



Immunization sub-topic and interactive multimedia courseware for Malaysian students: An impact study

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Abstract

The term alternative framework or misconceptions refers to any ideas held by students which are inconsistent or in conflict with the general idea accepted by scientists. Teachers need to uncover student's prior knowledge, identify their alternative framework and subsequently find effective strategies and appropriate learning style for students to solve the problems. This action research aims to study the effects of interactive multimedia courseware in addressing the problems of students' alternative frameworks in Immunization topic and identify the perceptions of students and lecturers about the appropriateness and quality of the software. Samples of the study included one lecturer and 30 students sitting for the Bachelor of Education in Biology and Bachelor of Science in Biology programmes in two Malaysia's universities. An interactive multimedia courseware entitled "Immunization" was developed using PowerPoint 2010 software. Questionnaires on the effectiveness of the courseware, pretest and post-test were administered as the instruments in this study. Results of data analysis showed that there was a statistically significant difference between the means of post-test and the pretest scores. Students of the Bachelor of Science in Biology programme showed higher and better achievement scores as compared to their counterparts of the Bachelor of Education in Biology programme after using the interactive multimedia courseware. The majority of the students and lecturers agreed that the adoption of this courseware helped increase students' understanding of the Immunization topic.

Keywords: action research, alternative frameworks, courseware effectiveness, immunization topic, interactive multimedia courseware, students' misconception

Introduction

Problem regarding alternative frameworks or misconception among students is often studied by researchers. Tekkaya (2002) describe the term alternative framework or misconceptions as any ideas held by students, which are inconsistent or in conflict with the general idea accepted by scientists. Teachers need to uncover student's prior knowledge, identify their alternative framework and subsequently find effective strategies and appropriate learning style for students to solve the problems.

Statement of the problem

Immunization is a subtopic taught in Immune System topic, especially in Biology at school or in institutions of higher learning in Malaysia. Although it is not emphasized in the teaching at school, but general knowledge about immunization is very important to students as a guide to prevent diseases such as cervical cancer, polio, tetanus, diphtheria, vericella and many more. Cervical cancer is the second cancer that often affects women after breast cancer in Malaysia (Tan, Hesham & Qodriyah, 2010).

Therefore, the delivery of information about health issues such as immunization and vaccination program needs to be improved and construction of interactive multimedia courseware is an effort to increase student awareness of the importance of immunization.

The objective of the study

The objectives of this study are to:

- 1) Develop the interactive multimedia courseware for Immunization subtopic.
- 2) Identify student's alternative framework in Immunization subtopic.
- 3) Review the impact of interactive multimedia courseware in addressing student's alternative framework in Immunization subtopic.
- 4) Identify the perception of students and lecturers about the appropriateness and quality of interactive multimedia courseware built.

Literature review

Tekkaya (2002) and Boo (2005), describes the term an alternative framework as any scientific ideas held by students who are inconsistent or in conflict with the idea that are generally accepted by scientists. Students' alternative frameworks were built from a variety of sources, usually from daily experiences. According to Uzuntiryaki & Geban (2005), many studies show that the formal reasoning ability (Haidar & Abraham, 1991; Abraham et al., 1994; Chandran et al., 1987), existing knowledge (Haidar & Abraham, 1991; Abraham et al., 1994), the daily language (Prieto *et al.*, 1989; Ebenezer & Erickson, 1996; Yip, 1998) and directive (Haidar & Abraham, 1991) plays an important role in the development of students. Teachers (Osborne and Cosgrove, 1983, Bar & Travis, 1991 in Boo, 2005) and textbooks (Boo, 2005) contains figures, the reality (Boo, 2005) or misinformation (Storey, 1991, 1992 in Tekkaya, 2002) makes the students creating their alternative frameworks that are difficult to change.

Basic principles in developing effective software are interactivity and individualization, the application of multimedia elements, textology and instructional system (Chambers and Sprecher, (2003) in Mazanah Muhamad, Ahmad Zamri Mansur & On Lily, 2010). According Sambrook (2003), an important factor affecting students' perceptions of the quality of computer-based materials are user-friendly, presentations, graphics, information, knowledge, understanding, levels, types of learning, language and text.

Methodology

This action research was conducted on a lecturer and 30 students majoring in the Bachelor of Education Sciences from an education university, which is located at Perak and another lecturer and 30 students of Bachelor of Science in Biology from a local university located in Arau, Perlis. Development of interactive multimedia courseware entitled 'Immunization' was developed using '*PowerPoint 2010*' and in accordance with the teaching syllabus for Immunization subtopic at degree level. The learning courseware prototype was prepared in compact disc or CD with seven main interfaces which include Home menu, Table of Contents, Learning Maps, Video, Quizzes, Glossaries, Log Out and it includes animation, audio and video.

Achievement tests such as pre and post tests and also questionnaires on the effectiveness and quality of interactive multimedia courseware were provided for students and lecturers and administered as the study instruments. The qualities of the courseware developed were measured in terms of multimedia elements, textology, the language used, the information provided, interactivity and user-friendly. Mean

scores for both tests are compiled, calculated and compared to the analysis of qualitative data. Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 14.0.

Paired sample t-test was carried out to investigate the relevance of student achievement in performance tests with their SPM results. On the other hand, *one sample t-test* was used to compare the overall performance of students in both programmes. In order to identify the level of student's understanding on the two subtopics in the courseware, i.e. Foundations of Immunizations and Vaccinations, question item analysis and subtopics analysis were conducted to compare the results according to the programmes and the overall results.

Findings and discussion

Alternative framework in the topic Immunization

Alternative frameworks among the students in Immunization topics were identified and shown in the figure below. Figure 1 shows an example of pre-test questions.

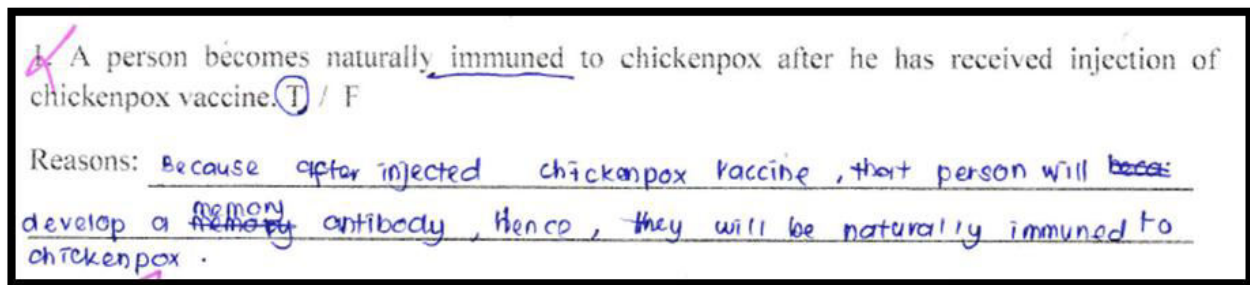


Figure 1. An alternative framework for pre-examination

In this example, the students could not answer the question correctly although the scientific explanations were given because they still have an alternative framework on the basic concepts of immunization. On the overall, students were still confused and did not understand the types of immunity. After using the multimedia courseware, students were found to have a better understanding of the Foundation of Immunization sub topics.

The achievements and the effectiveness of multimedia courseware

The achievements and the effectiveness of multimedia courseware were analyzed according to the students' programmes. The results as tabulated in Table 1 shows the mean scores of students in the pre-test 4.57 ± 1.60 is lower than the passing score of 5 while in the post test scores of students is 6.80 ± 1.52 higher than the passing score ($t(59) = 9.197, p < .05$). The result suggests that there has been the increment of the students' knowledge after using multimedia courseware.

Table 1. Student achievement results for all respondents (n = 60)

Test	Number of samples (n)	Score Mean	Standard Deviation	t-Value	Significant Value p (2-tail)
Pre	60	4.57	1.60	-2.100	0.040
Post	60	6.80	1.52	9.197	0.000

The increased marks after using this courseware showed that the students enjoyed and digested the information better. This is consistent with studies by Aini Arifah & Norizan, (2008) that state in their

study that courseware Physics that they developed made learning more fun and exciting which include the interactive teaching materials. Tables 2 and 3 show the level of achievement of students majoring in BoS in Biology and BoE in Biology.

Table 2. Student achievement results for students of BoE in Biology (n = 30)

Test	Number of samples (n)	Score Mean	Standard Deviation	t-Value	Significant Value p (2-tail)
Pre	30	4.30	1.51	-2.536	0.017
Post	30	6.53	1.85	4.535	0.000

Table 3. Student's achievement results for students of BoS in Biology (n = 30)

Test	Number of samples (n)	Score Mean	Standard Deviation	t-Value	Significant Value p (2-tail)
Pre	30	4.83	1.66	-0.549	0.587
Post	30	7.07	1.05	10.798	0.000

Based on these findings, the mean pretest scores for both majors were less than 5 points with a score of 4.30 and 4.83 respectively for the BoE in Biology and BoS in Biology. As for the post-test, the mean score of the both programs has increased with 6.53 for the BoE Biology while 7.07 for BoS Biology students. There was a significant increase in terms of achievement scores after using multimedia courseware.

On the overall, the achievements of the students in Biology majors were better than students majoring in Education. This could be due to the fact that the students of BoS in Biology were more serious with their studies and furthermore they have a better prior knowledge pertaining to the Biology subject in general. This is evident as they have sat for other courses such as Cell Biology and Biochemistry earlier and gave them a deeper knowledge in topics related to immunization. Their understanding was further reinforced after the use of interactive multimedia courseware.

Perception of students and lecturers of the courseware

Frequency scores, percentage and mean for each item in questionnaires regarding the effectiveness of interactive multimedia courseware for students were shown in Table 4. Likert Scale of four was used in this research which is Strongly Disagree (SD) with a 1 mark, Disagree (D) carries 2 marks, Agree for 3 marks and Strongly Agree for 4 marks.

Table 4. Frequency score, percentage and mean for each item questionnaire effectiveness of interactive multimedia courseware for students

Criteria	Likert Scale (n=60)									
	SD (1)		D (2)		A (3)		SA(4)		Mean	
	f	%	f	%	f	%	f	%		
A) Content of the Courseware										
1. The content of the courseware is accurate and current.	0	0	0	0	44	73.3	16	26.7	3.27	
2. The content is presented in a clear and orderly manner.	0	0	1	1.7	41	68.3	18	30.0	3.28	
3. The content of the courseware is according to instructional plan.	0	0	1	1.7	40	66.7	19	31.6	3.30	

Criteria	Likert Scale (n=60)								
	SD (1)		D (2)		A (3)		SA(4)		Mean
	f	%	f	%	f	%	f	%	
4. This courseware provides enough examples of each description.	0	0	7	11.7	36	60.0	17	28.3	3.17
5. The content of the courseware is easy to understand.	0	0	2	3.3	40	66.7	18	30.0	3.27
B) Teaching and Learning (T&L)	Average Mean								3.26
6. Animations that are displayed can increase my understanding about subtopic Immunization.	0	0	0	0	41	68.3	19	31.6	3.32
7. Courseware is suitable for the use of a wide range of students.	0	0	1	1.7	37	61.7	22	36.6	3.35
8. This courseware can stimulate me to think creatively and critically.	0	0	3	5.0	35	58.4	22	36.6	3.32
9. This courseware can motivate myself to study Immunization sub topic.	0	0	0	0	33	55.0	27	45.0	3.45
10. The provided animation can save my time to study Immunization sub topic.	0	0	0	0	36	60.0	24	40.0	3.40
11. This courseware can diversify the activities of T&L in the classroom.	0	0	3	5.0	33	55.0	24	40.0	3.35
12. The Animation of vaccines mechanism that acts in the body include in courseware can trigger my interest to this topic.	0	0	0	0	37	61.7	23	38.3	3.38
13. The Animation in this courseware can clearly explain to me how the vaccines can prevent illness.	0	0	2	3.3	37	61.7	21	35.0	3.32
C) Technology-related Assistance	Average Mean								3.36
14. The graphic, sound and animation contained in this courseware will spark your interest to learn Immunization sub topic.	0	0	1	1.7	40	66.7	19	31.6	3.33
15. Text displayed is clear and the use of writing is appropriate.	0	0	3	5.0	39	65.0	18	30.0	3.25
16. The graphic displayed is clear and not blurred.	0	0	1	1.7	37	61.7	22	36.6	3.35
17. This courseware can be used as support material for lecturers.	0	0	2	3.3	34	56.7	24	40.0	3.37
18. Courseware is user-friendly.	0	0	0	0	38	63.4	22	36.6	3.37
19. The screen display is consistent.	0	0	0	0	37	61.7	23	38.3	3.38
20. Student's achievement was shown through tutorial contained in the courseware.	0	0	0	0	36	60.0	24	40.0	3.40
Average Mean									3.35

The three key elements on the effectiveness of multimedia courseware that were examined in this study, namely:

a. The contents of the courseware (Items 1-5)

The majority of students agreed that the courseware content is good, but there are few students (11.7%) felt that this courseware needs more examples for each explanation and think that the courseware is difficult to understand (3.3%). This may be due to the lacking of examples for each explanation. This measure was taken in fear that too much information given would make the students bored. The result of this study was not in line with the study by Woodruff *et al.* (1998) as they found that the compactness of information has a negative impact on the learning process. The information which is too dense and complex can cause the students to feel hard to understand and being bored towards the subject. Therefore, in preparation of the courseware, a precaution was taken to ensure the selection of the simple and accurate information needs to be implemented during the construction process of a courseware. The irony was that the students in this study preferred the opposite. Due to this, it was clearly shown that even students in higher institutions are not independent in knowledge seeking.

b. Teaching and learning (Items 6-13)

The majority of students agreed that the courseware helps the process of teaching and learning with the mean value of 3:36. This element also shows the highest average mean compared to the other two elements studied. The highest mean is 3:45 for item 9 which described that this courseware can motivate students to study the topic Immunizations. On the overall, students and lecturers both agreed that interactive multimedia courseware for the Immunization topic helped in teaching and learning process.

c. Technology-related Assistance (Item 14-20)

For the aspect of technology-related assistance, majority of the students and lecturers agreed that the courseware has good technology-related assistance with an average mean value of 3.35. All respondents agreed that the courseware is user-friendly, the screen display is consistent and the student were happy to have their achievement was displayed after attempts were made to answer the tutorial or a quiz in the courseware. This result is consistent with the study by Sambrook, (2003) that stated the most important factor that influence students' perceptions of the quality of computer-based materials is able to be user-friendly.

Conclusion

This study was conducted to evaluate the effects of interactive multimedia courseware in solving problems of student's alternative framework in the topic Immunization. Among the conclusions derived in this study are that the student were found to have an alternative framework related to the basic concepts of immunization and they were still confused on the types and examples of immunity as well as the misconceptions about the safety of vaccines. Students majoring in BoS Biology shown an increased and higher academic achievement in the subtopic Foundations of Immunization and Vaccinations compared to their counterpart students majoring in Bio Biology after using the interactive multimedia courseware.

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