

**CREATIVE ADOPTION OF MS EXCEL
IN TEACHING AND LEARNING OF
CHEMISTRY IN MALAYSIA**

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ABSTRACT

This study concerns the creative use of MS Excel in teaching and learning chemistry in Malaysian secondary schools and universities. It is used to explain, explore and understand chemical concepts. Topics such as chemical kinetics, gas compressibility, distribution of molecular speed, period three elements, qualitative analysis, spectroscopy and chemical equilibrium were chosen from Form Six and first/second year university syllabus as examples. For the “qualitative analysis” workbook, a set of videos showing the reactions described are also provided to give the ‘intuitive feel’ of the experiments described in the worksheets.

Simple functions in Excel such as ‘Active X’ control tool box, simple macro, chart wizard, hyperlink function and some built in mathematical functions were used extensively in creating the workbooks. These workbooks have provided a stimulative and interesting methodology in learning chemistry. It could offer great benefits to teachers and students in teaching and learning of the said topics.

The chemical kinetics workbooks were tried out in secondary schools and the spectroscopy workbook was brought to local universities as field studies. Opinion survey of 612 students from 12 different secondary schools from three states in Malaysia and 68 undergraduate students from various local universities indicated that students were very satisfied with the use of Excel in teaching and learning of chemistry. Data collected were analyzed with descriptive statistics to examine the perception of the respondents and inferential statistics were used to observe the difference in perception between gender and races. The results of the field study showed that most students (>93%) felt that MS Excel program provides a very convenient way for handling experimental kinetic data. It has increased students’ appreciation of chemical kinetics and helped develop their computer skills. The activities provided have exposed students to alternative and more innovative ways of learning chemical kinetics. There is significant difference ($p=0.038$) in perception between male and female students but no significant difference ($p=0.820$) in perception among different races. All 24 teachers from 12 schools surveyed also gave very positive comments about this approach. More than 95.0% of the teachers involved in this study found that the MS Excel program is very stimulative and motivated students’ interest in chemistry lessons. They believed that by using this program, thinking process of the students could be further stimulated and improved.

Undergraduate students also showed very positive perception towards the spectroscopy workbook. Most (>80%) students agreed that the spectroscopy workbook could help them in learning spectroscopy. However, there is no significant difference ($p=0.560$) between different gender in their perceptions.

This study illustrates how teachers/lecturers can make use of Excel in creating effective and interactive educational environment for teaching and learning chemistry. Workbooks could be created by merely using standard MS Excel program. Simple functions and macros were used to run the task of some buttons created without employing difficult programming or add-ins. With elementary knowledge of Excel, a chemistry teacher would be able to create effective and entertaining teaching aids by using this widely available spreadsheet package in school/university for the benefit of the students.

ABSTRAK

Kajian ini mengkaji tentang penggunaan “MS Excel” secara kreatif dalam pengajaran dan pembelajaran kimia di sekolah menengah dan universiti di Malaysia di mana ia digunakan untuk menerang, menjelajah dan memahami konsep kimia. Topik-topik seperti kinetik kimia, kebolehtekanan gas, taburan kelajuan molekul, unsur kala tiga, analisis kualitatif, spektroskopi dan keseimbangan kimia telah dipilih sebagai contoh daripada sukatan pelajaran Tingkatan Enam dan sukatan tahun pertama/kedua universiti. Untuk buku kerja “qualitative analysis” (analisis kualitatif), video setiap tindakbalas juga disediakan bagi menambah ‘gambaran intuitif’ sesebuah eksperimen yang diperihalkan di dalam helaian-helaian kerja.

Fungsi mudah di dalam “Excel” seperti alat kawalan “Active X”, makro mudah, “chart wizard”, “hyperlink” dan beberapa fungsi matematik sedia ada banyak digunakan untuk mencipta buku kerja. Buku-buku kerja ini telah memberikan kaedah pembelajaran kimia yang menarik dan memberangsangkan. Ia telah memberi banyak faedah kepada guru dan pelajar dalam pengajaran dan pembelajaran topik-topik tersebut.

Buku kerja “Chemical kinetics” telah dicuba di sekolah-sekolah menengah dan buku kerja “Spectroscopy” dibawa ke universiti tempatan sebagai kajian lapangan. Tinjauan pendapat 612 orang pelajar dari 12 sekolah menengah di tiga negeri di Malaysia dan 68 orang mahasiswa/wi dari universiti tempatan menunjukkan pelajar-pelajar sangat berpuas hati dengan penggunaan “Excel” dalam pengajaran dan pembelajaran kimia. Data terkumpul dianalisis dengan statistik deskriptif untuk memeriksa persepsi responden dan statistik inferensi digunakan untuk memerhati perbezaan persepsi dari segi jantina dan kaum. Dapatan kajian lapangan menunjukkan kebanyakan pelajar (>93%) berpendapat bahawa program “MS Excel” memberi cara mudah untuk mengendalikan data eksperimen kinetik. Ia telah meningkatkan penghayatan pelajar terhadap konsep kinetik kimia dan membina kemahiran komputer mereka. Aktiviti yang diberikan telah mendedahkan pelajar kepada cara alternatif serta lebih inovatif untuk mempelajari kinetik kimia. Terdapat perbezaan persepsi yang signifikan ($p=0.038$) di antara pelajar lelaki dan perempuan tetapi tiada perbezaan persepsi yang signifikan ($p=0.820$) di antara kaum. Semua 24 orang guru dari 12 sekolah yang terlibat dalam kajian juga memberi komen yang positif terhadap kaedah ini. Lebih daripada 95% daripada guru terlibat dalam kajian ini berpendapat bahawa program “MS Excel” adalah memberangsang dan dapat memotivasikan minat pelajar dalam pelajaran-pelajaran kimia. Mereka percaya bahawa dengan penggunaan program ini, proses berfikir pelajar dapat dirangsangkan dengan lebih lanjut dan dipertingkatkan.

Mahasiswa/wi juga menunjukkan persepsi yang sangat positif terhadap buku kerja “spectroscopy”. Kebanyakan (>80%) mahasiswa/wi bersetuju bahawa buku kerja “spectroscopy” dapat membantu mereka dalam pembelajaran spektroskopi. Walau bagaimanapun, tiada perbezaan persepsi yang signifikan ($p=0.560$) di antara jantina.

Kajian ini mengilustrasikan bagaimana guru/pensyarah boleh menggunakan “Excel” untuk mewujudkan suasana pembelajaran yang berkesan dan interaktif dalam pengajaran dan pembelajaran kimia. Buku kerja boleh dicipta dengan hanya menggunakan program “MS Excel” asas. Fungsi-fungsi mudah dan makro mudah digunakan untuk menjalankan tugas beberapa butang yang direka tanpa menggunakan pengaturcaraan yang sukar atau “add-in”. Dengan pengetahuan asas “MS Excel”,

seorang guru kimia di sekolah/universiti boleh mencipta bahan-bahan bantuan mengajar yang berkesan dan menyeronokkan dengan menggunakan program yang boleh diperolehi dengan mudah untuk manfaat pelajar.

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