ability to evaluate new ideas and apply them in novel situations (Duncan & McKeachie, 2005). Most medical students have reported high use of elaboration and organization learning strategies (Lee et al., 2019).

2.6.2 Metacognitive Self-Regulation

Metacognition is one of the core elements of SRL (Panadero, 2017). Metacognitive self-regulation entails various planning, monitoring, and regulation strategies that a self-regulated use adapt and enhance learning (Duncan & McKeachie, 2005). Some example of metacognitive strategies includes setting goals for studying, performing task analysis, skimming reading material in advance, monitoring comprehension, tracking attention, self-testing, regulating behaviour and refining cognitive strategies to repair deficits in comprehension (Pintrich, 1999; Wolters et al., 2005). Within medical education literature, students' metacognition level was shown to positively influence surgical skills acquisition (Gardner, Jabbour, Williams, & Huerta, 2016).

2.7 Resource Management Strategies in Self-Regulated Learning

Resource management strategies is another significant component of self-regulatory strategies in SRL (Pintrich, 1999). These strategies concern the students' approaches and tactics to manage, control and regulate resources other than their cognition (Duncan & McKeachie, 2005). The MSLQ measures four resource management strategies that are salient to students, including time and study environment, effort regulation, peer learning and help-seeking. In the next sub-sections, the effect of these subscales on students' SRL and the academic outcomes was reviewed.

2.7.1 Time and Study Environment

Time management concerns the students' effective use study time for completing the academic task, while study environment refers to the ability to utilize learning space appropriately (Duncan & McKeachie, 2005). Students ability to effectively manage their study time and environment have been identified as an essential determinant of academic performance in medical school (Barbosa et al., 2018; West & Sadoski, 2011).

2.7.2   Effort Regulation

Past studies have suggested that self-regulated learners showed a high level of persistence and grit in learning because they held the belief that effort led to success (Ames, 1992). Effort regulating enabled students to block out distractors and drove their commitment to fulfil a task. Higher effort regulation has been hypothesized to result in higher achievement (Vrugt & Oort, 2008). Research evidence also suggested that effort regulation partially mediated the correlation between self-efficacy and academic achievements (Komarraju & Nadler, 2013).

2.7.3   Peer Learning

Peer learning is regarded as a crucial pedagogical practice in higher education as it has a significant positive effect on students' psychological well-being (Hanson, Trolian, Paulsen, & Pascarella, 2016). A study among nursing students showed that peer learning improves students' self-efficacy in clinical practice education (Pålsson, Mårtensson, Swenne, Ädel, & Engström, 2017). Peer learning has been positively linked to medical students learning outcome in a learner-centred setting such as flipped classroom and problem-based learning (Ebomoyi, 2020; Zheng & Zhang, 2020).

2.7.4   Help Seeking

Help seeking is a vital SRL strategy associated with adaptive motivation (Gonida, Karabenick, Stamovlasis, Metallidou, & Greece, 2019). Help seeking is defined as the process of becoming aware and deciding that assistance is needed to overcome academic challenges, identifying individuals that can assist, obtaining help and evaluating the help received (Aleven, Stahl, Schworm, Fischer, & Wallace, 2003). Within medical education literature, help seeking was positively linked with students' learning outcome (Zheng & Zhang, 2020).

2.8   Self-Regulated Learning Support Interventions in Medical Education

Although admission to medical schools is generally based on high prior academic performance, many studies have reported that undergraduate students experience learning challenges (Garrud & Yates, 2012; Lee et al., 2019). As compared to the medical students of the graduate medical entry programs in the United States of America, undergraduate medical students in Europe, Africa, Australia and Asia were generally found to be lacking the required behavioural attributes to cope with the rigour and demand of the medical school (Kebaetse et al., 2018). Given that inefficient cognitive skills, and paucity of self-regulation and metacognition were some of the significant factors for academic failure in the undergraduate medical education (Gettinger & Seibert, 2002; Patel et al., 2015), the need for supporting the medical students' SRL development have been stressed by many medical educational psychologists (Cho et al., 2017a; White, 2007; White, Gruppen, & Fantone, 2014).

A literature search in medical education identified several SRL support intervention programmes. Table 2.2 summarises the focus, approach, strategy and outcomes on these intervention programs. There were generally three approaches that have been used in the medical education SRL support interventions programs. The most common approach was the developmental proactive approach (Cheung et al., 2018; Dempsey & Kauffman, 2017; Hauer et al., 2018; Kiger et al., 2020; Leggett, Sandars, & Burns, 2012; Patel, Green, Shahzad, Church, & Sandars, 2020; Thomas, Bennett, & Lockyer, 2016; Xu et al., 2018). The developmental proactive approach focuses on facilitating lifelong learning skills, and personal and professional growth of all students, irrespective of academic performance (Sandars, Patel, Steele, & McAreavey, 2014). This approach has been suggested to reduce stigmatisation among students as compared to the deficit-proactive and deficit-reactive approaches (Kebaetse et al., 2018). According to Sanders et al. (2014), the deficit-

proactive approach involves facilitation for students who were perceived or identified at risk before failure in assessments, while deficit-reactive approach focuses on remediation for failed students. Only two studies were identified to follow the deficit-proactive approach (Andrews et al., 2018) and deficit-reactive approach (Winston, Van der Vleuten, & Scherpbier, 2010) in medical education.

Overall, the interventions listed in Table 2.2 (Page 42) showed positive outcomes in improving students' prescribing competency (Patel et al., 2020), SRL skills (Kiger et al., 2020; Patel et al., 2020; Thomas et al., 2016), knowledge acquisition and retention (Cheung et al., 2018; Xu et al., 2018), academic performance (Andrews et al., 2018; Hauer et al., 2018; Leggett et al., 2012) and medical skills competency (Dempsey & Kauffman, 2017). While all the intervention mentioned here aimed to improve students' SRL skills, the implicit teaching approach was shown to hamper the effectiveness of some intervention in doing so. For instance, Leggett et al. (2012) and Hauer et al. (2018) reported that students' failure to understand and appreciate the SRL processes embedded in the intervention strategies.

Table 2.2: Summary of Medical Education SRL Support Intervention Program Focus, Approach, Strategy and Outcome

Citation	Research	Focus of Intervention	Approach	Intervention Strategy	Outcomes
Patel, Green, Shahzad, Church, & Sandars, 2020	Using a Self-Regulated Learning-Enhanced Video Feedback Educational Intervention to Improve Junior Doctor Prescribing	Improving prescribing competency of junior doctors in simulated clinical encounters during renal medicine rotation	Proactive-developmental (implicit approach)	Patient encounter video feedback and faculty-facilitated learning	Intervention cohort showed a significant improvement in prescribing competency, goal setting and self-monitoring skills as compared to control cohort. Self-efficacy improved in both cohort with a larger effect size in the control cohort.
Kiger, Riley, Stolfi, Morrison, Burke, & Lockspeiser, 2020	Use of Individualized Learning Plans to Facilitate Feedback Among Medical Students	Increasing quality of feedback by aligning feedback with individualized learning goals and evaluating perception of the third-year medical students on quality of feedback during pediatric clerkship	Proactive-developmental (explicit approach)	Faculty's feedback based on student's individualized learning plans.	Sharing individualized learning plans with preceptors helped align feedback with learning goals but did not change student perceptions of the usefulness of learning goals
Xu, Campisi, Forte, Carrillo, Vescan, & Brydges, 2018	Effectiveness of discovery learning using a mobile otoscopy simulator on knowledge acquisition and retention in medical students: a randomized controlled trial	Improving knowledge acquisition and retention of preclinical students using discovery then instruction learning sequence	Proactive-developmental (implicit approach)	Experiential learning using a mobile otoscopy simulator and different learning sequence between discovery and instruction	Both learning sequences led to improved knowledge scores, however students' engagement in discovery learning which promotes SRL is minimal.

Table 2.2: Summary of Medical Education SRL Support Intervention Program Focus, Approach, Strategy and Outcome (Continued)

Citation	Research	Focus of Intervention	Approach	Intervention Strategy	Outcomes
Hauer, Iverson, Quach, Yuan, Kaner, & Boscardin, 2018	Fostering medical students' lifelong learning skills with a dashboard, coaching and learning planning	Increasing preclinical students engagement in SRL using infrastructural support and exploring students perspective perceived value of the support.	Proactive-developmental (implicit approach)	Infrastructural supports: individual performance dashboard, coaching relationship, and opportunities for reflection and goal-setting.	Students valued dashboard as indicator of their achievement rather than self-improvement guide. They valued coaches as sources of advice but varied in their perceptions of the value of discussing learning planning.
Andrews, Kelly, & DeZee, 2018	Why Does This Learner Perform Poorly on Tests? Using Self-Regulated Learning Theory to Diagnose the Problem and Implement Solutions	Identify struggling test-taker subtype within the internal medicine residency for quality improvement.	Deficit-proactive	Application of a test-taking assessment developed based on SRL microanalytic assessment and training to identify struggling test-taker subtype and implementing personalized remediation.	The test-taking assessment identified four subtypes: lack of script recognition, lack of script specificity, premature closure, and inappropriate adaptive inferences. Personalized learning plan based on the subtypes yielded improvements.

Table 2.2: Summary of Medical Education SRL Support Intervention Program Focus, Approach, Strategy and Outcome (Continued)

Citation	Research	Focus of Intervention	Approach	Intervention Strategy	Outcomes
Cheung, Kulasegaram, Woods, Moulton, Ringsted, & Brydges, 2018	Knowing How and Knowing Why: testing the effect of instruction designed for cognitive integration on procedural skills transfer	Increasing retention and transfer of simulation-based lumbar puncture skill among preclinical students using instruction that integrates conceptual (why) and procedural (how) knowledge	Proactive-developmental (implicit approach)	Promoting SRL through self-study materials and without external feedback	Integrated instruction was associated with improved conceptual but not procedural knowledge test scores. Improved conceptual knowledge mediated a positive indirect effect on skill retention and transfer.
Dempsey & Kauffman, 2017	Supporting Third Year Medical Students' Skill Acquisition and Self-Efficacy with Coping Models and Process Feedback during Laparoscopic Knot Tying Simulation	Improving third-year students' skill acquisition and self-efficacy during a laparoscopic surgical simulation training session using different types of role modelling and feedback	Proactive-developmental (implicit approach)	Instructional interventions using two types of role modelling (expert vs. coping) and received either process-oriented or outcome-oriented feedback	The coping model combined with process feedback had a positive influence on students' efficiency in learning the task, on their satisfaction with their performance, and on their self-efficacy for laparoscopic knot typing
Thomas, Bennett, & Lockyer, 2016	Using concept maps and goal-setting to support the development of self-regulated learning in a problem-based learning curriculum	Developing second year students' SRL skills through SRL support activities embedded in problem-based learning (PBL) curriculum	Proactive-developmental (explicit approach)	Introductory workshop on learning skills and followed by learning skills activity integrated into PBL tutorials. Activities were aligned to SRL phases; planning monitoring and reflecting on learning	Students reported increase in their cognitive and metacognitive functioning, and also increased confidence in selecting and applying appropriate learning strategies.

44

Table 2.2: Summary of Medical Education SRL Support Intervention Program Focus, Approach, Strategy and Outcome (Continued)

Citation	Research	Focus of Intervention	Approach	Intervention Strategy	Outcomes
Leggett, Sandars, & Burns, 2012.	Helping students to improve their academic performance: a pilot study of a workbook with self-monitoring exercises	Improving the second-year medical students' calibration of accuracy and academic performance in a Biomedical Science (BMS) module	Proactive-developmental (implicit approach)	Workbook, which encouraged participants to complete self-monitoring exercises	Intervention significantly improved calibration accuracy, self-efficacy and academic achievement in the BMS module. Despite the outcome some students disliked that the self-monitoring exercises as they felt it was repetitive and time consuming.
Winston, Van der Vleuten, & Scherpbier, 2010	An investigation into the design and effectiveness of a mandatory cognitive skills programme for at-risk medical students.	Improving first-year, at-risk medical students' academic performance through mandatory intervention programme	Deficit-reactive (explicit)	Cognitive skills programme facilitated by faculty staffs	91% passed their repeat semester, compared to 58% for controls. This significant effect persisted for progression through the school for the subsequent three semesters

2.9   Conception of Self-Regulated Learning Strategies

Conception of learning is a growing area of interest in the field of educational psychology as it represents a prominent influence on learning approach (Vezzani, Vettori, & Pinto, 2018). The term 'conception of learning' alludes to an individual's mental representation of what learning means and how it occurs based on past experience (Lin, Liang, & Tsai, 2012; Vezzani, Vettori, & Pinto, 2017). A more precise and formal definition was provided by Vermunt et al. (2004), where the conception of learning was defined as "a coherent system of knowledge and beliefs about learning and related phenomena".

As compared to other earlier studies, Vermunt's conceptual framework for the conception of learning was more congruent with the core elements of SRL, whereby he demonstrated a strong interrelation between students' conceptions of learning with their learning goal orientation, and their use of cognitive and metacognitive strategies (Vermunt & Vermetten, 2004). The conception of learning that was constructive (viewed of learning as understanding) led to the active use learning processes and strategies relevant to deep-learning, while the reproductive or memorisation view resulted in the use of surface-learning strategies (Chiou, Lee, & Tsai, 2013; Chiou, Liang, & Tsai, 2012; Lin et al., 2012; Sadi & Lee, 2015; Vermunt, 1998, 2005).

The conception of learning has also been shown to exert influence on motivational processes of learning (Negovan, Sterian, & Colesniuc, 2015; Vermunt & Vermetten, 2004) and eventually, impact academic outcomes (Cano, 2005; Kállay, 2012; McLean, 2001). Cano (2005) stated that the interrelationship between conception of learning and academic outcomes were mediated by learning approaches. Therefore, the constructive conception of learning was assumed to be associated with higher academic achievement

or performance. A study among the second-year Romanian psychology students revealed that 65% of the academic success of these students was predicted by their cognitive learning strategies and metacognitive skills, with learning strategies explaining as much as 46% of the variance (Kállay, 2012).

Although conception of learning is said to be moulded by the students' past learning experiences, it is far from fixed (Gravoso et al., 2002). Hence, educational psychologists have emphasised on the need for promoting SRL awareness among the undergraduate students to foster the constructive conception of learning (McLean, 2001). According to Deci (1975), the awareness of the potential satisfaction from feeling more competent and self-determined will lead to the activation of intrinsic motivation to behave in a way that will result in the perceived satisfaction (Deci, 1976).

Following this literature review, it could be assumed that conceptions of learning have a potential role in influencing lifelong learning. Hence, the present study was designed to evaluate the impact of direct teaching of SRL strategies on the preclinical conception of SRL from the perspective of their motivation orientation and learning strategies.

2.10   Chapter Summary

This chapter discussed relevant works of literature that have contributed significantly in understanding the role and significance of SRL. Within the medical education literature, SRL was shown to be associated with academic success, higher clinical performance, lifelong learning, and optimal patient care. Of the various factors that have been identified to influence and affect the medical students' ability to self-regulate their learning, the most fundamental is the lack or inadequacy of SRL mechanisms awareness. Despite that, the literature in medical education suggests that most SRL support

intervention programmes were based on the implicit approach, which limits its effectiveness in cultivating the SRL awareness and behaviour among undergraduate students. As past studies suggest that the conception of SRL have can influence students' learning behaviour, the present study was devised to explore the impact of imparting of SRL strategies explicitly on the preclinical students' conception of SRL. Based on the literature review, the MSLQ was identified as the most suitable instrument to evaluate the students' SRL components at the baseline level and conception of SRL. The conceptualisation of this study and the underpinning theoretical frameworks are discussed in the next chapter.

CHAPTER 3: CONCEPTUALIZATION OF STUDY

3.1 Introduction

Science and technology of medicine are evolving rapidly; hence it is critical that both physicians and medical students persistently recognize the gaps in their knowledge and stay updated with their skills and knowledge. Being on par with the current advancements, while confronting the challenges of workload, time pressures, and accompanying stress, entails adeptness in highly motivated learning strategies (Vilppu et al., 2019). The capability to autonomously identify one's own learning needs and regulate one's motivation, cognition, and behaviour toward attaining the learning goal represent the self-regulated learning (SRL) skills (Schunk & Zimmerman, 2012). These skills do not come instinctively, and individuals' ability to self-regulate their learning varies based on their experiences (Bjork et al., 2013).

The investigation of the present study was built upon two important lines of research related to motivated learning strategies; (i) the development of students' metacognitive skills can be enhanced through support, and (ii) motivation regulation influences students' approach to learning.

Metacognitive skills, which entails metacognitive knowledge (awareness of cognitive learning strategies and processes) and metacognitive regulation (ability to coordinate the cognitive and affective processes to accomplish the task), is the key component of SRL (Cao & Nietfeld, 2007). Guiding students on the development of metacognitive skills can lead to high-quality learning (Colthorpe, Ogiji, Ainscough, Zimbardi, & Anderson, 2019; Ebomoyi, 2020). Literature in SRL suggested two divergent ways of imparting the learning strategies; implicit instruction and explicit instruction (Kistner, Rakoczy, Otto,

Klieme, & Büttner, 2015; Paris & Paris, 2001). Implicit instruction involves prompting of learning strategies without addressing the strategic aspect of the approach, while the explicit instruction refers to the direct guides to how, why and when to use a particular strategy (De Smul, Heirweg, Van Keer, Devos, & Vandevelde, 2018; Kistner et al., 2015). As compared to the implicit instruction, explicit instruction have associated with better gain of performance (Kistner et al., 2010).

The second line of research is on motivation as a major determinant quality of learning and success in medical education (Pelaccia & Viau, 2017). Studies have shown that students with a higher level of intrinsic motivation tend to engage in more-deep processing strategies and effective metacognitive regulation as compared to those who are more extrinsically motivated (Kusurkar, Ten Cate, Van Asperen, & Croiset, 2011; Stegers-Jager, Cohen-Schotanus, & Themmen, 2012). Furthermore, students' commitment and perseverance in their learning have been associated with a higher level of perceived control and self-efficacy (Demirören et al., 2016; Ryan & Deci, 2000a).

A thorough search of the literature in multiple databases showed that explicit teaching of learning strategies to the preclinical students had not been researched much upon in medical education. Therefore, this study was designed to evaluate the impact of direct teaching of SRL strategies on the preclinical conception of SRL from the perspective of their motivation orientation and learning strategies. The preclinical students' baseline level of motivation orientation and learning strategies, and the subsequent change in these levels were measured using the Motivated Strategies for Learning Questionnaire (MSLQ). This chapter delineates the conceptual framework and the theoretical framework of the present study.

3.2   Conceptual Framework

In this section, the research directions in SRL are depicted based on the past studies entailing the SRL in medical education, motivation and learning strategies of medical students, and SRL strategies support interventions in medical education. Based on the critical analysis of these works of literatures, the gaps in knowledge and hence, the conceptual framework of this study is presented.

Table 3.1 shows the summary of research that has been conducted on SRL in medical education in the past ten years. The focus of these studies can be divided into four themes; (1) context/approach, (2) social determinant, (3) transition, and (4) validation. Majority of the studies of SRL in medical education are oriented towards exploring the role of clinical context (Berkhout et al., 2018; Berkhout, Slootweg, et al., 2017; Berkhout, Teunissen, et al., 2017; Bierer & Dannefer, 2016; Cleary, Durning, & Artino, 2016; Gaupp, Fabry, & Körner, 2018; Kennedy, Rea, & Rea, 2019; Koziol-Dube, Burke, & Dimario, 2016; Lyons-Warren et al., 2016; Sawatsky et al., 2020; Turan & Konan, 2012; N. N. Woods, M. Mylopoulos, & R. Brydges, 2011) and learning approach such as student-centred (Matsuyama et al., 2019; Zheng & Zhang, 2020), competency-based (Zheng et al., 2020), problem-based and traditional curriculum in developing the students' SRL skills (Lucieer, van der Geest, et al., 2016; Siddaiah-Subramanya et al., 2017; Turan, Demirel, & Sayek, 2009).

While most of these studies supported the notion that clinical context and student-centred approach were influential in promoting SRL among the medical students, Lucieer et al. reported that the medical students SRL skills did not develop irrespective of the context (2016) and curriculum (2015). Although medical students had sufficient procedural and diagnostic skills and knowledge, they were unable to function efficiently

in the complex clinical environment (Sandars & Patel, 2015). A multi-centre randomized controlled trial conducted at US medical schools associated attrition of medical students with lack of SRL skills (Kalet et al., 2013).

The second line of research focused on the impact of social determinant of SRL skills. Social interactions between peers and teachers in the clinical environment were found to promote students' SRL (Berkhout et al., 2015a; Berkhout, Helmich, et al., 2017; Bransen et al., 2020; Demirören et al., 2020). The third line of research focused profiling the SRL skills of preclinical students transitioning to the clinical phase (Artino, Jr. et al., 2012; Cho et al., 2017a, 2017b; Kim & Jang, 2015; Lucieer, Jonker, et al., 2016; Patel et al., 2015; Tio, Stegmann, Koerts, van Os, & Cohen-Schotanus, 2016). It was revealed that SRL does not develop spontaneously in the clinical environment and therefore, strategies to promote SRL needs to be implemented as early as the students enter medical school. The fourth line of research focused on validating measures to understand better the medical students' SRL (Gandomkar et al., 2020; Naeimi et al., 2019; Soemantri et al., 2018).

Table 3.1: Summary of Research on SRL in Medical Education

Year	Authors	Research
2020	Zheng B, Zhang Y.	Self-regulated learning: the effect on medical student learning outcomes in a flipped classroom environment
2020	Siddiqui F, Khan RA.	Correlation between stress scores and self-regulated learning perception scores in Pakistani students
2020	Demirören M, Turan S, Taşdelen Teker G.	Determinants of self-regulated learning skills: the roles of tutors and students
2020	Gandomkar R, Yazdani K, Fata L, Mehrdad R, Mirzazadeh A, Jalili M, Sandars J.	Using multiple self-regulated learning measures to understand medical students' biomedical science learning

Table 3.1: Summary of Research on SRL in Medical Education (Continued)

Year	Authors	Research
2020	Zheng B, Ward A, Stanulis R.	Self-regulated learning in a competency-based and flipped learning environment: learning strategies across achievement levels and years
2020	Sawatsky AP, Halvorsen AJ, Daniels PR, Bonnes SL, Issa M, Ratelle JT, Stephenson CR, Beckman TJ.	Characteristics and quality of rotation-specific resident learning goals: a prospective study
2019	Kennedy G, Rea JNM, Rea IM.	Prompting medical students to self-assess their learning needs during the ageing and health module: a mixed methods study
2019	Bransen D, Govaerts MJB, Sluijsmans DMA, Driessen EW.	Beyond the self: The role of co-regulation in medical students' self-regulated learning
2019	Naeimi L, Abbaszadeh M, Mirzazadeh A, Sima AR, Nedjat S, Mortaz Hejri S.	Validating Self-Reflection and Insight Scale to Measure readiness for Self-Regulated Learning
2019	Matsuyama Y, Nakaya M, Okazaki H, Lebowitz AJ, Leppink J, van der Vleuten C.	Does changing from a teacher-centered to a learner-centered context promote self-regulated learning: a qualitative study in a Japanese undergraduate setting
2019	Lee SS, Samarasekera DD, Sim JH, Hong W-H, Foong CC, Pallath V, Vadivelu J.	Exploring the Cultivation of Self-Regulated Learning (SRL) Strategies Among Pre-Clinical Medical Students in Two Medical Schools
2018	Soemantri D, Mccoll G, Dodds A.	Measuring medical students' reflection on their learning: modification and validation of the motivated strategies for learning questionnaire (MSLQ)
2018	Gaupp R, Fabry G, Körner M.	Self-regulated learning and critical reflection in an e-learning on patient safety for third-year medical students
2018	Berkhout JJ, Helmich E, Teunissen PW, van der Vleuten CPM, Jaarsma ADC.	Context matters when striving to promote active and lifelong learning in medical education

Year	Authors	Research
2017	Berkhout JJ, Slootweg IA, Helmich E, Teunissen PW, van der Vleuten CPM, Jaarsma ADC.	How characteristic routines of clinical departments influence students' self-regulated learning: A grounded theory study
2017	Cho KK, Marjadi B, Langendyk V, Hu W.	The self-regulated learning of medical students in the clinical environment - a scoping review
2017	de Bruin ABH, Dunlosky J, Cavalcanti RB.	Monitoring and regulation of learning in medical education: the need for predictive cues
2017	Cho KK, Marjadi B, Langendyk V, Hu W.	Medical student changes in self-regulated learning during the transition to the clinical environment
2017	Siddaiah-Subramanya M, Nyandowe M, Zubair O.	Self-regulated learning: why is it important compared to traditional learning in medical education?
2017	Berkhout JJ, Helmich E, Teunissen PW, van der Vleuten CP, Jaarsma AD.	How clinical medical students perceive others to influence their self-regulated learning
2017	Berkhout JJ, Teunissen PW, Helmich E, van Exel J, van der Vleuten CP, Jaarsma DA.	Patterns in clinical students' self-regulated learning behavior: a Q-methodology study
2016	Bierer SB, Dannefer EF.	The Learning Environment Counts: Longitudinal Qualitative Analysis of Study Strategies Adopted by First-Year Medical Students in a Competency-Based Educational Program
2016	Lyons-Warren AM, Kirby JP, Larsen DP.	Student views on the role of self-regulated learning in a surgery clerkship
2016	Koziol-Dube K, Burke G, Dimario F Jr.	A Study of Self-Regulated Learning of Child Neurology for Medical Students
2016	Cleary TJ, Durning SJ, Artino AR Jr.	Microanalytic Assessment of Self-Regulated Learning During Clinical Reasoning Tasks: Recent Developments and Next Steps
2016	Tio RA, Stegmann ME, Koerts J, van Os TW, Cohen-Schotanus J.	Weak self-directed learning skills hamper performance in cumulative assessment

Table 3.1: Summary of Research on SRL in Medical Education (Continued)

Year	Authors	Research
2016	Lucieer SM, Jonker L, Visscher C, Rikers RM, Themmen AP.	Self-regulated learning and academic performance in medical education
2015	Jouhari Z, Haghani F, Changiz T.	Factors affecting self-regulated learning in medical students: a qualitative study
2015	Lucieer SM, van der Geest JN, Elói-Santos SM, et al.	The development of self-regulated learning during the pre-clinical stage of medical school: a comparison between a lecture-based and a problem-based curriculum
2015	Berkhout JJ, Helmich E, Teunissen PW, van den Berg JW, van der Vleuten CP, Jaarsma AD.	Exploring the factors influencing clinical students' self-regulated learning
2015	Sandars J, Patel R.	Self-regulated learning: the challenge of learning in clinical settings
2015	Patel R, Tarrant C, Bonas S, Yates J, Sandars J.	The struggling student: a thematic analysis from the self-regulated learning perspective
2013	Kalet A, Ellaway RH, Song HS, Nick M, Sarpel U, Hopkins MA, Hill J, Plass JL, Pusic MV.	Factors influencing medical student attrition and their implications in a large multi-center randomized education trial
2012	Artino AR Jr, Dong T, DeZee KJ, Gilliland WR, Waechter DM, Cruess D, Durning SJ.	Achievement goal structures and self-regulated learning: relationships and changes in medical school
2012	Turan S, Konan A.	Self-regulated learning strategies used in surgical clerkship and the relationship with clinical achievement
2011	Woods NN, Mylopoulos M, Brydges R.	Informal self-regulated learning on a surgical rotation: uncovering student experiences in context

Table 3.2 shows the summary of research on motivation of medical students. Most studies identified self-efficacy beliefs as an essential predictor of SRL (Demirören et al., 2016; Schauber, Hecht, Nouns, Kuhlmey, & Dettmer, 2015). The differences in the type of curriculum did not influence self-efficacy beliefs and academic performance (Schauber et al., 2015). High-performing students demonstrate competence in the crucial SRL measures, including firmer beliefs for self-efficacy and task value, while reporting lower anxiety and frustrations (Artino, Hemmer, & Durning, 2011; Kim & Jang, 2015). Several studies investigated the role of social emotions on clinical students' learning. Students experienced negative emotion and depression when they received negative feedback or encounter incongruity between their cognitive capability and the demand of the task (Barbosa, Silva, Ferreira, & Severo, 2016; Cleary, Dong, & Artino, 2015; Jakobsen, Musaeus, Kirkeby, Hansen, & Mørcke, 2018; Van Nguyen et al., 2015).

Table 3.2: Summary of Research on Motivation of Medical Students

Year	Authors	Research
2018	Jakobsen F, Musaeus P, Kirkeby L, Hansen TB, Mørcke AM.	Emotions and clinical learning in an interprofessional outpatient clinic: a focused ethnographic study
2016	Barbosa J, Silva Á, Ferreira MA, Severo M.	Transition from Secondary School to Medical School: The Role of Self-Study and Self-Regulated Learning Skills in Freshman Burnout.
2016	Demirören M, Turan S, Öztuna D.	Medical students' self-efficacy in problem-based learning and its relationship with self-regulated learning.
2015	Kim KJ, Jang HW.	Changes in medical students' motivation and self-regulated learning: a preliminary study
2015	Schauber SK, Hecht M, Nouns ZM, Kuhlmey A, Dettmer S.	The role of environmental and individual characteristics in the development of student achievement: a comparison between a traditional and a problem-based-learning curriculum

Table 3.2: Summary of Research on Motivation of Medical Students (Continued)

Year	Authors	Research
2015	Van Nguyen H, Laohasiriwong W, Saengsuwan J, Thinkhamrop B, Wright P.	The relationships between the use of self-regulated learning strategies and depression among medical students: an accelerated prospective cohort study
2014	Cleary TJ, Dong T, Artino AR Jr.	Examining shifts in medical students' microanalytic motivation beliefs and regulatory processes during a diagnostic reasoning task
2011	Artino AR Jr, Hemmer PA, Durning SJ.	Using self-regulated learning theory to understand the beliefs, emotions, and behaviours of struggling medical students

Table 3.3 shows the summary of research on the learning strategies of medical students. Most of past studies were focused on medical students' metacognition. These studies revealed that academically successful medical students use metacognitive strategies (Ebomoyi, 2020; Khalil et al., 2018). Proficiency in metacognitive skills was linked to increased self-regulation of learning (Gandomkar et al., 2016; Jouhari, Haghani, & Changiz, 2016; Pizzimenti & Axelson, 2015; Skinner et al., 2015; Turan et al., 2009). Many medical students, however, lacked the metacognitive skills such as identify goals, self-monitoring, self-questioning, and self-assessing (Jouhari et al., 2016). While some studies suggest that students ultimately develop metacognitive skills (Hong, Vadivelu, Daniel, & Sim, 2015), other suggest the need for intervention programs to enhance students metacognitive skills (Medina et al., 2017; Siegesmund, 2017).

Table 3.3: Summary of Research on Learning Strategies of Medical Students

Year	Author	Research
2020	Ebomoyi JI.	Metacognition and Peer Learning Strategies as Predictors in Problem-Solving Performance in Microbiology
2018	Khalil MK, Williams SE, Gregory Hawkins H.	Learning and study strategies correlate with medical students' performance in anatomical sciences
2017	Medina MS, Castleberry AN, Persky AM.	Strategies for Improving Learner Metacognition in Health Professional Education.
2017	Siegesmund A.	Using self-assessment to develop metacognition and self-regulated learners
2016	Gandomkar R, Mirzazadeh A, Jalili M, Yazdani K, Fata L, Sandars J.	Self-regulated learning processes of medical students during an academic learning task
2016	Jouhari Z, Haghani F, Changiz T.	Assessment of medical students' learning and study strategies in self-regulated learning
2016	Husmann PR, Barger JB, Schutte AF.	Study skills in anatomy and physiology: Is there a difference?
2015	Skinner DE, Saylors CP, Boone EL, Rye KJ, Berry KS, Kennedy RL.	Becoming Lifelong Learners: A Study in Self-Regulated Learning
2015	Hong WH, Vadivelu J, Daniel EG, Sim JH.	Thinking about thinking: changes in first-year medical students' metacognition and its relation to performance
2015	Pizzimenti MA, Axelson RD.	Assessing student engagement and self-regulated learning in a medical gross anatomy course
2014	Gonullu I, Artar M.	Metacognition in medical education
2014	Kim S, Hur Y, Park JH.	The correlation between achievement goals, learning strategies, and motivation in medical students
2013	Cebeci, S., Dane, S., Kaya, M. and Yigitoglu, R.	Medical students' approaches to learning and study skills

Table 3.3: Summary of Research on Learning Strategies of Medical Students (Continued)

Year	Author	Research
2012	Stegers-Jager KM, Cohen-Schotanus J, Themmen AP.	Motivation, learning strategies, participation and medical school performance
2009	Turan S, Demirel O, Sayek I.	Metacognitive awareness and self-regulated learning skills of medical students in different medical curricula

Table 3.4 shows the summary of research on SRL strategies support interventions in medical education. The focus of the vast majority of these studies was on the clinical years (Andrews et al., 2018; Cheung et al., 2018; Patel et al., 2020; van Houten-schat et al., 2018). The literature search identified very few studied that focused on the preclinical years (Barbosa, Silva, Ferreira, & Severo, 2016; Hauer et al., 2018; Leggett et al., 2012; MacKenzie et al., 2019). Intervention to promote the development of SRL skills were generally based on indirect instructions (Dempsey & Kauffman, 2017; Kiger et al., 2020; Shariff, Hatala, & Regehr, 2020; Thomas et al., 2016). Evidence suggests that SRL skills development is minimal when instructions are made implicit (Xu et al., 2018). On the other hand, explicit instructions in metacognition skills showed improvements in the students' SRL strategies (Safari & Meskini, 2015).
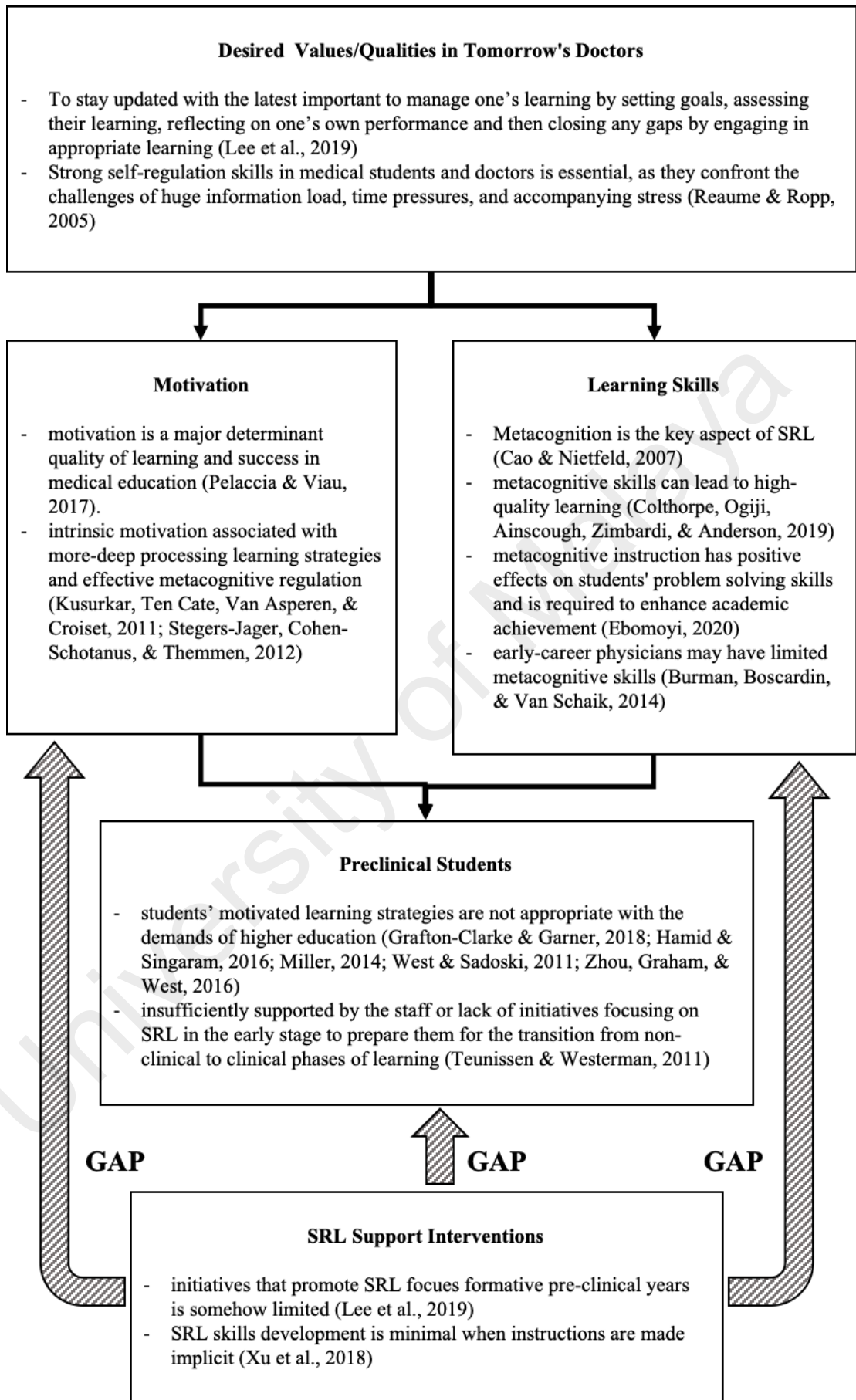
Table 3.4: Summary of Research on SRL Strategies Support Interventions

Year	Author	Research
2020	Patel R, Green W, Shahzad MW, Church H, Sandars J.	Using a Self-Regulated Learning-Enhanced Video Feedback Educational Intervention to Improve Junior Doctor Prescribing
2020	Shariff F, Hatala R, Regehr G.	Learning After the Simulation Is Over: The Role of Simulation in Supporting Ongoing Self-Regulated Learning in Practice
2020	Kiger ME, Riley C, Stolfi A, Morrison S, Burke A, Lockspeiser T.	Use of Individualized Learning Plans to Facilitate Feedback Among Medical Students
2019	MacKenzie JJ, Stockley D, Hastings-Truelove A, et al.	Student Reflections on the Queen's Accelerated Route to Medical School Programme
2018	Xu J, Campisi P, Forte V, Carrillo B, Vescan A, Brydges R.	Effectiveness of discovery learning using a mobile otoscopy simulator on knowledge acquisition and retention in medical students: a randomized controlled trial
2018	Van Houten-Schat MA, Berkhout JJ, van Dijk N, Endedijk MD, Jaarsma ADC, Diemers AD.	Self-regulated learning in the clinical context: a systematic review
2018	Hauer KE, Iverson N, Quach A, Yuan P, Kaner S, Boscardin C.	Fostering medical students' lifelong learning skills with a dashboard, coaching and learning planning
2018	Barbosa J, Silva Á, Ferreira MA, Severo M.	Do reciprocal relationships between academic workload and self-regulated learning predict medical freshmen's achievement? A longitudinal study on the educational transition from secondary school to medical school
2018	Andrews MA, Kelly WF, DeZee KJ.	Why Does This Learner Perform Poorly on Tests? Using Self-Regulated Learning Theory to Diagnose the Problem and Implement Solutions
2018	Cheung JJH, Kulasegaram KM, Woods NN, Moulton CA, Ringsted CV, Brydges R.	Knowing How and Knowing Why: testing the effect of instruction designed for cognitive integration on procedural skills transfer

Table 3.4: Summary of Research on SRL Strategies Support Interventions (Continued)

Year	Author	Research
2017	Dempsey MS, Kauffman DF.	Supporting Third Year Medical Students' Skill Acquisition and Self-Efficacy with Coping Models and Process Feedback during Laparoscopic Knot Tying Simulation
2016	Thomas L, Bennett S, Lockyer L.	Using concept maps and goal-setting to support the development of self-regulated learning in a problem-based learning curriculum
2015	Rezaee R, Mosalanejad L.	The effects of case-based team learning on students' learning, self regulation and self direction
2015	Safari Y, Meskini H.	The Effect of Metacognitive Instruction on Problem Solving Skills in Iranian Students of Health Sciences
2012	Leggett H, Sandars J, Burns P.	Helping students to improve their academic performance: a pilot study of a workbook with self-monitoring exercises

In a nutshell, these shreds of evidence suggest that most of the studies on SRL, motivation, learning strategies, and the support interventions in medical education are concentrated on the clinical years. Most intervention strategies implemented in the studies were used to help students build their SRL skills employed using implicit approaches. Thus, the present study attempted to evaluate the impact of explicit teaching of SRL strategies on the preclinical conception of SRL from the perspective of their motivation orientation and learning strategies. The preclinical students' baseline level of motivation orientation and learning strategies, and the subsequent change in these levels were measured. Figure 3.1 shows the conceptual framework of the present study. The conceptual framework outlines the connection and gaps between the preclinical students' motivation and learning strategies, and SRL strategies support intervention. In the next section, the theoretical framework that underpinned the present study is elucidated.

Desired Values/Qualities in Tomorrow's Doctors

- To stay updated with the latest important to manage one's learning by setting goals, assessing their learning, reflecting on one's own performance and then closing any gaps by engaging in appropriate learning (Lee et al., 2019)
- Strong self-regulation skills in medical students and doctors is essential, as they confront the challenges of huge information load, time pressures, and accompanying stress (Reaume & Ropp, 2005)

Motivation

- motivation is a major determinant quality of learning and success in medical education (Pelaccia & Viau, 2017).
- intrinsic motivation associated with more-deep processing learning strategies and effective metacognitive regulation (Kusurkar, Ten Cate, Van Asperen, & Croiset, 2011; Stegers-Jager, Cohen-Schotanus, & Themmen, 2012)

Learning Skills

- Metacognition is the key aspect of SRL (Cao & Nietfeld, 2007)
- metacognitive skills can lead to high-quality learning (Colthorpe, Ogiji, Ainscough, Zimbardi, & Anderson, 2019)
- metacognitive instruction has positive effects on students' problem solving skills and is required to enhance academic achievement (Ebomoyi, 2020)
- early-career physicians may have limited metacognitive skills (Burman, Boscardin, & Van Schaik, 2014)

Preclinical Students

- students' motivated learning strategies are not appropriate with the demands of higher education (Grafton-Clarke & Garner, 2018; Hamid & Singaram, 2016; Miller, 2014; West & Sadoski, 2011; Zhou, Graham, & West, 2016)
- insufficiently supported by the staff or lack of initiatives focusing on SRL in the early stage to prepare them for the transition from non-clinical to clinical phases of learning (Teunissen & Westerman, 2011)

GAP   **GAP**   **GAP**

SRL Support Interventions

- initiatives that promote SRL focuses formative pre-clinical years is somehow limited (Lee et al., 2019)
- SRL skills development is minimal when instructions are made implicit (Xu et al., 2018)

Figure 3.1: Conceptual Framework of Study

3.3 Theoretical Framework

The theoretical framework of this study is rooted in the Self-Determination Theory (SDT) and Piaget's Schema Theory. This section describes these theories and depicts their alignment in the theoretical framework structure.

3.3.1 Self-Determination Theory

Self-regulated learning is the interplay between motivation and cognition (Duncan & McKeachie, 2005). As motivation plays a crucial role in determining the learning quality, academic success, and students' well-being (Pelaccia & Viau, 2017; Ten Cate, Kusurkar, & Williams, 2011), the self-determination theory (SDT) was adopted to inform this study.

The SDT, founded by Edward Deci and Richard Ryan in 1985, is one of the most extensively used motivational theory in the field of psychology and education (Ten Cate, Kusurkar, & Williams, 2011). This theory distinguishes various motivation orientations based on the attitudes or goals that underlie an action (Ryan & Deci, 2000a). The most basic and standard distinction of motivation orientation in the educational field is between intrinsic motivation and extrinsic motivation (Ryan & Deci, 2000a).

Intrinsic motivation is defined as the innate drive of an individual to autonomously engage in a behaviour for its inherent satisfaction in the absence of external impetus (Vallerand et al., 1992). Therefore, intrinsic motivation is central to humans' inherent tendencies to learn and assimilate. As intrinsic motivation results in high-quality learning, it has emerged as an essential construct in SRL (Pelaccia & Viau, 2017). The SDT implies that the basic psychological needs for autonomy, competence, and relatedness sustain intrinsic motivation (Niemiec & Ryan, 2009).

On the other hand, extrinsic motivation has been typically characterized as a pale and impoverished form of motivation in education, as it must be externally prompted (Ryan & Deci, 2000a). However, SDT postulates that the extrinsic motivation represents a series of orientations that varies substantially in its relative autonomy and thus can either reflect external control or true self-regulation (Ryan & Deci, 2000a). The SDT distinguished the extrinsic motivation into the four different orientations, including external regulation, introjected regulation, identified regulation, and integrated regulation. Among these, external regulation is the least autonomous. It is characterized by behaviours to satisfy external pressure, such as to gain rewards or avoid punishments (Ten Cate et al., 2011). The introjected regulation is characterized by behaviour regulation that is more internalized but not self-determined. This includes the desire to avoid shame, anxiety or guilt and ego-enhancement, which may stop as soon as the external pressure becomes less apparent (Ten Cate et al., 2011). The next level of extrinsic motivation is the identified regulation, which defined by higher commitments and more persistent behaviour because the behaviour is valued and considered personally important. The final level is the integrated regulation, which is considered as the most autonomous extrinsic motivation. It is characterized by self- and goal-directed behaviour, although it is guided by external demands (Barkoukis, Tsorbatzoudis, Grouios, & Sideridis, 2008; Ten Cate et al., 2011).

3.3.2   Schema Theory

Piaget's schema theory was adopted to inform this research as it was designed to evaluate the impact of direct instruction of SRL strategies on the preclinical students' conception of SRL. According to Piaget, the pieces of information in mind are organised as schema (Yilmaz, 2011). The hypothetical cognitive structures are reorganised continuously as new information are encountered. As the schema develops, the thinking processes become more regulated and sophisticated (Bormanaki & Khoshhal, 2017).

The schema theory states that the mind interprets new incoming information based on prior knowledge. When the prior knowledge fails to construe the new information, a state of disequilibrium is experienced (Fosnot & Perry, 1996). The mind is inclined to adaptation in order to restore equilibrium in the cognitive structure. Adaptation can occur through either assimilation or accommodation (Devi, 2019). Assimilation refers to the process of integrating the new information into existing schemas. The accommodation process, on the other hand, can follow three different paths. These paths include, (1) adhering to original schema; (2) revamping the existing schema; or (3) retaining both schemas as separate cases and alternating between both (Yilmaz, 2011).

Figure 3.2 (Page 67) illustrates the alignment of the SDT and schema theory in the theoretical framework of the present study. The theoretical framework involves three phases, including pre-intervention, intervention, and post-intervention. In the pre-intervention phase, the preclinical students' baseline level of SRL in measured as their motivation and learning strategies. The letter 'A' and 'B' relates the motivation and learning strategies to the SDT, respectively. The SDT provides an insight into how the students' motivation and learning strategies scores explain their adeptness to self-regulate learning. The letter 'C' represents the disequilibrium state in the students' cognitive structure induced by the new information encountered during the intervention phase. The letter 'D' represents the adaptation process that occurs to restore the equilibrium in the cognitive structure. The students may either assimilate or accommodate the new SRL strategies learned in the intervention programs. The schema theory explains the cognitive restructuring process in 'C' and 'D'. Changes in the students' conception of SRL, in terms of motivation and learning strategies, are then measured again in the post-intervention. In this phase, the letter 'A' and 'B' are used again to explain the students' conception of SRL in relation to SDT.

## 3.4	Chapter Summary

The significance of supporting and nurturing SRL skills among medical students has been long recognized. However, most research in this field were emphasized on the clinical students' SRL development. Furthermore, a large portion of the intervention strategies implemented to foster SRL skills employed implicit approaches, which led to minimal impact on the medical students' SRL development. As SRL development is a long-term process, efforts to facilitate the development of students' SRL should begin from the preclinical years. Therefore, the present study was conceptualized to evaluate the impact explicit teaching of SRL strategies on the preclinical students' conception of SRL. The SDT and Piaget's schema theory was adopted to inform this study. In the next chapter, the methodology used in this study will be described in detail.
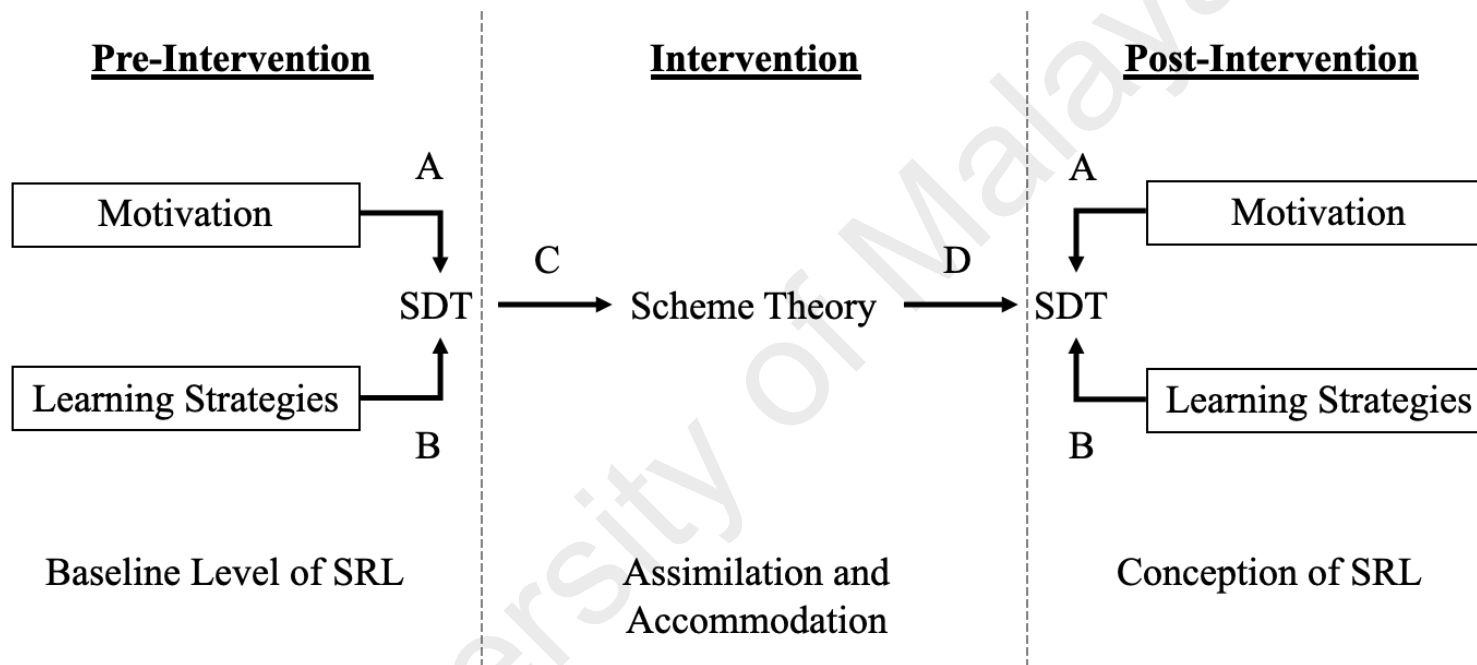
Figure 3.2: Alignment of the SDT and Schema Theory in the Theoretical Framework

CHAPTER 4: METHODOLOGY

4.1   Introduction

The present study was conceived to evaluate the impact of imparting direct instruction of self-regulated learning (SRL) strategies on the preclinical students' conception of the SRL. A one-group pretest-posttest quasi-experimental research design was devised first to profile the preclinical students' baseline level of SRL and then, assess the changes in their conception of SRL after attending the learning support invention. The scope of this study was limited to the first-year and second-year undergraduate medical students enrolled at Perdana University - Royal College of Surgeons in Ireland (PU-RCSI) School of Medicine.

The protocol of this research was designed in accordance with the ethical principles of the Declaration of Helsinki for conducting research with human subjects. Ethics approval for this study was obtained from the Perdana University-Institutional Review Board (PU-IRB); PU IRBHR0237 (Appendix A). A quantitative approach was utilised to address the objectives of this study. For this purpose, the Motivated Strategies for Learning Questionnaire (MSLQ) developed by Pintrich et al. (1991) was deployed to gather the empirical evidence. The MSLQ measures SRL based on theoretical aspects of motivation orientation and the types of learning strategies. This instrument was administered before- and post-intervention. The matching pre-test and post-test data were analysed using the Statistical Package for the Social Sciences (SPSS) software Version 25.

This chapter will dissect the methodology of this study under the following:

(i)   Selection of Samples

(ii)   Location of the Research

(iii)   Data Collection Duration

(iv)   Procedure of Research

(v)   Research Instrument

(vi)   Reliability of Instrument

(vii)   Analytical Methods

4.2   Selection of Sample

In this study, all of the preclinical students enrolled in PU-RCSI School of Medicine, Malaysia were invited to participate in this research voluntarily. This included students who were commencing their first year or second year of the RCSI undergraduate medical programme in September 2019. Among these, 32 were first-years, and 40 were the second-year students. This study included only the data of the preclinical students who completed both the pre-test (before intervention) and post-test MSLQs. The present study targeted only the preclinical students as the literature suggests that early interventions to prime the students SRL skills will enhance their capacity to self-regulate their learning and hence, facilitate a smooth transition into the clinical years (Cho et al., 2017a).

4.3   Location of Research

All research activities of the present study were conducted at Perdana University, Selangor. The administration of the instrument was done using Google form, and the learning support intervention was conducted in the classroom.

4.4   Data Collection Duration

Data collection from both batches of the preclinical students were conducted at the beginning of their academic years, in September 2019. The student who volunteered to join the study were given a timeframe of one week to complete the pre-test MSLQ before

the learning support intervention and the post-test MSLQ were administered at the end of the 4-hours workshop.

4.5   Procedures of Research

The procedures of research in this study involves two phases; the pre-test phase and post-test phase. In the pre-test phase, the preclinical students were briefed about this study, and their informed consent to participate in this study was obtained. The pre-test MSLQ were administered through Google form a week before the learning support intervention.

In the post-test phase, all students were required to attend the intervention, which was conducted as a 4-hours workshop. The learning support intervention for the first-year and second-year students occurred at different times according to their respective timetables. The content, and the delivery approach, however, remained the same for both the first-year and second-year students. The post-test MSLQ was administered at the end of the workshop.

In this workshop, the preclinical students were taught about mindset, socio-affective, cognitive and metacognitive learning strategies and deep learning study cycle (Appendix B). These contents were designed based on Saundra McGuire's book on 'Teach Students How to Learn' (McGuire, 2015) and Donna Wilson's book on 'Teaching Students to Drive Their Brains' (Wilson & Conyers, 2016). In addition to that, students were also exposed to the relevant learning theories and concepts, such as the Atkinson and Shiffrin's information processing theory (1986) and Albert Bandura's social learning theory (1977), to provide them with conditional knowledge. The delivery of the program was based on instructional methods that encourage active learning among the students.

4.6   Research Instrument

In the present study, the preclinical students' baseline level and conception of SRL was assessed using the adopted MSLQ (P. R. Pintrich et al., 1991). The MSLQ is an 81-item instrument consisting of two sections; Part 1. Motivation Orientation, and Part 2. Learning Strategies (Appendix C). A detailed description of the theoretical constructs of both parts are presented in Chapter 1 (Section 1.7.1.1, Page 12; Section 1.7.1.2. Page 13).

As shown in Table 4.1, the motivation orientation section constitutes of 31 items in 6 subscales, and the learning strategies section constitutes 50 items in 9 subscales. All of the items in this instrument are Likert scale items with a seven-point format. The Likert scale of 1 represents "not at all true for me", and the Likert scale of 7 represents "very true for me". Eight of the items in the learning strategies section are reversed scored.

Table 4.1: Structure and Items of the MSLQ

Section	Constructs	Subscales	Question
Motivation orientation	Value	Intrinsic goal orientation	1, 16, 22, 24
		Extrinsic goal orientation	7, 11, 13, 30
		Task value	4, 10, 17, 23, 26, 27
	Expectancy	Control belief	2, 9, 18, 25
		Self-efficacy for learning and performance	5, 6, 12, 15, 20, 21, 29, 31
	Affective	Test anxiety	3, 8, 14, 19, 28
Learning strategies	Cognitive and metacognitive strategies	Rehearsal	39, 46, 59, 72
		Elaboration	53, 62, 64, 67, 69, 81
		Organization	32, 42, 49, 63
		Critical Thinking	38, 47, 51, 66, 71
		Metacognitive self-regulation	33[r], 36, 41, 44, 54, 55, 56, 57[r], 61, 76, 78, 79
	Resource management strategies	Time and study environment	35, 43, 52[r], 65, 70, 73, 77[r], 80[r]
		Effort Regulation	37[r], 48, 60[r], 74
		Peer Learning	34, 45, 50
		Help Seeking	40[r], 58, 64, 75

r. Reversed scored items

4.7   Reliability of Instrument

The confirmatory factor analysis and predictive validity of MSLQ are well-established (P. R. Pintrich, Smith, Garcia, & McKeachie, 1993). Many previous studies have validated the MSLQ with high internal consistency for all of the MSLQ items collectively (Cronbach's $\alpha \geq 0.90$), and for each subscale ($\alpha \geq 0.60$) (Hamid & Singaram, 2016; Lee et al., 2019).

As presented in Table 4.2, the overall Cronbach-alpha for the present study ($n = 53$) was 0.96. According to Schmitt (1996), a Cronbach-alpha value of 0.70 and above was regarded as satisfactory. Hence, the internal consistency of the MSLQ for the data set of this study is satisfactory. The summary for item statistics of MSLQ for this study is shown in Table 4.3.

Table 4.2: Overall Reliability of the MSLQ

Cronbach's Alpha	Number of Items
.960	81

Table 4.3: Summary Item Statistics for MSLQ

	Mean	Minimum	Maximum	Range	Maximum/ Minimum	Variance	N of Items
Item Means	5.278	3.189	6.434	3.245	2.018	.429	81

Table 4.4 reports the internal consistency of all 15 subscales of the MSLQ for the data set of this study. The Cronbach-alpha value for the subscales ranged from 0.715 to 0.905, except for the subscale "effort regulation" and "help-seeking", which had Cronbach-alpha value of 0.601 and 0.520, respectively. According to Pallant (2013), when the number of items for a particular construct is less than 10, it is not easy to achieve Cronbach-alpha value of 0.70 and above. In such a situation (items <10) Cronbach-alpha value of 0.50

and above is satisfactory. Therefore, the results suggest that the reliability of all subscale of the MSLQ in this study are satisfactory. The summary for item statistics of MSLQ subscales for this study is shown in Table 4.5.

Table 4.4: Reliability of MSLQ Subscales

Subscale	Cronbach's Alpha	Number of Items
Intrinsic goal orientation	.717	4
Extrinsic goal orientation	.845	4
Task value	.861	6
Control belief	.776	4
Self-efficacy for learning and performance	.905	8
Test anxiety	.802	5
Rehearsal	.759	4
Elaboration	.865	6
Organization	.721	4
Critical Thinking	.866	5
Metacognitive self-regulation	.817	12
Time and study environment	.715	8
Effort Regulation	.601	4
Peer Learning	.731	3
Help Seeking	.520	4

Table 4.5: Summary Item Means Statistics for MSLQ Subscales

Subscale	Mean	Min.	Max.	Range	Max. / Min.	Variance	N of Items
Intrinsic goal orientation	5.410	4.849	6.094	1.245	1.257	.271	4
Extrinsic goal orientation	5.670	5.283	5.906	.623	1.118	.086	4
Task value	5.858	5.547	6.208	.660	1.119	.057	6
Control belief	5.915	5.396	6.208	.811	1.150	.137	4
Self-efficacy for learning and performance	5.189	4.623	5.698	1.075	1.233	.149	8
Test anxiety	4.894	4.509	5.226	.717	1.159	.126	5

Table 4.5: Summary Item Means Statistics for MSLQ Subscales (Continued)

Subscale	Mean	Min.	Max.	Range	Max. / Min.	Variance	N of Items
Rehearsal	5.448	5.113	5.755	.642	1.125	.069	4
Elaboration	5.465	5.170	5.698	.528	1.102	.041	6
Organization	5.542	5.340	5.792	.453	1.085	.038	4
Critical Thinking	5.121	5.038	5.226	.189	1.037	.009	5
Metacognitive self-regulation	5.138	3.358	5.962	2.604	1.775	.652	12
Time and study environment	5.047	3.302	6.434	3.132	1.949	1.350	8
Effort Regulation	4.958	4.283	5.698	1.415	1.330	.508	4
Peer Learning	5.000	4.528	5.604	1.075	1.238	.302	3
Help Seeking	4.792	3.189	5.528	2.340	1.734	1.204	4

4.8 Analytical Methods

The data obtained from the pre-test and post-test MSLQ were analysed quantitatively using the SPSS software Version 25. Upon completing the data preparation and cleaning, the normality of data distribution was characterized using the Kolmogorov-Smirnov and Shapiro-Wilk test for normality. This characterization step was essential to determine the statistical methods for data analysis (Mishra et al., 2019). Data that followed a normal distribution were analysed using parametric tests, while the data which are not normally distributed were analysed using non-parametric tests (Sullivan & Artino, 2013). As the measures of MSQL are based on a Likert scale of 1 to 7, the scores for each subscale were computed as either mean (parametric) or medians (non-parametric) of items within that subscale.

Descriptive statistics were used to analyse the demographic data and to profile the preclinical students' baseline level of SRL. To compare the differences in the mean scores of the subscales between the first-year and second-year students, either the independent *t*-test (parametric test) or Mann-Whitney U test (non-parametric test) were used depending on the normality of the data. Similarly, to evaluate the significant differences between the mean scores of pre-test and post-test data, either pair-sample *t*-test (parametric test) or the Wilcoxon signed-rank test was deployed. A *p*-value less than 0.05 was considered significant. The summary of the data analysis to answer the research questions of the present study is shown in Table 4.6.

Table 4.6: Summary of Data Analysis

Research Question	Measurement Scale	Statistical Methods
1. What baseline level of the preclinical students' self-regulated learning from the dimension of a) motivation orientation b) learning strategies	Nominal scale	Descriptive statistics
2. Is there a significant difference between the first year and second year medical students' self-regulated learning from the dimension of a) motivation orientation b) learning strategies	Nominal scale	Independent *t*-test or Mann-Whitney U test
3. Did the learning support intervention bring about a significant change in the preclinical students' conception self-regulated learning from the dimension a) motivation orientation b) learning strategies	Nominal scale	Paired sample *t*-test or Wilcoxon signed-rank test

Table 4.6: Summary of data analysis (Continued)

	Research Question	Measurement Scale	Statistical Methods
4	Is there a significant difference in the preclinical students' conception of SRL induced by the intervention between the first year and second year medical students from the dimension of	Nominal scale	Independent t-test or Mann-Whitney U test
a)	motivation orientation		
b)	learning strategies		

4.9   Chapter Summary

This chapter presented the quantitative approach that was used to evaluate the impact of imparting direct instruction of SRL strategies on the preclinical students' conception of the SRL. The empirical measure of the preclinical students' SRL was performed using the MSLQ. The internal consistency of this instrument was found to be satisfactory.

This instrument was administered twice to the preclinical students. First administration occurred during the pre-test phase, which was before the learning support intervention was conducted. These scores were regarded as the pre-test scores, and they were used to profile the students' baseline level of SRL. The second administration of the MSLQ occurred after the students have completed the intervention program that was carried out as a four-hour workshop. These scores were regarded as the pre-test scores, and they were used to measure the students' conception of SRL.

This chapter also described a series of statistical method that was performed to address the research questions of this study. These includes parametric test such as the independent t-test and paired sample t-test, and the non-parametric test such as the Mann-Whitney U test and Wilcoxon signed-rank test.

CHAPTER 5: RESULTS AND DISCUSSION

5.1   Introduction

This chapter sets forth the results and discussion of the present study. This quasi-experimental research evaluated the impact of the learning skills support intervention on the baseline level of the preclinical students' self-regulated learning (SRL) strategies. The intervention entails explicit instructions on SRL skills. Data on the students' motivation orientation and learning strategies were obtained before and after the intervention using the Motivated Strategies for Learning Questionnaire (MSLQ) developed by Pintrich et al. (1991). This instrument was administered to first-year, and second-year undergraduate medical students enrolled in the RCSI Medical Programme in 2019 at the PU-RCSI School of Medicine, Malaysia.

This study assessed the different aspects of the preclinical students' motivation and learning strategies to gain insight on the baseline level of their self-regulated learning (SRL) and the impact of explicit instruction on the SRL strategies on their conception of SRL. The statistical analysis of this study data was performed in line with the research questions presented in Chapter 1 (Section 1.5, Page 9) using the SPSS software Version 25.

5.2   Demographics of the Preclinical Students

The MSLQ was administered to a total of 72 preclinical students who were in their first and second academic years. Among these students, a total of 53 students participated in this study, leading to a response rate of 73.6%. As indicated in Table 5.1, the study population consisted of an almost equal number of students for each academic year, where 28 were the first-year medical students, and 25 were the second-year medical students.

Table 5.1: Distribution of the Preclinical Students according to Academic Year

Academic year	*n*	%
First-year	28	52.8
Second-year	25	47.2

The Kolmogorov-Smirnov and Shapiro-Wilk tests were computed to evaluate the normality of preclinical student distribution in terms of gender and ethnicity in both the academic years. Table 5.2 shows the normality of the preclinical students' gender and ethnicity distribution according to the academic years. Since the sample size is small, the Shapiro-Wilk was used to characterize the normality of the sample distribution. The results shown in Table 5.2 indicates that the p-values for all the tested variables are lesser than 0.05 ($p < 0.001$), which suggests that the samples are not normally distributed. Therefore, the Mann-Whitney U test was performed to compare the gender and ethnicity distribution differences between first-year and second-year students.

Table 5.2: Kolmogorov-Smirnov and Shapiro-Wilk test for Normality of the Preclinical Students' Gender and Ethnicity Distribution according to the Academic Years

Variable	Academic year	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Gender	First-year	.465	28	.000	.541	28	.000
	Second-year	.469	25	.000	.533	25	.000
Ethnicity	First-year	.268	28	.000	.827	28	.000
	Second-year	.375	25	.000	.675	25	.000

a. Lilliefors Significance Correlation

The preclinical students' gender and ethnicity distribution according to the academic years and in total, are shown in Table 5.3. The descriptive statistics in Table 5.3 indicates that a higher percentage of the study population were female students (75.5%). In terms of ethnicity, more than half of the respondents were Indians (50.9%), followed by 28.3%

Malays, 18.9% Chinese and 1.9% others. As shown in Table 5.3, the Mann-Whitney U test indicated a *p*-value of greater than 0.05 for both gender (*p* = 0.933) and ethnicity (*p* = 0.593) of the preclinical students. These findings imply that there were no significant differences between the first- and second-year students in terms of gender and ethnicity distribution.

Table 5.3: The Preclinical Students' Gender and Ethnicity Distribution according to Academic Years and in Total

Variables		First-Year		Second-Year		Sig.	Total Students	
		n	*%*	*n*	*%*		*n*	*%*
Gender	Male	7	25.0	6	24.0	.933	13	24.5
	Female	21	75.0	19	76.0		40	75.5
	Total	28	100.0	25	100.0		53	100.0
Ethnicity	Malay	8	28.6	7	28.0	.593	15	28.3
	Chinese	7	25.0	3	12.0		10	18.9
	Indian	12	42.9	15	60.0		27	50.9
	Others	1	3.5	-	-		1	1.9
	Total	28	100.0	25	100.0		53	100.0

5.3   The Baseline Level of the Preclinical Students' Self-Regulated Learning

In order to evaluate the baseline level of the preclinical students' SRL, the scores of the MSLQ administered before the learning skills support intervention (pre-test MSQL) were calculated. The students' scores for the pre-test MSLQ were measured as either mean or medians of items within each subscale, as shown in Chapter 4 (Table 4.1, Page 71), based on the distribution normality (Mishra et al., 2019; Sullivan & Artino, 2013).

The MSLQ measures the preclinical students' SRL based on their motivation and learning strategies. As described in Chapter 1 (Section 1.7.1.1, Page 12), the motivation orientation inventory in this questionnaire comprised of 31 items within five subscales that measured three constructs of the students' motivational beliefs, including value

aspects, expectancy aspect and affective aspect. The metacognitive learning strategies inventory, on the other hand, comprised 50 items within nine subscales that measure two constructs of the students' learning strategies, including cognitive and metacognitive learning strategies, and resource management strategies (Chapter 1, Section 1.7.1.2, Page 13).

Hence, the results which address the first research question on the baseline level of the preclinical students' SRL, are presented in the two subsequent sections as follows:

(i)   The preclinical students' baseline level of motivation orientation;

(ii)   The preclinical students' baseline level of learning strategies.

5.3.1   The preclinical students' baseline level motivation orientation

The normality of the preclinical students' scores for motivation orientation subscales in the pre-test MSLQ was characterized using the Kolmogorov-Smirnov and Shapiro-Wilk tests. Normality characterization is a critical step in determining central tendency measures and statistical methods for data analysis (Mishra et al., 2019). Parametric approaches were applied when the data follow a normal distribution; otherwise, the non-parametric approaches were applied (Mishra et al., 2019; Sullivan & Artino, 2013).

Table 5.4 shows the normality test results of the students' scores for the five motivation orientation subscales. Based on the Shapiro-Wilk test, the p-value for three subscales, including intrinsic goal ($p = 0.293$), self-efficacy ($p = 0.335$) and test anxiety ($p = 0.205$), were greater than 0.05. These p-values indicated a normal distribution of the scores. On the other hand, p-value for the extrinsic goal ($p = 0.001$), task value ($p = 0.031$) and test anxiety ($p = 0.002$) were lesser than 0.05. Thus, indicating that the scores for these subscales were not normally distributed.

Table 5.4: Kolmogorov-Smirnov and Shapiro-Wilk test for Normality of the Preclinical Students' Scores for Motivation Orientation Subscales in the Pre-Test MSLQ

Construct	Subscale	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Value	Intrinsic goal	.078	53	.200*	.974	53	.293
	Extrinsic goal	.126	53	.036	.910	53	.001
	Task value	.117	53	.068	.952	53	.031
Expectancy	Control belief	.181	53	.000	.922	53	.002
	Self-efficacy	.083	53	.200*	.975	53	.335
Affective	Test anxiety	.089	53	.200*	.970	53	.205

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correlation

Based on these normality test results, the central tendencies of items for the subscales that followed a normal distribution were measured as means, while those that followed a non-normal distribution were measured as medians. Table 5.5 shows the baseline level of the preclinical students' motivation orientation based on their scores for the five subscales in the pre-test MSLQ.

Table 5.5: The Baseline Level of the Preclinical Students' Motivation Orientation based on the Pre-Test MSLQ

Construct	Subscale	Mean	Std. Dev.	Median	IQR
Value	Intrinsic goal	5.41	0.87	5.50	4.75 – 6.00
	Extrinsic goal*	5.67	1.16	6.00	4.75 – 6.75
	Task value*	5.86	0.81	6.00	5.33 – 6.55
Expectancy	Control belief*	5.92	0.85	6.00	5.37 – 6.62
	Self-efficacy	5.19	0.92	5.25	4.69 – 6.00
Affective	Test anxiety	4.89	1.27	5.00	4.00 – 5.90

*. Data not normally distributed.

As shown in 5.5, the preclinical students' motivation orientation was primarily driven by extrinsic goal orientation, task value and control of learning beliefs with a median of 6.00. This finding partially corroborated with the findings of Lee et al. (2019), which

showed that preclinical students from University Malaya (UM) and the National University of Singapore (NUS) had a higher mean score for task value and control of learning beliefs. However, the students in that study reported a higher level mean score of intrinsic goal orientation (Lee et al., 2019). This discrepancy could be explained based on the self-determined theory, which suggests that intrinsic motivation was sustained when the three basic psychological needs, autonomy, competence, and relatedness, were fulfilled (Edward L Deci & Ryan, 1985). Autonomy was felt only when behaviour was aligned with authentic interests or integrated values (Ryan & Deci, 2000b). While Lee et al. (2019) studied students in public universities, the students in the present study were private university students, where a more substantial familial or parental influence may affect student's choice to do medicine (Adom, 2015; Dundes, Cho, & Kwak, 2009). In such a situation, autonomy was lost as students may feel obliged to learn.

Besides, according to the SDT, extrinsic motivation constitutes four different levels that vary substantially in its relative autonomy. Among these, the two highest orientation of extrinsic motivation, including identified regulation and integrated regulation were more persistent behaviour that were closer to true self-regulation (Ryan & Deci, 2000a). Thus, it possible that the students may have valued and considered learning medicine as personally relevant, although it may be guided by external demands (Ten Cate et al., 2011). As the MSLQ used in this study does not distinguish the different orientations of extrinsic motivation, it is difficult to conclude on the preclinical students' level of extrinsic motivation. Nevertheless, evidence from the past studies suggested that intrinsic motivation was necessary for SRL as it stimulates students to engage in deep learning processes (Pelaccia & Viau, 2017; P. R. Pintrich, 1999) and utilize more SRL strategies, especially metacognitive strategies, to learn (Mukhtar, Muis, & Elizov, 2018). Therefore, it was vital to foster intrinsic motivation among medical students.

The lowest-rated subscales in the present study were the test anxiety ($M = 4.89 \pm 1.27$), suggesting that the preclinical students were less nervous with assessments. Other studies have also reported that test anxiety was generally low among preclinical students (Hamid & Singaram, 2016; Kim & Jang, 2015; Lee et al., 2019). Hamid and Singaram (2016) suggested that students with high task value and firm self-efficacy beliefs would presumably demonstrate lower test anxiety, as they were more likely to feel more confident and capable of performing in assessments. Likewise, the inverse correlation between self-efficacy and test anxiety has been reported by several other studies (Artino et al., 2010; Onyeizugbo, 2010; Roick & Ringeisen, 2017). In the present study, however, the preclinical students' self-efficacy mean score ($M = 5.19 \pm 0.92$) was the second lowest-rated motivation orientation subscale.

A comparable finding was also reported by Lee et al. (2019), and they suggested that low self-efficacy does not necessarily translate into poor performance or elevated test anxiety. Furthermore, Asian students mostly were shown to have a lower self-efficacy belief (Henning, Hawken, Krägeloh, Zhao, & Doherty, 2011; Klassen, 2004), which may be linked to the values and cultures in the East (Schunk & Dibenedetto, 2016). However, self-efficacy has been identified as a critical variable for improving students' self-regulated learning skills (Cook & Artino, 2016; Turan et al., 2013). Moreover, self-efficacy plays a vital role in fostering the development of intrinsic motivation (Nabizadeh, Hajian, Sheikhan, & Rafiei, 2019) and facilitating the cognitive processes involved in high-quality learning (Papinczak, Young, Groves, & Haynes, 2008). Hence, it was possible that the low self-efficacy beliefs of the preclinical students in the present study could have also contributed to the higher extrinsic motivation among the students.

5.3.2   The preclinical students' baseline level of learning strategies

The normality of the preclinical students' scores for nine subscales of the learning strategies dimension in the pre-test MSLQ was characterized using the Kolmogorov-Smirnov and Shapiro-Wilk tests. The results on the normality of the students' scores for these subscales are presented in Table 5.6.

Table 5.6: Kolmogorov-Smirnov and Shapiro-Wilk test for Normality of the Preclinical Students' Scores for Learning Strategies Subscales in the Pre-Test MSLQ

Construct	Subscale	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Learning strategies	Rehearsal	.116	53	.072	.966	53	.134
	Elaboration	.067	53	.200*	.970	53	.202
	Organization	.095	53	.200*	.953	53	.038
	Critical thinking	.140	53	.011	.957	53	.057
	Metacognitive self-regulation	.104	53	.200*	.979	53	.456
Resource management	Time/study environment	.072	53	.200*	.973	53	.277
	Effort regulation	.108	53	.184	.967	53	.155
	Peer learning	.086	53	.200*	.961	53	.081
	Help seeking	.124	53	.042	.969	53	.187

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correlation

Based on the Shapiro-Wilk test, the p-value for eight subscales, rehearsal ($p = 0.134$), elaboration ($p = 0.202$), critical thinking ($p = 0.057$), metacognitive self-regulation ($p = 0.456$), time and study environment ($p = 0.277$), effort regulation ($p = 0.155$) and help seeking ($p = 0.187$), were greater than 0.05, indicating a normal distribution of the scores.

Only one subscale, organization (p = .038), were not normally distributed as the p-value was less than 0.05.

Based on these normality test results, the central tendencies of all subscales, except the organization, were calculated as mean. The median value was considered for the organization subscale. Table 5.7 shows the baseline level of the preclinical students' learning strategies based on their scores for the nine subscales in the pre-test MSLQ.

Table 5.7: The Baseline Level of the Preclinical Students' Learning Strategies based on the Pre-Test MSLQ

Construct	Subscale	Mean	Std. Dev.	Median	IQR
Learning strategies	Rehearsal	5.45	0.95	5.50	4.75 – 6.13
	Elaboration	5.47	0.98	5.50	4.83 – 6.25
	Organization*	5.54	0.94	5.50	5.00 – 6.25
	Critical thinking	5.12	1.07	5.00	4.40 – 6.00
	Metacognitive self-regulation	5.14	0.78	5.25	4.58 – 5.75
Resource management	Time and study environment	5.05	0.84	5.00	4.44 – 5.63
	Effort regulation	4.96	1.04	4.75	4.00 – 5.75
	Peer learning	5.00	1.08	5.00	4.33 – 6.00
	Help seeking	4.79	0.95	4.75	4.25 – 5.38

*. Data not normally distributed.

As shown in 5.7, the preclinical students reported that they used organization (Mdn = 5.50; IQR = 5.00 – 6.25), elaboration (M = 5.47 ± 0.98), and rehearsal (M = 5.45 ± 0.95) learning strategies the most than other strategies. Two other studies have also reported that the use of elaboration and organization strategies were much higher than other

learning strategies among the preclinical students in their studies (Hamid & Singaram, 2016; Lee et al., 2019). Both these cognitive learning strategies were essential for students to construct connection within the new information to be learned, and prior knowledge, respectively (Bergin, Reilly, & Traynor, 2005; Duncan & McKeachie, 2005). While, these learning strategies were considered as complex strategies that may lead to a deeper processing of information (Duncan & McKeachie, 2005; Wolters et al., 2005), the critical thinking and metacognitive regulation were even more crucial for clinical reasoning and problem-solving (Cutrer, Sullivan, & Fleming, 2013; Kiesewetter et al., 2016; Royce, Hayes, & Schwartzstein, 2019). However, the preclinical students in this study reported lower mean scores for both critical thinking and metacognitive self-regulation. Several studies have suggested that undergraduate students have poor metacognition and critical thinking skills as the pre-university education often prepare them to focus on the lower levels of Bloom's Taxonomy in acquiring and processing knowledge (Nordell, 2009). As a result of the mismatch between the students' conception of effective learning and the inherent demands of the new learning environment, students' performance in the medical school were more often below expectation (Raidal & Volet, 2009).

In the present study, the preclinical students were also found to be highly dependent on the rehearsal learning strategies. The rehearsal learning strategies involve the recitation of information and mnemonic techniques for memorization of learning material (Bergin et al., 2005; Duncan & McKeachie, 2005; Garcia & Pintrich, 1993). This learning strategy was assumed to help students to attend to and reproduce selected information (Bergin et al., 2005). Therefore, it leads to the acquisition of knowledge at the surface level (Broadbent & Poon, 2015; Wolters et al., 2005). However, it has been noted that surface approaches to learning or rote learning strategies were quite common among undergraduate medical students (Bickerdike, O'Deasmhunaigh, O'Flynn, & O'Tuathaigh,

2016). Some studies suggest that students predominantly use surface learning strategies when they encounter novel knowledge (Aharony, 2006; Good, Ramos, & D'Amore, 2013). Others suggest that it was due to the perceived efficacy of rehearsal learning strategy in pre-university education (Almeida, Teixeira-Dias, Martinho, & Balasooriya, 2011; Yonker, 2011).

The preclinical students in the present study, generally scored very low for all of the resource management strategies; time and study environment ($M = 5.05 \pm 0.84$), effort regulation ($M = 4.96 \pm 1.04$), peer learning ($M = 5.00 \pm 1.08$) and help-seeking ($M = 4.79 \pm 0.95$). These strategies, which relates to students' skills to manage, control, and regulate resources other than their cognition (Duncan & McKeachie, 2005), were indispensable for effective SRL (P. R. Pintrich, 1999). Several studies have suggested that metacognitive skills were strongly associated with effective resource management skills (Luwel, Torbeyns, & Verschaffel, 2003; Sperling, Howard, Staley, & DuBois, 2004; Vrugt & Oort, 2008). For instance, a study among the first-year pharmacy students suggested that students with higher metacognitive skills were more aware of their limits and would seek for help (Chu, Palmer, & Persky, 2018). Furthermore, in a recent review article, it was highlighted that students' ability to monitor their progress was often limited (de Bruin, Dunlosky, & Cavalcanti, 2017). This paucity in their metacognitive skills results in the inefficient use of study time (de Bruin et al., 2017). Therefore, it is possible that the low baseline level of resource management strategies among the preclinical students may be due to their metacognitive inaptness. As stated earlier, most undergraduate students have poor metacognitive skills (Nordell, 2009). Lee et al. (2019) also reported lower help-seeking behaviour among the preclinical students in UM and NUS.

These findings imply that the preclinical students' baseline level of learning strategies were inadequate and inefficient for self-regulating learning in medical school. Although some studies suggested that students will eventually develop SRL skill over time (Kell & van Deursen, 2003; Premkumar et al., 2013), it has been noted that when students were not given enough explicit instruction about the knowledge and skills that guide SRL, they may develop forms of SRL that are suboptimal (Winne, 1996).

5.4 The Difference in the Baseline Level of Self-Regulated Learning Between the First-Year and Second-Year Medical Students

The pre-test MSLQ data was used to address the second research question of this study. The results are presented in the two subsequent sections as follows:

(i)   The differences in the baseline level of motivation orientation between the first-year and second-year medical students;

(ii)   The differences in the baseline level of learning strategies between the first-year and second-year medical students.

5.4.1 The Differences in the Baseline Level of Motivation Orientation Between the First-Year and Second-Year Medical Students

The normality of the preclinical students' scores for motivation orientation subscales according to their academic year was characterized using the Kolmogorov-Smirnov and Shapiro-Wilk tests. The results on the normality of the students' scores for five subscales of motivation orientation dimension are presented in Table 5.8.

The results of the Shapiro-Wilk test suggest a non-normal distribution of data ($p < 0.05$) for the three subscales, including extrinsic goal (first and second year), task value (first year only) and control belief (first and second year). Based on these normality test results, the motivation orientation differences between the first year and second-year

medical students were analysed using two different statistical tests. While the scores of subscales that did not follow a normal distribution were analysed using the non-parametric Mann-Whitney U test, those that followed a normal distribution (intrinsic goal, self-efficacy, and test anxiety) were analysed using the parametric independent *t*-test. As the independent t-test assumes the variances of the two groups measured are equal in the population, hence the assumption of homogeneity of variance was tested using Levene's Test of Equality of Variances. The group variances are assumed equal when the significance value of this test is greater than 0.05. Therefore, the *p*-value for the independent *t*-test was determined based on the assumption of homogeneity of variance. Table 5.9 shows the comparison of the motivation orientation subscales between the first- and second-year medical students.

Table 5.8: Kolmogorov-Smirnov and Shapiro-Wilk test for Normality of the Students' Scores for Motivation Orientation Subscales according to the Academic Years

Subscale	Academic Year	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Intrinsic goal	First year	.107	28	.200*	.949	28	.182
	Second year	.144	25	.192	.953	25	.291
Extrinsic goal	First year	.166	28	.047	.917	28	.030
	Second year	.209	25	.006	.904	25	.023
Task value	First year	.195	28	.008	.891	28	.007
	Second year	.168	25	.066	.958	25	.384
Control belief	First year	.194	28	.008	.912	28	.022
	Second year	.222	25	.003	.905	25	.023
Self-efficacy	First year	.134	28	.200*	.941	28	.118
	Second year	.106	25	.200*	.967	25	.564
Test anxiety	First year	.079	28	.200*	.979	28	.824
	Second year	.169	25	.063	.931	25	.092

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correlation

Table 5.9: Comparison of the Motivation Orientation Subscales between the First-Year and Second-Year Medical Students

Subscales	First year		Second year		p-value [a]
	Mean	SD	Mean	SD	
Intrinsic goal	5.51	0.99	5.30	0.70	0.099
Extrinsic goal	5.45	1.29	5.92	0.95	0.207 [b]
Task value	5.88	0.95	5.84	0.63	0.491 [b]
Control belief	5.79	0.97	6.06	0.68	0.434 [b]
Self-efficacy	5.17	1.00	5.21	0.83	0.342
Test anxiety	4.78	1.19	5.02	1.36	0.640

a. Independent *t*-test unless otherwise indicated
b. Mann-Whitney U test

As shown in Table 5.9, no significance differences ($p > 0.05$) were observed between the first-year and second-year medical students' scores for the motivation orientation subscales. Nevertheless, the mean scores indicate that the extrinsic goal orientation was higher among the second-year students. On contrary, Kim and Jang (2015) reported that the of the preclinical student became more motivated as the progressed to the second year. A possible explanation to this is that the students may have directed their motivation toward achieving the highest grade (White, 2007).

5.4.2   The Differences in the Baseline Level of Learning Strategies Between the First Year and Second Year Medical Students

The normality of the preclinical students' scores for learning strategies subscales according to their academic year was characterized using the Kolmogorov-Smirnov and Shapiro-Wilk tests. The results on the normality of the students' scores for nine subscales of learning strategies dimension are presented in Table 5.10. The results of the Shapiro-Wilk test indicate that the scores for all subscales, except the elaboration, were normally distributed.

Based on these normality test results, the differences in the learning strategies between the first and second-year medical students were analysed using two different statistical tests. All subscales, except the elaboration, were analysed using the independent *t*-test. The elaboration subscale was analysed using the Mann-Whitney U test.

Table 5.10: Kolmogorov-Smirnov and Shapiro-Wilk test for Normality of the Students' Scores for Learning Strategies Subscales according to the Academic Years

Subscale	Academic Year	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Rehearsal	First-year	.214	28	.002	.932	28	.068
	Second-year	.150	25	.148	.923	25	.061
Elaboration	First-year	.152	28	.099	.944	28	.143
	Second-year	.159	25	.104	.917	25	.043
Organization	First-year	.161	28	.062	.928	28	.054
	Second-year	.197	25	.013	.928	25	.077
Critical thinking	First-year	.127	28	.200*	.954	28	.254
	Second-year	.164	25	.081	.942	25	.163
Metacognitive self-regulation	First-year	.149	28	.112	.963	28	.400
	Second-year	.090	25	.200*	.972	25	.709
Time & study environment	First-year	.139	28	.175	.943	28	.132
	Second-year	.101	25	.200*	.979	25	.873
Effort regulation	First-year	.148	28	.121	.950	28	.200
	Second-year	.162	25	.088	.927	25	.074
Peer learning	First-year	.153	28	.093	.942	28	.126
	Second-year	.094	25	.200*	.962	25	.459
Help seeking	First-year	.163	28	.055	.960	28	.346
	Second-year	.135	25	.200*	.962	25	.446

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correlation

As shown in Table 5.11, the scores for the learning strategies reported by first- and second-year medical students were not significantly different ($p > 0.05$). Students in both years rely heavily on rehearsal, elaboration and organization. Past research has shown

that medical students SRL skills did not change much during three years in medical school (Lucieer, Jonker, et al., 2016). Moreover, the researchers emphasized the need for medical schools to support students SRL with sufficient explicit instructions.

Table 5.11: Comparison of the Learning Strategies Subscales between the First-Year and Second-Year Medical Students

Subscales	First year		Second year		p-value [a]
	Mean	(SD)	Mean	(SD)	
Rehearsal	5.38	1.09	5.52	0.77	.087
Elaboration	5.47	1.07	5.45	0.88	.701 [b]
Organization	5.50	1.12	5.59	0.74	.207
Critical thinking	5.09	1.18	5.15	0.95	.441
Metacognitive self-regulation	5.17	0.85	5.12	0.72	.330
Time & study environment	4.98	0.87	5.13	0.83	.427
Effort regulation	4.98	0.95	4.93	1.15	.548
Peer learning	4.94	1.28	5.07	0.83	.070
Help seeking	4.88	0.97	4.70	0.93	.868

a. Independent *t*-test unless otherwise indicated
b. Mann-Whitney U test

5.5 Impact of the Learning Skills Support Intervention on the Preclinical Students' Conception Self-Regulated Learning

In this section, the preclinical students' scores for the post-test MSLQ were compared with the pre-test MSLQ data in order to explore the impact of the explicit SRL skills teaching on the students' conception of SRL. These results, which addresses the third research question of this study, are presented in the two subsequent sections as follows:

(i)   The impact of learning skills support intervention on the preclinical students' motivation;

(ii)   The impact of learning skills support intervention on the preclinical students' conception of SRL learning strategies;

5.5.1 The Impact of Learning Skills Support Intervention on the Preclinical Students' Motivation

The normality of the preclinical students' scores for motivation orientation subscales in the pre-test and post-test MSLQ was characterized using the Kolmogorov-Smirnov and Shapiro-Wilk tests. The results on the normality of the students' scores for six subscales of motivation orientation dimension are presented in Table 5.12. Based on the Shapiro-Wilk test results, the p-value for the post-test scores in all subscales were less than 0.05. As $p < 0.05$ indicated that the data was not normally distributed, the mean differences in the pre-test and the post-test scores were analysed using the non-parametric Wilcoxon Signed Ranks test. Table 5.13 presents the comparison of the preclinical students' pre-test and post-test MSLQ scores for motivation orientation subscales.

Table 5.12: Kolmogorov-Smirnov and Shapiro-Wilk test for Normality of the Preclinical Students' Scores for Motivation Orientation Subscales in the Pre-Test and Post-Test MSLQ Data

Subscale	MSLQ data	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Intrinsic goal	Pre-test	.078	53	.200[*]	.974	53	.293
	Post-test	.130	53	.026	.937	53	.008
Extrinsic goal	Pre-test	.126	53	.036	.910	53	.001
	Post-test	.133	53	.020	.930	53	.004
Task value	Pre-test	.117	53	.068	.952	53	.031
	Post-test	.155	53	.003	.908	53	.001
Control belief	Pre-test	.181	53	.000	.922	53	.002
	Post-test	.137	53	.014	.892	53	.000
Self-efficacy	Pre-test	.083	53	.200[*]	.975	53	.335
	Post-test	.182	53	.000	.891	53	.000
Test anxiety	Pre-test	.089	53	.200[*]	.970	53	.205
	Post-test	.102	53	.200[*]	.951	53	.029

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correlation

Table 5.13: Comparison of the Preclinical Students' Pre-Test and Post-Test MSLQ Scores for Motivation Orientation Subscales

Subscales	Pre-test		p-value (2-tailed)[a]	Paired differences	
	Mean	SD		Mean	SD
Intrinsic goal	5.41	0.87	< 0.001*	0.45	0.64
Extrinsic goal	5.67	1.16	0.124	-0.11	0.91
Task value	5.86	0.81	< 0.001*	0.35	0.61
Control belief	5.92	0.85	0.008*	0.26	0.73
Self-efficacy	5.19	0.92	< 0.001*	0.49	0.58
Test anxiety	4.89	1.27	0.011*	-0.38	1.19

*. Significant at p<0.05
a. Wilcoxon Signed Ranks Test

As shown in Table 5.13, significant differences were observed in the post-test mean scores of all subscales, except the extrinsic goal orientation (p = 0.124). As compared to the baseline level of the preclinical students' motivation orientation described in section 5.3.1 (Page 80 – 84), the intervention has increased their self-efficacy (M = 5.68 ± 1.03; p < 0.001) and shifted their motivation towards intrinsic goal orientation (M = 5.86 ± 0.85; p < 0.001). This finding could possibly indicate that the intervention promoted the assimilation of sophisticated conception about learning among the preclinical students. Paulsen and Feldman (2005) described the sophisticated conception of learning to include two principal learning beliefs. First is that knowledge is as a complex interrelationship between many concepts and ideas, rather than simple, isolated fragments of information (Paulsen & Feldman, 2005). Second, learning capabilities are not inherent, and it can be enhanced through effort and experience over time (Paulsen & Feldman, 2005). Evidence from literature studies suggests that students' differences in the conception of learning underlie their involvement in specific motivational aspect of SRL (Hofer, 1999; Valle et al., 2003). A study among undergraduate students showed that those with a sophisticated conception of learning are more likely to sustain intrinsic goal, high self-efficacy and task value, and reduced test anxiety (Paulsen & Feldman, 2005). Two other studies have also

94

linked the sophisticated conception of learning with higher self-efficacy (Hofer, 1994; Tsai, Ho, Liang, & Lin, 2011)

The post-test scores in the present study also shows a significant increase in task value ($M = 5.86 \pm 0.85$; $p < 0.001$), control beliefs ($M = 6.20 \pm 0.71$; $p = 0.008$) and reduced test anxiety ($M = 4.52 \pm 1.48$; $p = 0.011$). In a nutshell, the SRL skills support intervention induced a significant positive impact on the preclinical students' motivation orientation. Similarly, a recent study on the impact of skills learning support program among first-year undergraduate students in the United States also reported a positive outcome on the students' motivational beliefs (Wibrowski, Matthews, & Kitsantas, 2017).

5.5.2 The Impact of Learning Skills Support Intervention on the Preclinical Students' Conception of SRL Learning Strategies

The normality of the preclinical students' scores for learning strategies subscales in the pre-test and post-test MSLQ was characterized using the Kolmogorov-Smirnov and Shapiro-Wilk tests. The results on the normality of the students' scores for nine subscales of learning strategies dimension are presented in Table 5.14. Based on the Shapiro-Wilk test results, the p-value for the post-test scores in four subscales, including rehearsal ($p = 0.001$), elaboration ($p = 0.008$), organization ($p = 0.004$; pre-test, $p = 0.038$), and peer learning ($p < 0.001$), was less than 0.05. This p-value indicates that the scores in these subscales were not normally distributed. The mean differences in the pre-test and the post-test scores were analysed using two different statistical tests since the five other subscales were normally distributed. Subscales that followed a normal distribution were analysed using the paired-sample t-test, while the Wilcoxon Signed Ranks Test was used to analyse subscales that are not normally distributed. Table 5.15 presents the comparison of the preclinical students' pre-test and post-test MSLQ scores for learning strategies subscales.

Table 5.14: Kolmogorov-Smirnov and Shapiro-Wilk Test for Normality of the Preclinical Students' Scores for Learning Strategies Subscales in the Pre-Test and Post-Test MSLQ Data

Subscale	MSLQ data	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Rehearsal	Pre-test	.116	53	.072	.966	53	.134
	Post-test	.145	53	.007	.917	53	.001
Elaboration	Pre-test	.067	53	.200*	.970	53	.202
	Post-test	.098	53	.200*	.938	53	.008
Organization	Pre-test	.095	53	.200*	.953	53	.038
	Post-test	.133	53	.020	.929	53	.004
Critical thinking	Pre-test	.140	53	.011	.957	53	.057
	Post-test	.130	53	.026	.958	53	.063
Metacognitive self-regulation	Pre-test	.104	53	.200*	.979	53	.456
	Post-test	.095	53	.200*	.970	53	.195
Time & study environment	Pre-test	.072	53	.200*	.973	53	.277
	Post-test	.117	53	.067	.963	53	.097
Effort regulation	Pre-test	.108	53	.184	.967	53	.155
	Post-test	.111	53	.151	.968	53	.172
Peer learning	Pre-test	.086	53	.200*	.961	53	.081
	Post-test	.168	53	.001	.902	53	.000
Help seeking	Pre-test	.124	53	.042	.969	53	.187
	Post-test	.096	53	.200*	.971	53	.215

*. This is a lower bound of the true significance
a. Lilliefors Significance Correlation

As shown in Table 5.15, significant differences were observed in the post-test mean scores of all subscales, except the effort regulation ($p = 0.290$). Literature in learning conception suggest that students with a sophisticated conception of learning have higher propensity to utilize productive self-regulated cognitive strategies (Dahl, Bals, & Turi, 2005; Kardash & Howell, 2000; Paulsen & Feldman, 2007; Schreiber & Shinn, 2003).

In this study, however, the post-test scores showed that the students still hold a strong preference for rehearsal ($M = 5.87 \pm 0.91$; $p < 0.001$), although a significant increase in their scores for other cognitive learning strategies, especially critical thinking strategies

($M = 5.55 \pm 0.95$; $p < 0.001$) and metacognition self-regulation ($M = 5.50 \pm 0.75$; $p <$ 0.001) was observed. These findings can be best explained using the schema theory which suggest that when the mind experience a state of disequilibrium, it undergoes adaptation process to restore equilibrium (Fosnot & Perry, 1996). In the case of the present study, the strong influence of students' perceived efficacy of rehearsal learning strategy in pre-university education (Almeida, Teixeira-Dias, Martinho, & Balasooriya, 2011; Yonker, 2011), may have induced imbalance and triggered the accommodation process (Devi, 2019). According Piagets' schema theory, the accommodation process may urge students to either adhere or revamp their original schema regarding the effectiveness of rehearsal learning strategies (Yilmaz, 2011). In some cases, they may retain both, the new and old schemas as separate cases and alternating between both (Yilmaz, 2011).

Table 5.15: Comparison of the Preclinical Students' Pre-Test and Post-Test MSLQ Scores for Learning Strategies Subscales

Subscales	Pre-test		Post-test		*p*-value (2-tailed)[a]	Paired differences	
	Mean	SD	Mean	SD		Mean	SD
Rehearsal	5.45	0.95	5.87	0.91	< 0.001*,b	0.42	0.57
Elaboration	5.47	0.98	5.92	0.83	< 0.001*,b	0.46	0.69
Organization	5.54	0.94	6.05	0.78	< 0.001*,b	0.51	0.69
Critical thinking	5.12	1.07	5.55	0.95	< 0.001*	0.43	0.72
Metacognitive self-regulation	5.14	0.78	5.50	0.75	< 0.001*	0.36	0.56
Time & study environment	5.05	0.84	5.26	0.76	0.009*	0.21	0.56
Effort regulation	4.96	1.04	5.10	0.99	0.290	0.14	0.97
Peer learning	5.00	1.08	5.46	1.32	0.001*,b	0.46	0.97
Help seeking	4.79	0.95	5.06	0.90	0.003*	0.27	0.64

*. Significant at p<0.05
a. Paired Samples T Test unless otherwise indicated
b. Wilcoxon Signed Ranks Test

As shown in Table 5.15, the preclinical students' post-test scores for effort regulation did not show a significant increase as compared to their baseline level of effort regulation. One possible explanation for this observation could be the preference for strong external regulation such as teacher's guidance (Raidal & Volet, 2009). Past research has shown that academic success in teacher regulated environment contributes to the undergraduate medical students' continued preference for external regulation (Dolmans & Wolfhagen, 2004).

5.6 The Difference in the Self-Regulated Learning Conception Level of Between the First-Year and Second-Year Medical Students

In this section, both the pre-test and post-test MSLQ data were used to explore the differences in the SRL conception level between the first- and second-year medical students. The results that addresses the final research question of this study, are presented in the two subsequent sections as follows:

(i)   The difference in the motivation orientation induced by the intervention between the first-year and second-year students;

(ii)   The difference in the learning strategies conception induced by the intervention between the first-year and second-year students.

5.6.1 The Difference in the Motivation Orientation Induced by the Intervention between the First-Year and Second-Year Students

The normality of the preclinical students' score differences for motivation orientation subscales according to their academic year were characterized using the Kolmogorov-Smirnov and Shapiro-Wilk tests. The results on the normality of the students' score differences for five subscales of motivation dimension are presented in Table 5.16.

Table 5.16: Kolmogorov-Smirnov and Shapiro-Wilk test for Normality of Preclinical Students' Score Differences in the Motivation Orientation Subscales according to Academic Year

Subscale	Academic year	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Intrinsic goal	First-year	.176	28	.027	.925	28	.047
	Second-year	.198	25	.012	.944	25	.183
Extrinsic goal	First-year	.174	28	.030	.951	28	.206
	Second-year	.254	25	.000	.865	25	.003
Task value	First-year	.243	28	.000	.908	28	.017
	Second-year	.131	25	.200[*]	.954	25	.302
Control belief	First-year	.151	28	.103	.967	28	.508
	Second-year	.185	25	.027	.866	25	.004
Self-efficacy	First-year	.145	28	.136	.952	28	.221
	Second-year	.144	25	.196	.957	25	.352
Test anxiety	First-year	.141	28	.161	.964	28	.429
	Second-year	.130	25	.200[*]	.965	25	.527

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correlation

The results of the Shapiro-Wilk test indicate that the scores for four subscales, intrinsic goal, extrinsic goal, task value, and control belief, are not normally distributed. On the other hand, scores for self-efficacy and test anxiety subscales were normally distributed. Based on these normality test results, the motivation orientation differences between the first year and second-year medical students were analysed using two different statistical tests. The independent t-test and Mann-Whitney U test were used to analyse subscales that were normally distributed and not normally distributed, respectively. Table 5.17 show the comparison of the paired score differences in the motivation orientation subscales between the first year and second year medical students.

As shown in Table 5.17, there were no significant differences ($p > 0.05$) between the first-year and second-year medical students in terms of the scores differences for the motivation orientation subscales. This suggests that the SRL skills support intervention

impact on motivation orientation was similar in both the first-year and second-year students.

Table 5.17: Comparison of the Paired Score Differences in the Motivation Orientation Subscales between the First-Year and Second-Year Medical Students

Subscales	First-Year		Second-Year		p-value [a]
	Mean	SD	Mean	SD	
Intrinsic goal	0.38	.72	0.53	0.56	0.438 [b]
Extrinsic goal	-0.12	.97	-0.10	0.87	0.753 [b]
Task value	0.35	.73	0.34	0.46	0.547 [b]
Control belief	0.45	.77	0.06	0.65	0.114 [b]
Self-efficacy	0.47	.62	0.51	0.55	0.845
Test anxiety	-0.45	1.39	-0.29	0.96	0.636

a. Independent t-test unless otherwise indicated
b. Mann-Whitney U test

5.6.2 The Difference in the Learning Strategies Conception Induced by the Intervention between the First-Year and Second-Year Students

The normality of the preclinical students' score differences for learning strategies subscales according to their academic year were characterized using the Kolmogorov-Smirnov and Shapiro-Wilk tests. The results on the normality of the students' score differences for nine subscales of learning strategies dimension are presented in Table 5.18.

The results of the Shapiro-Wilk test indicate that the scores for two subscales, rehearsal and peer learning are not normally distributed, while the rest of the subscale scores are normally distributed. Based on these normality test results, the learning strategies score differences between the first year and second-year medical students were analysed using two different statistical tests. The independent t-test and Mann-Whitney U test and were used to analyse subscales that were normally distributed and not normally distributed,

respectively. Table 5.19 show the comparison of the paired score differences in the learning strategies subscales between the first year and second year medical students.

Table 5.18: Kolmogorov-Smirnov and Shapiro-Wilk test for Normality of Preclinical Students' Score Differences in the Learning Strategies Subscales according to Academic Year

Subscale	Academic year	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Rehearsal	First-year	.118	28	.200*	.916	28	.028
	Second-year	.182	25	.032	.957	25	.358
Elaboration	First-year	.123	28	.200*	.963	28	.404
	Second-year	.144	25	.192	.964	25	.492
Organization	First-year	.110	28	.200*	.974	28	.704
	Second-year	.127	25	.200*	.968	25	.587
Critical thinking	First-year	.107	28	.200*	.954	28	.245
	Second-year	.160	25	.097	.952	25	.278
Metacognitive self-regulation	First-year	.103	28	.200*	.988	28	.978
	Second-year	.072	25	.200*	.989	25	.993
Time & study environment	First-year	.213	28	.002	.929	28	.058
	Second-year	.134	25	.200*	.950	25	.244
Effort regulation	First-year	.163	28	.055	.937	28	.093
	Second-year	.132	25	.200*	.963	25	.475
Peer learning	First-year	.169	28	.039	.904	28	.015
	Second-year	.160	25	.097	.942	25	.167
Help seeking	First-year	.127	28	.200*	.969	28	.561
	Second-year	.156	25	.118	.943	25	.174

*. This is a lower bound of the true significance
a. Lilliefors Significance Correlation

As shown in Table 5.19, there was no significant differences ($p > 0.05$) between the first-year and second-year medical students in terms of the scores differences for the learning strategies subscales. This suggests that the learning skills support intervention's impact on the learning strategies conception was similar in both the first-year and second-year students.

Table 5.19: Comparison of the Paired Score Differences in the Learning Strategies Subscales between the First-Year and Second-Year Medical Students

Subscales	First year		Second year		*p*-value [a]
	Mean	SD	Mean	SD	
Rehearsal	0.45	0.65	0.40	0.47	0.993 [b]
Elaboration	0.51	0.84	0.39	0.50	0.529
Organization	0.54	0.82	0.46	0.53	0.667
Critical thinking	0.44	0.90	0.42	0.48	0.923
Metacognitive self-regulation	0.40	0.71	0.31	0.32	0.534
Time & study environment	0.23	0.63	0.19	0.47	0.794
Effort regulation	0.11	1.10	0.18	0.83	0.779
Peer learning	0.54	1.09	0.37	0.81	0.340 [b]
Help seeking	0.28	0.65	0.26	0.64	0.940

a. Independent *t*-test unless otherwise indicated
b. Mann-Whitney U test

5.7   Chapter Summary

In this chapter, the findings of the present study were presented and discussed based on the research questions that were put forwards. In general, this study assessed the preclinical students' baseline level of SRL and thereafter, the conception of SRL using the MSLQ. The demographic characterization showed no significant differences in term of gender and ethnicity between the first-year and second-year preclinical students.

To answer the first research question, the preclinical students' baseline level of SRL was determined using the pre-test MSLQ data. It was found that the preclinical students were extrinsically motivated and had low self-efficacy beliefs. Although these students used some cognitive learning strategies that may lead to deep processing, competence in critical thinking, metacognitive self-regulation, and resource management strategies were mostly lacking. Furthermore, their preference for rehearsal learning strategies was still predominant, suggesting that they were ineffective in self-regulating their learning. As

for the second research question, there was no significant difference in the baseline level of SRL between the first-year and the second-year students.

To address the third research question, the impact of the SRL support intervention on the preclinical students' conception of SRL was determined by performing the pre-test-post-test analysis. The data revealed that intervention significantly enhanced students' motivational beliefs regarding SRL. The most noteworthy impact was in the increase of their self-efficacy beliefs and intrinsic motivation. It was interesting to note that the post-test mean scores for all subscales of the learning strategies, except effort regulation, were significantly higher than the pre-test score. The low effort regulation score suggested that the students were still expecting some external regulation of their learning. As for the final research question, there was no significant difference in the conception of SRL between the first-year and the second-year students. These findings could be attributed to the parallel baseline level of motivation and learning strategies between the two cohorts.

The implication of these findings, suggestion for future studies and the conclusion of this study is presented in the next chapter.

CHAPTER 6: SUMMARY, IMPLICATIONS AND CONCLUSION

6.1 Introduction

The present quasi-experimental research utilised the Motivated Strategies for Learning Questionnaire (MSLQ) to evaluate the impact of explicit self-regulated learning (SRL) support intervention on preclinical students' conception of SRL through the changes in their baseline level of motivation and learning strategies. This chapter summarises the key findings of the research and reviews its implication towards medical education. Further to that, the recommendations for future research and the concluding remarks are also presented here.

6.2 Summary of Research Findings

In the present study, the preclinical students' baseline level of SRL were profiled based on their motivation orientation and learning strategies. The study findings revealed that despite having high task value beliefs and control beliefs, the preclinical students were extrinsically motivated, and showed deficiency in self-efficacy beliefs. The MSLQ scales for extrinsic motivation orientation reflects the embracement of a performance goal that may lead to surface learning approaches (Pintrich, 2004). Despite the low self-efficacy belief, the preclinical students in this study also reported low test anxiety score. Although an inverse correlation between test anxiety and self-efficacy was more commonly suggested in past studies (Roick & Ringeisen, 2017), it could be possible that the low self-efficacy beliefs among the preclinical students in the present study is linked to the modest values and culture of the East (Schunk & Dibenedetto, 2016). Nevertheless, as self-efficacy is associated with grit (Wolters & Hussain, 2015) and resilience (Cassidy, 2015) in the academic environment, strategies to promote and enhance the students' self-efficacy beliefs may strengthen their engagement in SRL (Pajares, 2008).

The findings of the present study also shed some light on the preclinical students' SRL baseline level from the perspective of learning strategies. It was found that the students predominantly used the organization, elaboration, and rehearsal learning strategies. While the organization and elaboration learning strategies are essential for meaningful learning, rehearsal strategies basically involve memorization and reproducing facts (Duncan & McKeachie, 2005). Besides, the low mean scores reported for the higher-order cognitive processing skills (i.e. critical thinking and metacognitive self-regulation) and the resource management strategies (i.e. time and study environment, effort regulation, peer-learning, and help-seeking) indicates the paucity in the students learning skills to immerse in high-quality learning. The baseline profile of the preclinical students' motivation orientation and learning strategies implies their inadequacy and inefficiency in self-regulating their learning. Further to that, the parallel baseline pattern between the first-year and second-year students suggest that the students' competence to self-regulate learning may not advance without appropriate support.

"The only person who is educated is the person who has learned how to learn; the person who has learnt how to adapt and change; the person who has realised that no knowledge is secure, that only the process of seeking knowledge gives a basis for security." (Carls Roger, 1969, cited in McLean, 2001, p. 400)

The explicit instruction on SRL skills in this study was shown to impose a significant impact on the preclinical students' motivation. Their self-efficacy belief and intrinsic goal orientation, in particular, increased significantly. This finding may indicate a favourable outcome of the intervention in promoting assimilation of the sophisticated conception of learning among the students. A positive link between the sophisticated conception of learning and SRL-relevant motivational beliefs, including intrinsic goal, self-efficacy,

task value, and reduced test anxiety, have been affirmed by empirical evidence from several studies (Paulsen & Feldman, 2005; Tsai et al., 2011).

However, it was not quite the case when the impact of the intervention on the learning strategies was gauged. Although the post-test scores portray that the intervention has a significant and positive impact on the students' conception of SRL-relevant learning strategies, the findings must be interpreted with caution. The pattern in the post-test score was found to be similar to the baseline scores in the pre-test. The findings revealed that the preclinical students still hold a strong preference for rehearsal strategies and external regulation (low effort regulation). The students' continued preference for these strategies could be attributed their naïve conception of learning based on their successful academic outcomes in pre-university education (Dolmans & Wolfhagen, 2004; Raidal & Volet, 2009; Yonker, 2011).

Ultimately, the findings of the present study suggest that the SRL support intervention favourably heightened the preclinical students' motivation to self-regulate their learning. However, limited success was observed in transforming the students' naïve conception of learning towards engaging in learning strategies that will make them an effective self-regulated learner. This could be possibly attributed to the single session of intervention that was carried out in the present study. Hence, better outcomes could be expected if the intervention is repeated at certain interval of time.

6.3   Implication of Study towards Medical Education

Based on the findings of the present study, it became evident that most undergraduate medical students arrive at medical school with a deficit in skills to self-regulate their learning in the study context. The surface learning approaches that they perceive as a strategic tactic to achieve successful academic outcomes in medical school may impose a negative impact on their performance and well-being.

The findings of the present study imply that preclinical students must be supported sufficiently to enhance their awareness, skills and engagement in SRL. While the implementation of explicit learning skills support programmes in medical schools might be seen as unnecessary burden, failing to alleviate the learning skills deficits may impact not only the students' academic performance and emotions, but also compromise patient safety. In light of these implications, it is recommended that the medical schools should proactively promote students' SRL skills development through explicit instructions. This also means that faculty training is necessary to ensure they are more confident and better equipped to impart the SRL learning skills. The limited success to enhance the students' conception of SRL strategies seen in the present study implies that the duration of the support programme duration should be revised to reap the potential benefits of the support programme.

6.4   Suggestions for Future Research

The present study managed to merely hypothesise the impact of the SRL skills support intervention on the preclinical students' conception of learning based on the MSLQ score difference between the pre-test and post-test. Hence, several recommendations for future research are outlined as follows:

i.   The inclusion appropriate instruments to obtain a clearer picture of the influence of the intervention on the students' conception of learning should be considered. Some examples of instruments includes the Epistemological Questionnaire (Schommer, 1990) and the Inventory of Learning Styles (Vermunt, 1996).

ii. The differences in the duration of the SRL support intervention programmes on the students' conception of learning should be evaluated.

iii. The salient belief factors that will influence the preclinical students' intention to use the learned SRL strategies should be explored using the Theory of Planned Behaviour (Ajzen, 1991) enhance the support intervention further.

6.5   Conclusion

From the findings of the present study, it can be concluded that the need for SRL skills support is imperative during the early years of undergraduate medical education. Medical schools should take serious consideration on imparting explicit learning skills instruction as it can positively impact the students' motivation and learning strategies to effectively self-regulate their learning. Besides, competence in self-regulation learning has critical future implications on practice performance and lifelong learning for optimal patient care.

REFERENCES:

Adom, A. Y. (2015). *Students' Factors Preference Of Choosing Private University In Sarawak, Malaysia.* Paper presented at the Asia Pacific Conference on Business and Social Sciences, Kuala Lumpur.

Agustiani, H., Cahyad, S., & Musa, M. (2016). Self-efficacy and self-regulated learning as predictors of students academic performance. *The Open Psychology Journal, 9*(1), 1-6.

Aharony, N. (2006). The use of deep and surface learning strategies among students learning English as a foreign language in an Internet environment. *Br J Educ Psychol, 76*(Pt 4), 851-866. doi:10.1348/000709905x79158

Ainscough, L., Stewart, E., Colthorpe, K., & Zimbardi, K. (2018). Learning hindrances and self-regulated learning strategies reported by undergraduate students: identifying characteristics of resilient students. *Studies in Higher Education, 43*(12), 2194-2209.

Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes, 50*(2), 179-211.

Aleven, V., Stahl, E., Schworm, S., Fischer, F., & Wallace, R. (2003). Help seeking and help design in interactive learning environments. *Review of educational research, 73*(3), 277-320.

Almeida, P. A., Teixeira-Dias, J. J., Martinho, M., & Balasooriya, C. D. (2011). The interplay between students' perceptions of context and approaches to learning. *Research Papers in Education, 26*(2), 149-169.

Ames, C. (1992). Achievement goals and the classroom motivational climate. In D. H. Schunk & J. L. Meece (Eds.), *Stedent Perceptions in the Classroom* (pp. 327-348). New York: Routledge, Taylor & Francis Group.

Andrews, M. A., Kelly, W. F., & DeZee, K. J. (2018). Why Does This Learner Perform Poorly on Tests? Using Self-Regulated Learning Theory to Diagnose the Problem and Implement Solutions. *Acad Med, 93*(4), 612-615. doi:10.1097/acm.0000000000001422

Artino, A., Dong, T., Dezee, K., Gilliland, W., Waechter, D., Cruess, D., & Durning, S. (2012). Achievement Goal Structures and Self-Regulated Learning. *Academic medicine : journal of the Association of American Medical Colleges, 87*, 1375-1381. doi:10.1097/ACM.0b013e3182676b55

Artino, A. R., Jr., Dong, T., DeZee, K. J., Gilliland, W. R., Waechter, D. M., Cruess, D., & Durning, S. J. (2012). Achievement goal structures and self-regulated learning: relationships and changes in medical school. *Acad Med, 87*(10), 1375-1381. doi:10.1097/ACM.0b013e3182676b55

Artino, A. R., Jr., Hemmer, P. A., & Durning, S. J. (2011). Using self-regulated learning theory to understand the beliefs, emotions, and behaviors of struggling medical students. *Acad Med, 86*(10 Suppl), S35-38. doi:10.1097/ACM.0b013e31822a603d

Artino, A. R., La Rochelle, J. S., & Durning, S. J. (2010). Second-year medical students' motivational beliefs, emotions, and achievement. *Med Educ, 44*(12), 1203-1212. doi:10.1111/j.1365-2923.2010.03712.x

Artino Jr, A. R., & Stephens, J. M. (2009). Academic motivation and self-regulation: A comparative analysis of undergraduate and graduate students learning online. *The Internet and Higher Education, 12*(3-4), 146-151.

Ata, A. A., & Abdelwahid, A. E.-E. A. (2019). Nursing Students' Metacognitive Thinking and Goal Orientation as Predictors of Academic Motivation. *American Journal of Nursing Research, 7*(5), 793-801.

Baker, L., Millman, Z., & Trakhman, L. S. (2020). How the Construct of Metacognition Has Contributed to Translational Research in Education, Mental Health, and Beyond. *Translational Issues in Psychological Science, 6*(1), 1-7.

Bandura, A. (1991). Social cognitive theory of self-regulation. *Organizational Behavior and Human Decision Processes, 50*(2), 248-287.

Barbosa, J., Silva, Á., Ferreira, M. A., & Severo, M. (2016). Transition from Secondary School to Medical School: The Role of Self-Study and Self-Regulated Learning Skills in Freshman Burnout. *Acta Med Port, 29*(12), 803-808. doi:10.20344/amp.8350

Barbosa, J., Silva, Á., Ferreira, M. A., & Severo, M. (2016). Transition from Secondary School to Medical School: The Role of Self-Study and Self-Regulated Learning Skills in Freshman Burnout. *Acta medica portuguesa, 29*(12), 803.

Barbosa, J., Silva, Á., Ferreira, M. A., & Severo, M. (2018). Do reciprocal relationships between academic workload and self-regulated learning predict medical freshmen's achievement? A longitudinal study on the educational transition from secondary school to medical school. *Adv Health Sci Educ Theory Pract, 23*(4), 733-748. doi:10.1007/s10459-018-9825-2

Barkoukis, V., Tsorbatzoudis, H., Grouios, G., & Sideridis, G. (2008). The assessment of intrinsic and extrinsic motivation and amotivation: Validity and reliability of the Greek version of the Academic Motivation Scale. *J Assessment in Education: Principles, Policy & Practice, 15*(1), 39-55.

Bergin, S., Reilly, R., & Traynor, D. (2005). *Examining the role of self-regulated learning on introductory programming performance.* Paper presented at the Proceedings of the first international workshop on Computing education research.

Berkhout, J. J., Helmich, E., Teunissen, P. W., van den Berg, J. W., van der Vleuten, C. P., & Jaarsma, A. D. (2015a). Exploring the factors influencing clinical students' self-regulated learning. *Med Educ, 49*(6), 589-600. doi:10.1111/medu.12671

Berkhout, J. J., Helmich, E., Teunissen, P. W., van den Berg, J. W., van der Vleuten, C. P. M., & Jaarsma, A. D. C. (2015b). Exploring the factors influencing clinical students' self-regulated learning. *Medical Education, 49*(6), 589-600.

Berkhout, J. J., Helmich, E., Teunissen, P. W., van der Vleuten, C. P., & Jaarsma, A. D. C. (2017). How clinical medical students perceive others to influence their self-regulated learning. *Medical education, 51*(3), 269-279.

Berkhout, J. J., Helmich, E., Teunissen, P. W., van der Vleuten, C. P. M., & Jaarsma, A. D. C. (2018). Context matters when striving to promote active and lifelong learning in medical education. *Medical education, 52*(1), 34.

Berkhout, J. J., Slootweg, I. A., Helmich, E., Teunissen, P. W., van der Vleuten, C. P. M., & Jaarsma, A. D. C. (2017). How characteristic routines of clinical departments influence students' self-regulated learning: A grounded theory study. *Med Teach, 39*(11), 1174-1181. doi:10.1080/0142159x.2017.1360472

Berkhout, J. J., Teunissen, P. W., Helmich, E., van Exel, J., van der Vleuten, C. P. M., & Jaarsma, D. A. D. C. (2017). Patterns in clinical students' self-regulated learning behavior: a Q-methodology study. *Advances in Health Sciences Education, 22*(1), 105-121.

Bickerdike, A., O'Deasmhunaigh, C., O'Flynn, S., & O'Tuathaigh, C. (2016). Learning strategies, study habits and social networking activity of undergraduate medical students. *Int J Med Educ, 7*, 230-236. doi:10.5116/ijme.576f.d074

Bierer, S. B., & Dannefer, E. F. (2016). The Learning Environment Counts: Longitudinal Qualitative Analysis of Study Strategies Adopted by First-Year Medical Students in a Competency-Based Educational Program. *Acad Med, 91*(11 Association of American Medical Colleges Learn Serve Lead: Proceedings of the 55th Annual Research in Medical Education Sessions), S44-s52. doi:10.1097/acm.0000000000001363

Bjork, R. A., Dunlosky, J., & Kornell, N. (2013). Self-Regulated Learning: Beliefs, Techniques, and Illusions. *Annual Review of Psychology, 64*(1), 417-444. doi:10.1146/annurev-psych-113011-143823

Boekaerts, M. (2011). *Emotions, emotion regulation, and self-regulation of learning* (Vol. 5). New York: NY: Routledge.

Boekaerts, M., & Corno, L. (2005). Self-regulation in the classroom: A perspective on assessment and intervention. *Applied Psychology, 54*(2), 199-231.

Bormanaki, H. B., & Khoshhal, Y. (2017). The role of equilibration in Piaget's theory of cognitive development and its implication for receptive skills: A theoretical study. *Journal of Language Teaching and Research, 8*(5), 996-1005.

Bowman, M. (2017). The transition to self-regulated learning for first-year dental students: threshold concepts. *Eur J Dent Educ, 21*(3), 142-150. doi:10.1111/eje.12193

Bransen, D., Govaerts, M. J. B., Sluijsmans, D. M. A., & Driessen, E. W. (2020). Beyond the self: The role of co-regulation in medical students' self-regulated learning. *Med Educ, 54*(3), 234-241. doi:10.1111/medu.14018

Broadbent, J., & Poon, W. L. (2015). Self-regulated learning strategies & academic achievement in online higher education learning environments: A systematic review. *The Internet and Higher Education, 27*, 1-13.

Brydges, R., & Butler, D. (2012). A reflective analysis of medical education research on self-regulation in learning and practice. *Med Educ, 46*(1), 71-79. doi:10.1111/j.1365-2923.2011.04100.x

Cano, F. (2005). Epistemological beliefs and approaches to learning: their change through secondary school and their influence on academic performance. *Br J Educ Psychol, 75*(Pt 2), 203-221. doi:10.1348/000709904x22683

Cano, F., & Cardelle-Elawar, M. (2004). An Integrated Analysis of Secondary School Students' Conceptions and Beliefs about Learning. *European Journal of Psychology of Education, 19*(2), 167-187.

Cao, L., & Nietfeld, J. L. (2007). College Students' Metacognitive Awareness of Difficulties in Learning the Class Content Does Not Automatically Lead to Adjustment of Study Strategies. *Australian Journal of Educational & Developmental Psychology, 7*, 31-46.

Cassidy, S. (2015). Resilience Building in Students: The Role of Academic Self-Efficacy. *Front Psychol, 6*, 1781. doi:10.3389/fpsyg.2015.01781

Cazan, A. M. (2012). Self regulated learning strategies–predictors of academic adjustment. *Procedia-Social and Behavioral Sciences, 33*, 104-108.

Cheung, J. J. H., Kulasegaram, K. M., Woods, N. N., Moulton, C. A., Ringsted, C. V., & Brydges, R. (2018). Knowing How and Knowing Why: testing the effect of instruction designed for cognitive integration on procedural skills transfer. *Adv Health Sci Educ Theory Pract, 23*(1), 61-74. doi:10.1007/s10459-017-9774-1

Chiou, G.-L., Lee, M.-H., & Tsai, C.-C. (2013). High school students' approaches to learning physics with relationship to epistemic views on physics and conceptions of learning physics. *Research in Science & Technological Education, 31*(1), 1-15.

Chiou, G.-L., Liang, J.-C., & Tsai, C.-C. (2012). Undergraduate students' conceptions of and approaches to learning in biology: A study of their structural models and gender differences. *International Journal of Science Education, 34*(2), 167-195.

Cho, K. K., Marjadi, B., Langendyk, V., & Hu, W. (2017a). Medical student changes in self-regulated learning during the transition to the clinical environment. *BMC Medical Education, 17*(59), 1-8.

Cho, K. K., Marjadi, B., Langendyk, V., & Hu, W. (2017b). The self-regulated learning of medical students in the clinical environment–a scoping review. *BMC Medical Education, 17*(122), 1-13.

Chu, Y., Palmer, S., & Persky, A. M. (2018). Assessing metacognition in the classroom: Student help-seeking behavior. *Currents in Pharmacy Teaching and Learning, 10*(11), 1478-1487.

Cleary, T. J., Dong, T., & Artino, A. R., Jr. (2015). Examining shifts in medical students' microanalytic motivation beliefs and regulatory processes during a diagnostic reasoning task. *Adv Health Sci Educ Theory Pract, 20*(3), 611-626. doi:10.1007/s10459-014-9549-x

Cleary, T. J., Durning, S. J., & Artino, A. R., Jr. (2016). Microanalytic Assessment of Self-Regulated Learning During Clinical Reasoning Tasks: Recent Developments and Next Steps. *Acad Med, 91*(11), 1516-1521. doi:10.1097/acm.0000000000001228

Cleary, T. J., & Sandars, J. (2011). Assessing self-regulatory processes during clinical skill performance: a pilot study. *Med Teach, 33*(7), e368-374. doi:10.3109/0142159x.2011.577464

Colthorpe, K., Ogiji, J., Ainscough, L., Zimbardi, K., & Anderson, S. (2019). Effect of Metacognitive Prompts on Undergraduate Pharmacy Students' Self-regulated Learning Behavior. *Am J Pharm Educ, 83*(4), 6646. doi:10.5688/ajpe6646

Conley, D. T. (2008). Rethinking college readiness. *New directions for higher education, 2008*(144), 3-13.

Cook, D. A., & Artino, A. R., Jr. (2016). Motivation to learn: an overview of contemporary theories. *Med Educ, 50*(10), 997-1014. doi:10.1111/medu.13074

Cutrer, W. B., Sullivan, W. M., & Fleming, A. E. (2013). Educational strategies for improving clinical reasoning. *Curr Probl Pediatr Adolesc Health Care, 43*(9), 248-257. doi:10.1016/j.cppeds.2013.07.005

Dahl, T. I., Bals, M., & Turi, A. L. (2005). Are students' beliefs about knowledge and learning associated with their reported use of learning strategies? *British journal of educational psychology, 75*(2), 257-273.

de Bruin, A. B. H., Dunlosky, J., & Cavalcanti, R. B. (2017). Monitoring and regulation of learning in medical education: the need for predictive cues. *Med Educ, 51*(6), 575-584. doi:10.1111/medu.13267

De Smul, M., Heirweg, S., Van Keer, H., Devos, G., & Vandevelde, S. (2018). How competent do teachers feel instructing self-regulated learning strategies? Development and validation of the teacher self-efficacy scale to implement self-regulated learning. *Teaching and Teacher Education, 71*, 214-225.

Deci, E. L. (1976). Notes on the theory and metatheory of intrinsic motivation. *Organizational behavior and human performance, 15*(1), 130-145.

Deci, E. L., & Ryan, R. M. (1985). Cognitive evaluation theory. In *Intrinsic motivation and self-determination in human behavior* (pp. 43-85): Springer.

Demirören, M., Turan, S., & Taşdelen Teker, G. (2020). Determinants of self-regulated learning skills: the roles of tutors and students. *Adv Physiol Educ, 44*(1), 93-98. doi:10.1152/advan.00121.2019

Demirören, M., Turan, S., & Öztuna, D. (2016). Medical students' self-efficacy in problem-based learning and its relationship with self-regulated learning. *Medical education online, 21*(1), 30049.

Dempsey, M. S., & Kauffman, D. F. (2017). Supporting Third Year Medical Students' Skill Acquisition and Self-Efficacy with Coping Models and Process Feedback during Laparoscopic Knot Tying Simulation. *Front Psychol, 8*, 1171. doi:10.3389/fpsyg.2017.01171

Devi, K. S. (2019). Constructivist Approach to Learning based on the Concepts of Jean Piaget and Lev Vygotsky. *Journal of Indian Education, 44*(4), 5-19.

Dolmans, D. H., & Wolfhagen, I. H. (2004). The relationship between learning style and learning environment. *Med Educ, 38*(8), 800-801. doi:10.1111/j.1365-2929.2004.01941.x

Duncan, T. G., & McKeachie, W. J. (2005). The making of the motivated strategies for learning questionnaire. *Educational psychologist, 40*(2), 117-128.

Dundes, L., Cho, E., & Kwak, S. (2009). The duty to succeed: Honor versus happiness in college and career choices of East Asian students in the United States. *Pastoral care in education, 27*(2), 135-156.

Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological review, 95*(2), 256.

Ebomoyi, J. I. (2020). Metacognition and Peer Learning Strategies as Predictors in Problem-Solving Performance in Microbiology. *J Microbiol Biol Educ, 21*(1). doi:10.1128/jmbe.v21i1.1715

Eccles, J. S., & Wigfield, A. (2002). Motivational beliefs, values, and goals. *Annu Rev Psychol, 53*, 109-132. doi:10.1146/annurev.psych.53.100901.135153

Efklides, A. (2011). Interactions of metacognition with motivation and affect in self-regulated learning: The MASRL model. *Educational psychologist, 46*(1), 6-25.

Feri, R., Soemantri, D., & Jusuf, A. (2016). The relationship between autonomous motivation and autonomy support in medical students' academic achievement. *Int J Med Educ, 7*, 417-423. doi:10.5116/ijme.5843.1097

Flavell, J. H. (1979). Metacognition and Cognitive Monitoring: A New Area of Cognitive-Developmental Inquiry. *American Psychologist, 34*(10), 906-911.

Fosnot, C. T., & Perry, R. S. (1996). *Constructivism: A Psychological Theory of Learning.* (2 ed.). New York: Teachers College Press.

Gandomkar, R., Mirzazadeh, A., Jalili, M., Yazdani, K., Fata, L., & Sandars, J. (2016). Self-regulated learning processes of medical students during an academic learning task. *Med Educ, 50*(10), 1065-1074. doi:10.1111/medu.12975

Gandomkar, R., Yazdani, K., Fata, L., Mehrdad, R., Mirzazadeh, A., Jalili, M., & Sandars, J. (2020). Using multiple self-regulated learning measures to understand medical students' biomedical science learning. *Med Educ*. doi:10.1111/medu.14079

Garcia, T., & Pintrich, P. R. (1993). *Self-Schemas, Motivational Strategies and Self-Regulated Learning*. Paper presented at the Annual Meeting of the American Educational Research Association, Atlanta, GA.

Gardner, A. K., Jabbour, I. J., Williams, B. H., & Huerta, S. (2016). Different Goals, Different Pathways: The Role of Metacognition and Task Engagement in Surgical Skill Acquisition. *J Surg Educ, 73*(1), 61-65. doi:10.1016/j.jsurg.2015.08.007

Garrud, P., & Yates, J. (2012). Profiling strugglers in a graduate-entry medicine course at Nottingham: a retrospective case study. *BMC Med Educ, 12*, 124. doi:10.1186/1472-6920-12-124

Gaupp, R., Fabry, G., & Körner, M. (2018). Self-regulated learning and critical reflection in an e-learning on patient safety for third-year medical students. *Int J Med Educ, 9*, 189-194. doi:10.5116/ijme.5b39.d5a8

Gettinger, M., & Seibert, J. K. (2002). Contributions of study skills to academic competence. *School Psychology Review, 31*(3), 350-365.

Gonida, E. N., Karabenick, S. A., Stamovlasis, D., Metallidou, P., & Greece, t. C. T. Y. (2019). Help seeking as a self-regulated learning strategy and achievement goals: The case of academically talented adolescents. *High Ability Studies, 30*(1-2), 147-166.

Good, J. P., Ramos, D., & D'Amore, D. C. (2013). Learning style preferences and academic success of preclinical allied health students. *J Allied Health, 42*(4), e81-90.

Grafton-Clarke, C., & Garner, J. (2018). Study Skills, Social Life and Confidence in Undergraduate Medical Students. *MedEdPublish, 7*.

Gravoso, R. S., Pasa, A. E., & Mori, T. (2002). *Influence of students' prior learning experiences, learning conceptions and approaches on their learning outcomes.* Paper presented at the Higher Education Research and Development Society of Australasia's Annual Conference.

Greene, J. A., & Schunk, D. H. (2018). Historical, contemporary, and future perspectives on self-regulated learning and performance. In *Handbook of Self-Regulation of Learning and Performance* (pp. 17-32): Routledge.

Hahn, H., Kropp, P., Kirschstein, T., Rücker, G., & Müller-Hilke, B. (2017). Test anxiety in medical school is unrelated to academic performance but correlates with an effort/reward imbalance. *PLoS One, 12*(2), e0171220. doi:10.1371/journal.pone.0171220

Hamid, S., & Singaram, V. S. (2016). Motivated strategies for learning and their association with academic performance of a diverse group of 1st-year medical students. *African Journal of Health Professions Education, 8*(1), 104-107.

Hanson, J. M., Trolian, T. L., Paulsen, M. B., & Pascarella, E. T. (2016). Evaluating the influence of peer learning on psychological well-being. *Teaching in Higher Education, 21*(2), 191-206.

Hattie, J., Biggs, J., & Purdie, N. (1996). Effects of learning skills interventions on student learning: A meta-analysis. *Review of educational research, 66*(2), 99-136.

Hauer, K. E., Iverson, N., Quach, A., Yuan, P., Kaner, S., & Boscardin, C. (2018). Fostering medical students' lifelong learning skills with a dashboard, coaching and learning planning. *Perspect Med Educ, 7*(5), 311-317. doi:10.1007/s40037-018-0449-2

Hayat, A. A., Shateri, K., Amini, M., & Shokrpour, N. (2020). Relationships between academic self-efficacy, learning-related emotions, and metacognitive learning strategies with academic performance in medical students: a structural equation model. *BMC Med Educ, 20*(1), 76. doi:10.1186/s12909-020-01995-9

Henning, M. A., Hawken, S. J., Krägeloh, C., Zhao, Y., & Doherty, I. (2011). Asian medical students: quality of life and motivation to learn. *Asia Pacific Education Review, 12*(3), 437-445.

Hofer, B. K. (1994). *Epistemological Beliefs and First-Year College Students: Motivation and Cognition in Different Instructional Contexts*. Paper presented at the Annual Meeting of the American Psychological Association, Los Angeles, CA.

Hofer, B. K. (1999). Instructional Context in the College Mathematics Classroom: Epistemological Beliefs and Student Motivation. *Journal of Staff, Program & Organization Development, 16*(2), 73-82.

Hofer, B. K., & Yu, S. L. (2003). Teaching self-regulated learning through a" Learning to Learn" course. *Teaching of Psychology, 30*(1), 30-33.

Hong, W. H., Vadivelu, J., Daniel, E. G., & Sim, J. H. (2015). Thinking about thinking: changes in first-year medical students' metacognition and its relation to performance. *Med Educ Online, 20*, 27561. doi:10.3402/meo.v20.27561

Jakobsen, F., Musaeus, P., Kirkeby, L., Hansen, T. B., & Mørcke, A. M. (2018). Emotions and clinical learning in an interprofessional outpatient clinic: a focused ethnographic study. *J Interprof Care*, 1-9. doi:10.1080/13561820.2018.1514372

Jouhari, Z., Haghani, F., & Changiz, T. (2015). Factors affecting self-regulated learning in medical students: a qualitative study. *Med Educ Online, 20*, 28694. doi:10.3402/meo.v20.28694

Jouhari, Z., Haghani, F., & Changiz, T. (2016). Assessment of medical students' learning and study strategies in self-regulated learning. *J Adv Med Educ Prof, 4*(2), 72-79.

Järvelä, S., & Hadwin, A. F. (2013). New frontiers: Regulating learning in CSCL. *Educational Psychologist, 48*(1), 25-39.

Kaiser, V., Reppold, C. T., Hutz, C. S., & Almeida, L. S. (2019). Contributions of Positive Psychology in Self-Regulated Learning: A Study With Brazilian Undergraduate Students. *Front Psychol, 10*, 2980. doi:10.3389/fpsyg.2019.02980

Kalet, A., Ellaway, R. H., Song, H. S., Nick, M., Sarpel, U., Hopkins, M. A., . . . Pusic, M. V. (2013). Factors influencing medical student attrition and their implications in a large multi-center randomized education trial. *Adv Health Sci Educ Theory Pract, 18*(3), 439-450. doi:10.1007/s10459-012-9382-z

Kaplan, A., & Maehr, M. L. (2007). The Contributions and Prospects of Goal Orientation Theory. *Educational Psychology Review, 19*(2), 141-184.

Kardash, C. A. M., & Howell, K. L. (2000). Effects of epistemological beliefs and topic-specific beliefs on undergraduates' cognitive and strategic processing of dual-positional text. *Journal of Educational psychology, 92*(3), 524.

Kassab, S. E., Al-Shafei, A. I., Salem, A. H., & Otoom, S. (2015). Relationships between the quality of blended learning experience, self-regulated learning, and academic achievement of medical students: a path analysis. *Advances in medical education and practice, 6*, 27.

Kebaetse, M. B., Kebaetse, M., Mokone, G. G., Nkomazana, O., Mogodi, M., Wright, J., . . . Park, E. (2018). Learning support interventions for Year 1 medical students: a review of the literature. *Medical education, 52*(3), 263-273.

Kell, C., & van Deursen, R. (2003). Does a problem-solving based curriculum develop life-long learning skills in undergraduate students? *Physiotherapy, 89*(9), 523-530.

Kennedy, G., Rea, J. N. M., & Rea, I. M. (2019). Prompting medical students to self-assess their learning needs during the ageing and health module: a mixed methods study. *Med Educ Online, 24*(1), 1579558. doi:10.1080/10872981.2019.1579558

Khalil, M. K., Williams, S. E., & Gregory Hawkins, H. (2018). Learning and study strategies correlate with medical students' performance in anatomical sciences. *Anat Sci Educ, 11*(3), 236-242. doi:10.1002/ase.1742

Kiesewetter, J., Ebersbach, R., Tsalas, N., Holzer, M., Schmidmaier, R., & Fischer, M. R. (2016). Knowledge is not enough to solve the problems - The role of diagnostic knowledge in clinical reasoning activities. *BMC Med Educ, 16*(1), 303. doi:10.1186/s12909-016-0821-z

Kiger, M. E., Riley, C., Stolfi, A., Morrison, S., Burke, A., & Lockspeiser, T. (2020). Use of Individualized Learning Plans to Facilitate Feedback Among Medical Students. *Teach Learn Med*, 1-11. doi:10.1080/10401334.2020.1713790

Kim, K. J., & Jang, H. W. (2015). Changes in medical students' motivation and self-regulated learning: a preliminary study. *Int J Med Educ, 6*, 213-215. doi:10.5116/ijme.565e.0f87

Kistner, S., Rakoczy, K., Otto, B., Dignath-van Ewijk, C., Buttner, G., & Klieme, E. (2010). Promotion of Self-Regulated Learning in Classrooms: Investigating Frequency, Quality, and Consequences for Student Performance. *Metacognition and Learning, 5*(2), 157-171.

Kistner, S., Rakoczy, K., Otto, B., Klieme, E., & Büttner, G. (2015). Teaching learning strategies: The role of instructional context and teacher beliefs. *Journal for Educational Research Online/Journal für Bildungsforschung Online, 7*(1), 176-197.

Klassen, R. M. (2004). Optimism and realism: A review of self-efficacy from a cross-cultural perspective. *International Journal of Psychology, 39*(3), 205-230.

Klassen, R. M., & Klassen, J. R. L. (2018). Self-efficacy beliefs of medical students: a critical review. *Perspect Med Educ, 7*(2), 76-82. doi:10.1007/s40037-018-0411-3

Knapp, T. (2016). Why Is the One-Group Pretest-Posttest Design Still Used? *Clinical Nursing Research, 25*(5), 467-472. doi:10.1177/1054773816666280

Komarraju, M., & Nadler, D. (2013). Self-Efficacy and Academic Achievement: Why Do Implicit Beliefs, Goals, and Effort Regulation Matter? *Learning and Individual Differences, 25*, 67-72.

Kosnin, A. M. (2007). Self-regulated learning and academic achievement in Malaysian undergraduates. *International Education Journal, 8*(1), 221-228.

Koziol-Dube, K., Burke, G., & Dimario, F., Jr. (2016). A Study of Self-Regulated Learning of Child Neurology for Medical Students. *Conn Med, 80*(10), 581-584.

Kuhn, D. (2000). Metacognitive development. *Current directions in psychological science, 9*(5), 178-181.

Kusurkar, R., Ten Cate, T. J., Van Asperen, M., & Croiset, G. (2011). Motivation as an independent and a dependent variable in medical education: a review of the literature. *Medical teacher, 33*(5), e242-e262.

Kállay, É. (2012). Learning strategies and metacognitive awareness as predictors of academic achievement in a sample of Romanian second-year students. *Cognitie, Creier, Comportament/Cognition, Brain, Behavior, 16*(3), 369-385.

Lee, S. S., Samarasekera, D. D., Sim, J. H., Hong, W.-H., Foong, C. C., Pallath, V., & Vadivelu, J. (2019). Exploring the Cultivation of Self-Regulated Learning (SRL) Strategies Among Pre-Clinical Medical Students in Two Medical Schools. *Medical Science Educator*.

Leggett, H., Sandars, J., & Burns, P. (2012). Helping students to improve their academic performance: a pilot study of a workbook with self-monitoring exercises. *Med Teach, 34*(9), 751-753. doi:10.3109/0142159x.2012.691188

Lin, Y.-C., Liang, J.-C., & Tsai, C.-C. (2012). The relationships between epistemic beliefs in biology and approaches to learning biology among biology-major university students in Taiwan. *Journal of Science Education and Technology, 21*(6), 796-807.

Loyens, S. M. M., Magda, J., & Rikers, R. M. J. P. (2008). Self-directed learning in problem-based learning and its relationships with self-regulated learning. *Educational Psychology Review, 20*(4), 411-427.

Lucieer, S. M., Jonker, L., Visscher, C., Rikers, R. M., & Themmen, A. P. (2016). Self-regulated learning and academic performance in medical education. *Med Teach, 38*(6), 585-593. doi:10.3109/0142159x.2015.1073240

Lucieer, S. M., van der Geest, J. N., Elói-Santos, S. M., de Faria, R. M. D., Jonker, L., Visscher, C., . . . Themmen, A. P. N. (2016). The development of self-regulated learning during the pre-clinical stage of medical school: a comparison between a lecture-based and a problem-based curriculum. *Advances in Health Sciences Education, 21*(1), 93-104.

Luwel, K., Torbeyns, J., & Verschaffel, L. (2003). The relation between metastrategic knowledge, strategy use and task performance: Findings and reflections from a numerosity judgement task. *European Journal of Psychology of Education, 18*(4), 425.

Lyons-Warren, A. M., Kirby, J. P., & Larsen, D. P. (2016). Student views on the role of self-regulated learning in a surgery clerkship. *J Surg Res, 206*(2), 273-279. doi:10.1016/j.jss.2016.08.022

MacKenzie, J. J., Stockley, D., Hastings-Truelove, A., Nowlan Suart, T., Katsoulas, E., Kawaja, M., . . . Sanfilippo, A. (2019). Student Reflections on the Queen's Accelerated Route to Medical School Programme. *J Med Educ Curric Dev, 6*, 2382120519836789. doi:10.1177/2382120519836789

Matsuyama, Y., Nakaya, M., Okazaki, H., Lebowitz, A. J., Leppink, J., & van der Vleuten, C. (2019). Does changing from a teacher-centered to a learner-centered context promote self-regulated learning: a qualitative study in a Japanese undergraduate setting. *BMC Medical Education, 19*(1), 152. doi:10.1186/s12909-019-1550-x

McGuire, S. Y. (2015). *Teach students how to learn: Strategies you can incorporate into any course to improve student metacognition, study skills, and motivation*. Sterling, Virginia: Stylus Publishing, LLC.

McLean, M. (2001). Can we relate conceptions of learning to student academic achievement? *Teaching in higher education, 6*(3), 399-413.

Medina, M. S., Castleberry, A. N., & Persky, A. M. (2017). Strategies for improving learner metacognition in health professional education. *American journal of pharmaceutical education, 81*(4).

Miller, C. J. (2014). Implementation of a study skills program for entering at-risk medical students. *Advances in physiology education, 38*(3), 229-234.

Mishra, P., Pandey, C. M., Singh, U., Gupta, A., Sahu, C., & Keshri, A. (2019). Descriptive statistics and normality tests for statistical data. *Annals of cardiac anaesthesia, 22*(1), 67-72. doi:10.4103/aca.ACA_157_18

Mukhtar, F., Muis, K., & Elizov, M. (2018). Relations between psychological needs satisfaction, motivation, and self-regulated learning strategies in medical residents: a cross-sectional study. *MedEdPublish, 7*.

Muwonge, C. M., Schiefele, U., Ssenyonga, J., & Kibedi, H. (2017). Self-regulated learning among teacher education students: Motivational beliefs influence on the use of metacognition. *Journal of Psychology in Africa, 27*(6), 515-521. doi:10.1080/14330237.2017.1399973

Nabizadeh, S., Hajian, S., Sheikhan, Z., & Rafiei, F. (2019). Prediction of academic achievement based on learning strategies and outcome expectations among medical students. *BMC Med Educ, 19*(1), 99. doi:10.1186/s12909-019-1527-9

Naeimi, L., Abbaszadeh, M., Mirzazadeh, A., Sima, A. R., Nedjat, S., & Mortaz Hejri, S. (2019). Validating Self-Reflection and Insight Scale to Measure readiness for Self-Regulated Learning. *J Educ Health Promot, 8*, 150. doi:10.4103/jehp.jehp_101_19

Naveh-Benjamin, M., McKeachie, W. J., & Lin, Y.-g. (1987). Two Types of Test-Anxious Students: Support for an Information Processing Model. *Journal of Educational Psychology, 79*(2), 131-136.

Negovan, V., Sterian, M., & Colesniuc, G.-M. (2015). Conceptions of learning and intrinsic motivation in different learning environments. *Procedia-Social and Behavioral Sciences, 187*, 642-646.

Niemiec, C. P., & Ryan, R. M. (2009). Autonomy, competence, and relatedness in the classroom: Applying self-determination theory to educational practice. *Theory & Research in Education, 7*(2), 133-144.

Nordell, S. E. (2009). Learning How to Learn: A Model for Teaching Students Learning Strategies. *Bioscene: Journal of College Biology Teaching, 35*(1), 35-42.

Onyeizugbo, E. U. (2010). Self-efficacy and test anxiety as correlates of academic performance. *Educational research, 1*(10), 477-480.

Pajares, F. (2008). Motivational role of self-efficacy beliefs in self-regulated learning. In D. H. Schunk & B. J. Zimmerman (Eds.), *Motivation and self-regulated learning: Theory, research, and applications* (pp. 111-140). New York: Lawrence Erlbaum Associates, Taylor & Francis Group.

Pallant, J. (2013). *SPSS survival manual*: McGraw-Hill Education (UK).

Panadero, E. (2017). A review of self-regulated learning: Six models and four directions for research. *Frontiers in Psychology, 8*, 422.

Papinczak, T., Young, L., Groves, M., & Haynes, M. (2008). Effects of a metacognitive intervention on students' approaches to learning and self-efficacy in a first year medical course. *Advances in health sciences education: theory and practice, 13*(2), 213.

Paris, S. G., & Paris, A. H. (2001). Classroom applications of research on self-regulated learning. *Educational psychologist, 36*(2), 89-101.

Patel, R., Green, W., Shahzad, M. W., Church, H., & Sandars, J. (2020). Using a self-regulated learning-enhanced video feedback educational intervention to improve junior doctor prescribing. *Med Teach*, 1-10. doi:10.1080/0142159x.2020.1748183

Patel, R., Tarrant, C., Bonas, S., Yates, J., & Sandars, J. (2015). The struggling student: a thematic analysis from the self-regulated learning perspective. *Med Educ, 49*(4), 417-426. doi:10.1111/medu.12651

Paulsen, M. B., & Feldman, K. A. (2005). The conditional and interaction effects of epistemological beliefs on the self-regulated learning of college students: Motivational strategies. *Research in higher education, 46*(7), 731-768.

Paulsen, M. B., & Feldman, K. A. (2007). The conditional and interaction effects of epistemological beliefs on the self-regulated learning of college students: Cognitive and behavioral strategies. *Research in Higher Education, 48*(3), 353-401.

Pelaccia, T., & Viau, R. (2017). Motivation in medical education. *Medical Teacher, 39*(2), 136-140. doi:10.1080/0142159X.2016.1248924

Pintrich, P. R. (1999). The role of motivation in promoting and sustaining self-regulated learning. *International journal of educational research, 31*(6), 459-470.

Pintrich, P. R. (2000). The role of goal orientation in self-regulated learning. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 451-502). San Diego: CA: Academic Press.

Pintrich, P. R. (2004). A conceptual framework for assessing motivation and self-regulated learning in college students. *Educational psychology review, 16*(4), 385-407.

Pintrich, P. R., & De Groot, E. V. (1990). Motivational and Self-Regulated Learning Components of Classroom Academic Performance. *Journal of Educational Psychology, 82*(1), 33-40.

Pintrich, P. R., Garcia, T., McKeachie, W. J., & Smith, D. A. F. (1991). *Motivated strategies for learning questionnaire*: Regents of the University of Michigan.

Pintrich, P. R., McKeachie, W. J., & Lin, Y.-G. (1987). Teaching a course in learning to learn. *Teaching of Psychology, 14*(2), 81-86.

Pintrich, P. R., & Schunk, D. H. (1996). *Motivation in education: Theory, research, and applications*. Englewood Cli!s, NJ: Prentice Hall Merrill.

Pintrich, P. R., Smith, D. A. F., Garcia, T., & McKeachie, W. J. (1993). Reliability and predictive validity of the Motivated Strategies for Learning Questionnaire (MSLQ). *Educational and psychological measurement, 53*(3), 801-813.

Pizzimenti, M. A., & Axelson, R. D. (2015). Assessing student engagement and self-regulated learning in a medical gross anatomy course. *Anat Sci Educ, 8*(2), 104-110. doi:10.1002/ase.1463

Premkumar, K., Pahwa, P., Banerjee, A., Baptiste, K., Bhatt, H., & Lim, H. J. (2013). Does medical training promote or deter self-directed learning? A longitudinal mixed-methods study. *Acad Med, 88*(11), 1754-1764. doi:10.1097/ACM.0b013e3182a9262d

Purdie, N., Hattie, J., & Douglas, G. (1996). Student conceptions of learning and their use of self-regulated learning strategies: A cross-cultural comparison. *Journal of educational psychology, 88*(1), 87-100.

Puustinen, M., & Pulkkinen, L. (2001). Models of self-regulated learning: A review. *Scandinavian Journal of Educational Research, 45*(3), 269-286.

Pålsson, Y., Mårtensson, G., Swenne, C. L., Ädel, E., & Engström, M. (2017). A peer learning intervention for nursing students in clinical practice education: A quasi-experimental study. *Nurse education today, 51*, 81-87.

Raidal, S. L., & Volet, S. E. (2009). Preclinical students' predispositions towards social forms of instruction and self-directed learning: a challenge for the development of autonomous and collaborative learners. *Higher Education, 57*(5), 577-596.

Roick, J., & Ringeisen, T. (2017). Self-efficacy, test anxiety, and academic success: A longitudinal validation. *International Journal of Educational Research, 83*, 84-93.

Roohi, G. H., Asayesh, H., Bathai, S. A., Shouri Bidgoli, A. R., Badeleh, M. T., & Rahmani, H. (2013). The relationship between self-efficacy and academic motivation among students of medical sciences. *The Journal of Medical Education and Development, 8*(1), 45-51.

Roth, A., Ogrin, S., & Schmitz, B. (2016). Assessing self-regulated learning in higher education: a systematic literature review of self-report instruments. *Educational Assessment, Evaluation and Accountability, 28*(3), 225-250.

Rousseau, F. L., & Vallerand, R. J. (2000). Does motivation mediate influence of social factors on educational consequences? *Psychol Rep, 87*(3 Pt 1), 812-814. doi:10.2466/pr0.2000.87.3.812

Royce, C. S., Hayes, M. M., & Schwartzstein, R. M. (2019). Teaching Critical Thinking: A Case for Instruction in Cognitive Biases to Reduce Diagnostic Errors and Improve Patient Safety. *Academic Medicine, 94*(2), 187-194. doi:10.1097/acm.0000000000002518

Ryan, R. M., & Deci, E. L. (2000a). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary educational psychology, 25*(1), 54-67.

Ryan, R. M., & Deci, E. L. (2000b). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *Am Psychol, 55*(1), 68-78.

Sadi, O., & Lee, M.-H. (2015). The conceptions of learning science for science-mathematics groups and literature-mathematics groups in Turkey. *Research in Science & Technological Education, 33*(2), 182-196.

Safari, Y., & Meskini, H. (2015). The Effect of Metacognitive Instruction on Problem Solving Skills in Iranian Students of Health Sciences. *Glob J Health Sci, 8*(1), 150-156. doi:10.5539/gjhs.v8n1p150

Sandars, J., & Cleary, T. J. (2011). Self-regulation theory: applications to medical education: AMEE Guide No. 58. *Medical teacher, 33*(11), 875-886.

Sandars, J., & Patel, R. (2015). Self-regulated learning: the challenge of learning in clinical settings. *Med Educ, 49*(6), 554-555. doi:10.1111/medu.12695

Sandars, J., Patel, R., Steele, H., & McAreavey, M. (2014). Developmental student support in undergraduate medical education: AMEE Guide No. 92. *Med Teach, 36*(12), 1015-1026. doi:10.3109/0142159x.2014.917166

Sawatsky, A. P., Halvorsen, A. J., Daniels, P. R., Bonnes, S. L., Issa, M., Ratelle, J. T., . . . Beckman, T. J. (2020). Characteristics and quality of rotation-specific resident learning goals: a prospective study. *Med Educ Online, 25*(1), 1714198. doi:10.1080/10872981.2020.1714198

Schauber, S. K., Hecht, M., Nouns, Z. M., Kuhlmey, A., & Dettmer, S. (2015). The role of environmental and individual characteristics in the development of student achievement: a comparison between a traditional and a problem-based-learning curriculum. *Adv Health Sci Educ Theory Pract, 20*(4), 1033-1052. doi:10.1007/s10459-015-9584-2

Schmitt, N. (1996). Uses and abuses of coefficient alpha. *Psychological assessment, 8*(4), 350.

Schommer, M. (1990). Effects of beliefs about the nature of knowledge on comprehension. *Journal of Educational Psychology, 82*(3), 498-504.

Schreiber, J. B., & Shinn, D. (2003). Epistemological beliefs of community college students and their learning processes. *Community College Journal of Research &Practice, 27*(8), 699-709.

Schunk, D. H. (2005). Self-regulated learning: The educational legacy of Paul R. Pintrich. *J Educational psychologist, 40*(2), 85-94.

Schunk, D. H., & Dibenedetto, M. K. (2016). Self-efficacy theory in education. *Handbook of motivation at school, 2*, 34-54.

Schunk, D. H., & Zimmerman, B. J. (2012). Self-regulation and learning. In *Handbook of Psychology, Second Edition* (Vol. 7, pp. 59-78). Hoboken, New Jersey.

Schutte, T., Tichelaar, J., Dekker, R. S., Thijs, A., de Vries, T. P., Kusurkar, R. A., . . . van Agtmael, M. A. (2017). Motivation and competence of participants in a learner-centered student-run clinic: an exploratory pilot study. *BMC Med Educ, 17*(1), 23. doi:10.1186/s12909-017-0856-9

Shariff, F., Hatala, R., & Regehr, G. (2020). Learning After the Simulation Is Over: The Role of Simulation in Supporting Ongoing Self-Regulated Learning in Practice. *Acad Med, 95*(4), 523-526. doi:10.1097/acm.0000000000003078

Siddaiah-Subramanya, M., Nyandowe, M., & Zubair, O. (2017). Self-regulated learning: why is it important compared to traditional learning in medical education? *Advances in medical education and practice, 8*, 243-246. doi:10.2147/AMEP.S131780

Siddiqui, F., & Khan, R. A. (2020). Correlation between stress scores and self-regulated learning perception scores in Pakistani students. *J Pak Med Assoc, 70*(3), 447-451. doi:10.5455/jpma.6674

Siegesmund, A. (2017). Using self-assessment to develop metacognition and self-regulated learners. *FEMS Microbiol Lett, 364*(11). doi:10.1093/femsle/fnx096

Simpson, M. L., Stahl, N. A., & Francis, M. A. (2004). Reading and Learning Strategies: Recommendations for the 21st Century. *Journal of Developmental Education, 28*(2), 2.

Skinner, D. E., Saylors, C. P., Boone, E. L., Rye, K. J., Berry, K. S., & Kennedy, R. L. (2015). Becoming Lifelong Learners: A Study in Self-Regulated Learning. *J Allied Health, 44*(3), 177-182.

Sobral, D. T. (2000). An appraisal of medical students' reflection-in-learning. *Med Educ, 34*(3), 182-187. doi:10.1046/j.1365-2923.2000.00473.x

Soemantri, D., McColl, G., & Dodds, A. (2018). Measuring medical students' reflection on their learning: modification and validation of the motivated strategies for learning questionnaire (MSLQ). *BMC Med Educ, 18*(1), 274. doi:10.1186/s12909-018-1384-y

Sperling, R. A., Howard, B. C., Staley, R., & DuBois, N. (2004). Metacognition and self-regulated learning constructs. *Educational Research and Evaluation, 10*(2), 117-139.

Stegers-Jager, K. M., Cohen-Schotanus, J., & Themmen, A. P. (2012). Motivation, learning strategies, participation and medical school performance. *Med Educ, 46*(7), 678-688. doi:10.1111/j.1365-2923.2012.04284.x

Stolp, S., & Zabrucky, K. M. (2009). Contributions of metacognitive and self-regulated learning theories to investigations of calibration of comprehension. *International Electronic Journal of Elementary Education, 2*(1), 7-31.

Sullivan, G. M., & Artino, A. R., Jr. (2013). Analyzing and interpreting data from likert-type scales. *Journal of graduate medical education, 5*(4), 541-542. doi:10.4300/JGME-5-4-18

Tanaka, M., Fukuda, S., Mizuno, K., Kuratsune, H., & Watanabe, Y. (2009). Stress and coping styles are associated with severe fatigue in medical students. *Behav Med, 35*(3), 87-92. doi:10.1080/08964280903231979

Ten Cate, T. J., Kusurkar, R. A., & Williams, G. C. (2011). How self-determination theory can assist our understanding of the teaching and learning processes in medical education. AMEE guide No. 59. *Med Teach, 33*(12), 961-973. doi:10.3109/0142159x.2011.595435

Teunissen, P. W., & Westerman, M. (2011). Opportunity or threat: the ambiguity of the consequences of transitions in medical education. *Med Educ, 45*(1), 51-59. doi:10.1111/j.1365-2923.2010.03755.x

Thomas, L., Bennett, S., & Lockyer, L. (2016). Using concept maps and goal-setting to support the development of self-regulated learning in a problem-based learning curriculum. *Med Teach, 38*(9), 930-935. doi:10.3109/0142159x.2015.1132408

Tio, R. A., Stegmann, M. E., Koerts, J., van Os, T. W., & Cohen-Schotanus, J. (2016). Weak self-directed learning skills hamper performance in cumulative assessment. *Med Teach, 38*(4), 421-423. doi:10.3109/0142159x.2015.1132411

Tsai, C.-C., Ho, H. N. J., Liang, J.-C., & Lin, H.-M. (2011). Scientific epistemic beliefs, conceptions of learning science and self-efficacy of learning science among high school students. *Learning and Instruction, 21*(6), 757-769.

Turan, S., Demirel, O., & Sayek, I. (2009). Metacognitive awareness and self-regulated learning skills of medical students in different medical curricula. *Med Teach, 31*(10), e477-483. doi:10.3109/01421590903193521

Turan, S., & Konan, A. (2012). Self-regulated learning strategies used in surgical clerkship and the relationship with clinical achievement. *Journal of surgical education, 69*(2), 218-225.

Turan, S., Valcke, M., Aper, L., Koole, S., & Derese, A. (2013). Studying self-efficacy beliefs in medical education. *Procedia-Social and Behavioral Sciences, 93*, 1311-1314.

Valle, A., Cabanach, R. G., Núñez, J. C., González-Pienda, J., Rodríguez, S., & Pineiro, I. (2003). Cognitive, motivational, and volitional dimensions of learning: An empirical test of a hypothetical model. *Research in higher education, 44*(5), 557-580.

Vallerand, R., Pelletier, L., Blais, M. R., Brière, N., Senécal, C., & Vallieres, E. (1992). *The Academic Motivation Scale: A Measure of Intrinsic, Extrinsic, and Amotivation in Education* (Vol. 52).

van Houten-schat, M. A., Berkhout, J. J., Dijk, N. V., & Endedijk, M. D. (2018). Self-regulated learning in the clinical context: a systematic review. *Medical Education, 52*, 1008-1015.

Van Nguyen, H., Laohasiriwong, W., Saengsuwan, J., Thinkhamrop, B., & Wright, P. (2015). The relationships between the use of self-regulated learning strategies and depression among medical students: an accelerated prospective cohort study. *Psychol Health Med, 20*(1), 59-70. doi:10.1080/13548506.2014.894640

Vermunt, J. D. (1996). Metacognitive, cognitive and affective aspects of learning styles and strategies: A phenomenographic analysis. *Higher education, 31*(1), 25-50.

Vermunt, J. D. (1998). The regulation of constructive learning processes. *British journal of educational psychology, 68*(2), 149-171.

Vermunt, J. D. (2005). Relations between student learning patterns and personal and contextual factors and academic performance. *Higher education, 49*(3), 205.

Vermunt, J. D., & Vermetten, Y. J. (2004). Patterns in Student Learning: Relationships Between Learning Strategies, Conceptions of Learning, and Learning Orientations. *Educational Psychology Review*, 359-384.

Vezzani, C., Vettori, G., & Pinto, G. (2017). University students' conceptions of learning across multiple domains. *European Journal of Psychology of Education, 33*(4), 665-684.

Vezzani, C., Vettori, G., & Pinto, G. (2018). Assessing Students' Beliefs, Emotions and Causal Attribution: Validation of'Learning Conception Questionnaire'. *South African Journal of Education, 38*(2), 1453.

Vilppu, H., Laakkonen, E., Mikkilä-Erdmann, M., & Kääpä, P. (2019). Seeing beyond variables: applying a person-centered approach to identifying regulation strategy profiles among Finnish preclinical medical and dental students. *Canadian Medical Education Journal, 10*(1), e68.

Vrugt, A., & Oort, F. J. (2008). Metacognition, Achievement Goals, Study Strategies and Academic Achievement: Pathways to Achievement. *Metacognition and Learning, 3*(2), 123-146.

Weinstein, C. E., Husman, J., & Dierking, D. R. (2000). Self-regulation interventions with a focus on learning strategies. In *Handbook of self-regulation* (pp. 727-747): Elsevier.

Weinstein, C. E., & van Mater Stone, G. (1993). Broadening our conception of general education: The self-regulated learner. *New directions for community colleges, 1993*(81), 31-39.

West, C., & Sadoski, M. (2011). Do study strategies predict academic performance in medical school? *Medical education, 45*(7), 696-703.

White, C. B. (2007). Smoothing out transitions: how pedagogy influences medical students' achievement of self-regulated learning goals. *Advances in health sciences education: theory and practice, 12*(3), 279.

White, C. B., Gruppen, L. D., & Fantone, J. C. (2014). Self-regulated learning in medical education. In T. Swanwick (Ed.), *Understanding medical education* (pp. 201-211). UK: Wiley-Blackwell.

Wibrowski, C. R., Matthews, W. K., & Kitsantas, A. (2017). The role of a skills learning support program on first-generation college students' self-regulation, motivation, and academic achievement: A longitudinal study. *Journal of College Student Retention: Research, Theory & Practice, 19*(3), 317-332.

Williamson, G. (2015). Self-regulated learning: an overview of metacognition, motivation and behaviour. *Journal of Initial Teacher Inquiry, 1*, 25-27.

Wilson, D., & Conyers, M. (2016). *Teaching students to drive their brains: Metacognitive strategies, activities, and lesson ideas*. Alexandia, Virginia: ASCD.

Winne, P. H. (1996). A metacognitive view of individual differences in self-regulated learning. *Learning and individual differences, 8*(4), 327-353.

Winne, P. H., & Perry, N. E. (2000). Measuring self-regulated learning. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 531-566). San Diego, CA: Academic.

Winston, K. A., Van der Vleuten, C. P., & Scherpbier, A. J. (2010). An investigation into the design and effectiveness of a mandatory cognitive skills programme for at-risk medical students. *Med Teach, 32*(3), 236-243. doi:10.3109/01421590903197035

Wolters, C. A., & Hussain, M. (2015). Investigating Grit and Its Relations with College Students' Self-Regulated Learning and Academic Achievement. *Metacognition and Learning, 10*(3), 293-311.

Wolters, C. A., Pintrich, P. R., & Karabenick, S. A. (2005). Assessing academic self-regulated learning. In K. A. Moore & L. H. Lippman (Eds.), *What do children need to flourish?* (pp. 251-270). Boston, MA.: Springer.

Woods, N. N., Mylopoulos, M., & Brydges, R. (2011). Informal self-regulated learning on a surgical rotation: uncovering student experiences in context. *Adv Health Sci Educ Theory Pract, 16*(5), 643-653. doi:10.1007/s10459-011-9285-4

Woods, N. N., Mylopoulos, M., & Brydges, R. (2011). Informal self-regulated learning on a surgical rotation: uncovering student experiences in context. *Advances in health sciences education, 16*(5), 643-653.

Wu, H., Li, S., Zheng, J., & Guo, J. (2020). Medical students' motivation and academic performance: the mediating roles of self-efficacy and learning engagement. *Med Educ Online, 25*(1), 1742964. doi:10.1080/10872981.2020.1742964

Xu, J., Campisi, P., Forte, V., Carrillo, B., Vescan, A., & Brydges, R. (2018). Effectiveness of discovery learning using a mobile otoscopy simulator on knowledge acquisition and retention in medical students: a randomized controlled trial. *J Otolaryngol Head Neck Surg, 47*(1), 70. doi:10.1186/s40463-018-0317-4

Yamauchi, H., Kumagai, Y., & Kawasaki, Y. (1999). Perceived control, autonomy, and self-regulated learning strategies among Japanese high school students. *Psychol Rep, 85*(3 Pt 1), 779-798. doi:10.2466/pr0.1999.85.3.779

Yilmaz, K. (2011). The cognitive perspective on learning: Its theoretical underpinnings and implications for classroom practices. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas, 84*(5), 204-212.

Yonker, J. E. (2011). The relationship of deep and surface study approaches on factual and applied test-bank multiple-choice question performance. *Assessment & Evaluation in Higher Education, 36*(6), 673-686.

Zepeda, C. D., Richey, J. E., Ronevich, P., & Nokes-Malach, T. J. (2015). Direct instruction of metacognition benefits adolescent science learning, transfer, and motivation: An in vivo study. *Journal of Educational Psychology, 107*(4), 954.

Zheng, B., Ward, A., & Stanulis, R. (2020). Self-regulated learning in a competency-based and flipped learning environment: learning strategies across achievement levels and years. *Med Educ Online, 25*(1), 1686949. doi:10.1080/10872981.2019.1686949

Zheng, B., & Zhang, Y. (2020). Self-regulated learning: the effect on medical student learning outcomes in a flipped classroom environment. *BMC Med Educ, 20*(1), 100. doi:10.1186/s12909-020-02023-6

Zhou, Y., Graham, L., & West, C. (2016). The relationship between study strategies and academic performance. *International journal of medical education, 7*, 324.

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory into Practice, 41*(2), 64-70.