

Development of a Courseware on Learning Geography Lessons for Form 3: A Preliminary Study

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ABSTRACT

This study intends to develop a courseware on learning Geography subject for Form 3 students in secondary school. ADDIE instructional model has been chosen as the courseware development methodology employed in this work, with enhancement on the design phase using Interaction Design Lifecycle model. Other design guidelines that is relevant for academic community is also considered in this work. This paper describes the preliminary work carried out by the authors that covers the needs analysis, tasks analysis and initial design requirement. Due to the changes made to the assessment criteria in Geography for secondary school, the implementation of the learning content in the courseware must also be aligned to meet the learning objectives. Immediate future work will focus on designing the learning content for the proposed courseware.

KEYWORDS: Courseware, Multimedia Instruction, Geography, Form 3, Teaching and Learning.

INTRODUCTION

The use of interactive multimedia educational courseware has been widely adopted at school for teaching and learning purposes. Being confirmed as an effective learning tool, the multimedia-based learning courseware motivates students to learn and encourages them to participate actively [1]. In addition, the multimedia technology is proven to provide effective results in teaching and learning with its interesting, dynamic and interactive features [2]. The integration of multimedia technology in learning process allows students to acquire knowledge and skills in more meaningful way leading to improvement in student academic performance, knowledge, skills and attitudes [3-4]. Since multimedia-based technology is now being integrated in education curriculums, teachers can teach more consistently and effectively [5]. Therefore, content developers in academic settings must employ all the available means from theories to practices in order to advance the academic excellence in the aspects of teaching and learning.

It was reported that while students can retain information at about 80% of what they see, hear and do concurrently, seeing process or visual receptor alone has been ranked as the most effective in enhancing students' ability to remember and understand learning materials [6]. The visual receptor allows 75% of information retention as compared to the rest of receptors as shown in Table 1. However, the use of image, animation and video along with other medium should then be maximally exploited in order to enhance understanding. Therefore, effective learning process should take into consideration all the related features in order to improve the quality of teaching and learning.

Table 1: Effectiveness of multimedia components for memory storage [6]

Medium of Learning	Process	Percentage Gained
Graphic, video, images	Seeing	75
Audio	Hearing	13
Integration of texts	Touching	6
Digital environments	Feeling	3

Learning Theory stresses that there are 9 elements for an effective learning process [7]:

- Gain attention: Students will become involved in the learning process when interesting devices such as storytelling and demonstrations are able to grab their attention.
- Provide a learning objective: Students must be allowed to organize their thoughts on what they will learn and perform.
- Stimulate recall of prior knowledge: Students must be able to retrieve and reconstruct their knowledge.
- Present the material: Learning material should be sequentially presented and arranged into levels of difficulty.
- Provide guidance for learning: Guidance should be provided to the students on how to learn the skill or knowledge. The learning rate increases when students understand the concepts.

- f) Elicit performance: Students should be allowed to practice with their newly acquired knowledge.
- g) Provide feedback: Comments or feedbacks given should be specific to the task.
- h) Assess performance: Students performance should be evaluated and progress information provided to them to indicate how far the lesson has been learnt.
- i) Enhance retention and transfer: Students should be given similar problems or additional practice to let them review the lesson.

Inspired by Gagner's theory, many multimedia learning courseware have been developed and integrated into a course when current teaching methods do not effectively achieve the learning objectives [8]. It has been proven that engaging multimedia content has had positive educational impact for practice activities, learner-content interaction, and time on task for the learner. Until now, development works on multimedia learning courseware continue to grow tremendously with a large number of guidelines existed to assist developers [9]. However, a concise step-by-step model for developing multimedia courseware is not readily available to the academic community.

As an attempt to resolve this issue, a succinct multimedia development model based on literature and expert review is presented [8]. According to them, a multimedia development model should comprise the following steps: (1) define the instructional goals, objectives and audience, (2) review and investigate existing options, (3) determine format, budget and timeline, (4) determine the content, activities and assessment strategies, (5) develop evaluation strategies, criteria and instruments to determine the effectiveness of the project, (6) develop the flowchart, site map and/or storyboard, (7) develop a prototype, (8) perform a formative evaluation, (9) complete the design and (10) perform a summative evaluation of product and process. Of all the steps, the first one serves as the most important point every multimedia designer must consider. The step requires that the developers must have clear pedagogical goals and objectives prior to producing the multimedia instruction. The rationale for multimedia instruction is that people can learn more deeply from words and pictures than from words alone. Therefore, it is important that every multimedia learning courseware developer understands the principles of the learning courseware, the pedagogical aspects and other requirements [10].

The aim of this paper is to describe the preliminary study that has been carried out by the authors prior to developing the proposed courseware. It highlights the courseware instructional design process and the design requirements that will be considered in this work.

This paper is organized into the following sections. Section 2 describes the background study that initiates this research work, Section 3 explains on the methodology, Section 4 briefly describes the preliminary findings; Section 5 provides the discussion and Section 6 summarizes this paper.

Geography is one of the core subjects in the Integrated Curriculum for Secondary School and it is compulsory for the students to consecutively complete their learning from Form One until Form 3 on the subject. Since 2014, the Geography syllabus has been changed in its assessment aspect due to changes made to the academic curriculum i.e. from Lower Secondary Assessment (Penilaian Menengah Rendah-PMR) to Form 3 Assessment (Pentaksiran Tingkatan 3-PT3). The transition is seen as necessary as Malaysian educational system struggles to help students cultivate higher-order thinking skill (HOTS) [11]. Nevertheless, Malaysian Government continues its commitment to develop creativity, communication skills, analytical, critical thinking and problem-solving skills among students [12].

PT3 is one of the components under the School-based Assessment (SBA) where it is aimed at eliminating an exam-oriented assessment. Consequently, students taking Geography subject are assessed via assignments, practical tests, projects, field study and case studies. The marks will be given based on the band ranging from 1 until 6. The higher band indicates the higher depth of student understanding on the Geography subject.

In Malaysia, the conventional approach in teaching and learning is still being used in schools including in Geography subject in secondary schools [13], [14]. Currently, learning materials for Geography come from textbooks and references obtained from books and also from the Web. The weakness of a textbook is its static content. Using the textbook as a single source in teaching and learning Geography would result into a boring environment and students losing their focus [5]. Although the texts are accompanied with colourful pictures, however interactive animation can capture students' attention better.

In learning Geography, there are four important concepts [15]. First, Geography is not about memorizing the locations but instead why there are placements at those locations. Second, Geography is not mainly about maps; instead how students can explain the economic activities and the relationships with the nearby surroundings. Third, Geography is about doing a research on human beings and their relations to the environmental process that includes human, product and idea. Finally, Geography is integrative that brings together other disciplines that cover both local and global issues.

Most students at schools have difficulty in mastering geographic skills such as identification and interpretation of geographical information and map reading [16]. For students, they must demonstrate their skills in the following

aspects: (1) creating table, graphs, charts; (2) reading map and bearing; (3) calculating area; and (4) memorizing specific facts about locations and human. Inability to acquire the skills might lead the students into losing interest in this subject. Notably, students using web-based interactive animated maps outperformed those using the standard computer-delivered static maps [17]. Linking this to the Dual Coding Theory proposed by [18], the theory suggests that the formation of mental images improves in learning process [19]. Inspired by this theory, geographical maps act as retrieval guide since the map allows the students to associate the content and organize in the memory as an intact visual image [20], [21].

These issues could be solved by employing educational multimedia tools in teaching and learning Geography subject. Multimedia elements may assist students to better understand the aspects of map reading and geographical concepts. Content-based multimedia is seen to potentially transform the delivery of content in Geography subject [22]. It may also motivate students to enjoy learning and stimulate the eagerness to learn more. Studies have proven that students who were exposed to multimedia tools performed better in cognitive tests, learned faster and enjoyed the Geography lessons more [4].

On teachers' side, teachers are very keen to embed computer-based technology in their classroom practice [23]. In addition, the reconciliation of computer-based technology in educational setting is expected to produce competitive teachers in the classrooms [24]. Driven by eager teachers, learning process will have a positive impact on the students. As a result, not only teaching and learning Geography using interactive multimedia allows fast content delivery via tables, graphs and charts, but also it makes the learning more interesting [15]. Therefore, a courseware on learning Geography is proposed to assist Form 3 students to learn Geography in interactive and fun ways. As traditional face to face method is urged to be replaced with interactive learning environment, this is one such attempt to support the shift [25].

METHODOLOGY

In this work, the courseware design activities follow the ADDIE model. ADDIE model is a prior instructional design model for designers, teachers and developers in education, industry and business [26]. Instructional models focus on the design and development of learning content instead of on administrative or management issues such as budgets and staffing [8]. Thus, instructional models are more suitable for educational purposes since the models consider both the courseware planning in a systematic way and the evaluation on the impact of the courseware on the students [27].

Another important consideration is on producing an interactive courseware. Interactivity should contribute to overall job satisfaction [28]. For this reason, this work employs the Interaction Design Lifecycle model that concerns with designing interactive products to support people in their everyday and working lives [29]. Interaction design aims at meeting a usability goal and user experience. Thus, prior to developing a product, understanding on what is required of the product must be made clear first.

Since a substantial number of courseware were developed without giving any thought to design issues, in this work, the authors have given a detailed attention on the design aspect of the proposed courseware [30]. Existing and relevant guidelines are gathered and reviewed. For example, an interactive multimedia educational courseware should consist of components such as storyboard standard, instructional design standard, technical standard, interface design standard and references standard. A detailed characteristic for each standard is shown in II. Hence, in this proposed work, the guidelines will also be applied [1].

Table 2: Standard guidelines for interactive multimedia courseware [1]

Components	Characteristics
Storyboard	Layout Navigation Graphic / Animation / Video Text Audio script
Instructional design	Content / Concept / Evaluation Practice / Activity Test / Assessment / Evaluation
Interface design	Navigation Screen Display
Technical	Specifications requirement Environments requirement
References	Language Malay: Kamus Dewan Bahasa dan Pustaka English: Oxford English Dictionary Sign language Malay: Kod Tangan Bahasa Melayu English: American Sign Language

The following section describes ADDIE instructional model and Interaction Design model.

ADDIE Instructional Model

The ADDIE model is an organized procedure that lists generic processes of instructional design in five logical steps: (1) Analyze, (2) Design, (3) Development, (4) Implementation and (5) Evaluation. Each process is briefly described below [31].

- 1) Analysis (A): This step starts by collecting information on related areas. In this work, information gathering process takes place through interviews with the Geography teachers, documentation from the Ministry of Education and reviews on principles of educational courseware development and instructional design models.
- 2) Design (D): Design phase involves design activities including sketching interface design concept or storyboarding.
- 3) Development (D): This phase involves scripting and authoring activities using Adobe Flash.
- 4) Implementation (I): Implementation refers to the testing and installation of the completed courseware prototype at the targeted users' site.
- 5) Evaluation (E): In this phase, the proposed courseware prototype is tested based on usability and functionality aspects.

Interaction Design

Interaction design has four basic activities that are iterative as described below:

- 1) Requirements management: Identifying needs and establishing requirements
- 2) Design: developing alternative designs that meet those requirements
- 3) Prototyping: Building interactive versions of designs so they can be communicated and assessed
- 4) Evaluation: Evaluating what is being built throughout the process

In this work, interaction design principles are embedded into the ADDIE process at design phase as shown in Figure 1.

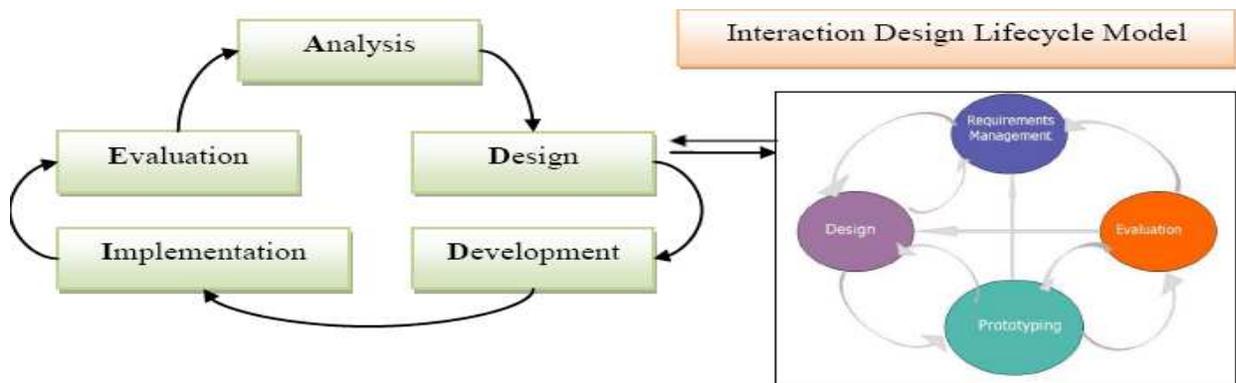


Figure 1: Interaction design activities in design phase of ADDIE

In the following section, detailed work performed during preliminary study is explained. A preliminary investigation was conducted to identify the justifications to develop this proposed courseware and to understand the issue in teaching and learning Geography subject in secondary school. The result of the investigation is delivered through the needs analysis and tasks analysis.

Needs Analysis

Three interviews were carried out with three teachers. In the first interview, the chairperson of Geography committee in Sekolah Menengah Kebangsaan Sungai Besar, Mrs. Sabariah Salminah revealed that most students do not perform well in their take-off value (TOV) test due to lacks in skills. This situation was confirmed by YM Engku Mohamad Putra Engku Jalil, who teaches Geography at Sekolah Menengah Kebangsaan Chendering. He added that students are not able to apply specific skills such as the ones that involve calculation and map reading.

Another teacher who is the chairman committee of Geography in the same school, Mrs. Hasnah Adis raised another concern. Since Geography is not a core subject, unlike Science and Mathematics, students tend to take it

lightly. Students hardly do exercises in the subject and pay less attention to it. As a result, Form 3 students scored lower in their TOV test as compared to much higher score obtained by Form 1 students in the subject. In addition, unattractive teaching method and solely relying on textbook when delivering learning content are also said to be other reasons for lower scores obtained by the students.

In addition, the assessment criterion has also changed from exam-oriented to assignment oriented. Various assessment instruments exist in the form of written assignments, case studies and field work. Therefore, the learning content should be carefully designed to meet the requirements of the subject.

Tasks Analysis

Error! Reference source not found.3 lists all the topics covered in Geography syllabus for secondary school and those are the knowledge and skills the students are expected to develop.

Table 3: Topics covered in geography syllabus for secondary school [32]

No	Topics
Part A: Geography Skills	
1	Position
2	Direction
3	Scale
4	Graph, Chart and Diagram
5	Map
Part B: Physical Geography and Human	
1	Resources
2	Economic Activities
Part C: Local Geography Study	

It is expected that upon completion of the Geography learning content, students should acquire the following skills as shown in **Error! Reference source not found.**4 [32].

Table 4: Learning objectives of geography subject

No.	Learning Objective
1.	To determine positional elements guided by row, column, direction, scale line and the distance from home to school.
2.	To acquire skills in reading, drawing and interpreting geographic features based on tables, simple bar graphs, line graphs, plans and sketch maps.
3.	To observe, measure, calculate, record, classify, interpret and make conclusions about geographic features through the Local Geography Study (Kajian Geografi Tempatan).
4.	To express and explain the characteristics of the special geographical contained in its landscape, weather and climate in the local area and the country.
5.	To state the interconnections between human and physical environment.
6.	To explain the impact of human activities on the physical environment and the importance of respecting and managing natural resources in a responsible and prudent way.
7.	To recognize and respect the various cultures and ways of living in the world.
8.	To describe the natural beauty and wealth of resources available in the country and the world.
9.	To be thankful for all the God's gift.
10.	To have the spirit of patriotism towards Malaysia.

Thus, based on the learning objectives mentioned above, learning content on Geography subject for Form 1 should try to embed the skills for the students to acquire. Particularly in Local Geography Study, students are expected to carry out case-study activities that act as independent research work. Through case studies, studies have shown that students were motivated to collaborate in groups, work cohesively together in sharing and exchanging ideas and information to foster their learning experience in Geography lessons [33].

Design Requirement

As a first step in the design phase, a navigation map was produced to provide a viewable scope on the topics covered as shown in **Error! Reference source not found.**5. The navigation map basically lists the design structure of the learning content in the courseware.

Table 5: The list of navigation map

Screen Number	Screen Description
1.0	Home
2.0	Notes
2.1	Geography Skills
2.1.1	Position
2.1.2	Direction
2.1.3	Scale
2.1.4	Graph, Chart and Diagram
2.1.5	Map
2.2	Part B: Physical Geography and Human Resources
2.2.1	Resources
2.2.2	Economic Activities
3.0	Mind Map
3.1	Part A: Geography Skills
3.1.1	Position
3.1.2	Direction
3.1.3	Scale
3.1.4	Graph, Chart and Diagram
3.1.5	Map
3.2	Part BL Physical Geography and Human Resources
3.2.1	Resources
3.2.2	Economic Activities
4.0	Video
4.1	Video 1
4.2	Video 2
4.3	Video 3
4.4	Video 4
5.0	Activities
5.1	Quiz 1
5.2	Quiz 2
5.3	Quiz 3
5.4	Quiz 4
5.5	Quiz 5

A storyboard for the courseware was also produced. Since this work employs Interaction Design model, several storyboard designs were first produced and shown to the selected targeted users. Only the storyboard design accepted by the targeted users would be considered. Figure2 shows the selected storyboard of the main menu in the proposed courseware. The list of menus is located at the right. Upon clicking on a specific topic from the menu, the subtopics for that topic will appear as shown below.



Figure2: Storyboard of the main menu

RESULTS AND DISCUSSION

From the needs and tasks analysis above, it was clear that the teaching and learning of Geography lessons require an in-depth study. In addition, since the orientation of the assessment for Geography subject has changed from exam-based to assignment-based, the implementation of the assessment practice should also change. Formative assessment instead of summative should be implemented to measure students' level of understanding [34].

As critical thinking and problem solving, creativity and innovation, communication and collaboration are the essential 21st century skills that should be diffused into educational system, it is timely that schools maximize the impact of the role of technology integration in the classroom [35]. These skills need to be constantly reviewed and refined in the context of teaching and learning process to prepare the younger generation to meet the challenges of the 21st century [36].

Looking at the learning objectives in Geography subject in secondary school set by the Ministry of Education, a lot of efforts are required from the teachers in order to prepare students to develop those skills. The construction of patriotism for example, requires a strategic and systematic planning that should be preached to students through the teaching and learning in schools [37]. In Geography subject, the elements of patriotism can be applied directly in the subject of Local Studies through the implementation of fieldwork. The fieldwork was introduced into the curriculum in order to expose students to their surrounding and instil understanding on the community and environment of Malaysia [38]. Hence, integrating fieldwork as an element into a courseware requires careful planning.

Teaching and learning Geography subject is quite similar to History. The lesson should be managed through various activities which involve analysing, exploring information, making interpretation, imagination and

rationalization [39]. Thus, the design of geography lessons in this proposed courseware should be well designed in order to fulfil the learning objectives.

CONCLUSION

This paper has described the preliminary work carried out by the authors prior to embarking into the development activities of the proposed courseware. The preliminary work has covered the needs analysis, tasks analysis and initial design requirement were produced to aid during the development phase. ADDIE instructional model has been chosen as the courseware development methodology employed in this work, with enhancement on the design phase using Interaction Design Lifecycle model. This paper has also discussed some of the issues that need to be considered. Future work will focus on detail design activities on each topic of the proposed courseware.

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