

Development of Physics 1 online module using Massive Open Online Course (MOOC)

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Abstract

Aim: This research aimed to better understand first-year Physics instructors and their students' challenges at University Tun Hussein Onn Malaysia (UTHM).

Method: The ADDIE Model was a guiding principle for the duration of this project's development and completion. The problem has been identified, which will aid in creating a MOOC online module to address it. A quiz is included at the end of each chapter of the online module to ensure that students have fully grasped the material covered there. Additionally, a second questionnaire was given out to 60 diploma students to gauge their opinion of the developed online module.

Findings: The positive responses to the second survey indicate that the online module has improved students' grasp of the fundamentals of Physics 1. This Physics 1 online module should be adapted into a novel application, like a compact disc, so students can use it without an internet connection.

Implications/Novel Contribution: Because of this online module, professors can spend less time on theoretical explanations and more time on interactive exercises, allowing their students to gain a deeper grasp of the material covered in class.

Keywords: Physics 1, MOOC, Students, Teaching and Learning, Online Module

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INTRODUCTION

Due to a decline in scientific studies and a lack of interest in physics courses at schools and universities, the challenges involved in studying and teaching physics 1 have become a global problem in today's physics education [Marušić and Sliško \(2012\)](#). Table 1 shows the results and discussion of this study's primary research problem: the decline in students' average performance on the UTHM physics 1 final exam. As evidenced by a study by [Tobias and Birrer \(1999\)](#), students' dissatisfaction with their academic performance has led to a decline in physics majors across the country. There are several reasons why fewer high school students sign up for physics classes, and researchers in the field have identified them [Angell, Guttersrud, Henriksen, and Isnes \(2004\)](#), [Carlone \(2004\)](#), [Häussler and Hoffmann \(2000\)](#), [Nashon \(2003\)](#), [Sheppard and Robbins \(2002\)](#). A special worry about the poor quality of learning is evident in many physics courses, which is related to this issue. As a result, the development of innovative strategies for delivering physics education, such as massive open online courses (MOOC), is on the rise. There has been a lot written about massive open online courses (MOOC) in scholarly journals and books for teachers and administrators ([Ashaari, 2017](#); [Hashim, Salam, & Mahfuzah Mohamad, 2017](#); [Haris, 2017](#); [Pence, 2012](#); [Waard, 2011](#)). To help students at UTHM do better in Physics 1, this project aims to create a massive open online course (MOOC) to teach and learn the material and identify and address the specific challenges students face while attempting to master it.

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LITERATURE REVIEW

MOOCs have received significant coverage in the higher education literature. MOOC is based on the world wide web and can reach students who have reliable access all over the world. The accessibility of the MOOCs via the internet is enhanced by the fact that most MOOCs are free to experience. People just need internet, e-mail and few minutes to sign up and browse the courses for something that they interested. According to Pappano (2012) MOOC have many platforms but most well-known are Udacity, edX and Coursera. MOOC is become students choice because they can gain many benefits from that tools. First and foremost, it is low cost for students to engage since no money is charged for them to sign up and participate. The most important part of MOOC is the lecture videos can be watched again and rewind. MOOC needs no code to access, so non-standard students can participate for a multitude of reasons.

Many studies have been carried out on the problem in study Physics. Based on the result of Bungadara (2016) initial study on students Physics Education, State University of Makassar, academic year 2012/2013 showed that the students ability to solve Physics problem is still low. In details, the result about concept understanding of Physics obtained that the students ability to translate and interpret an abstract concept to their own language or to table format, graph and mathematics symbol with numerals ability is very low. There seems to be general agreement on the mathematical skills among students Bungadara (2016), Marušić and Sliško (2012) is one of the problem that they faced in study Physics. Other than that, researched by Bungadara (2016) the problems in learning physics that occur among students are their attitudes towards and perceptions of Physic and content of traditional Physics curricular.

According to Farid, Luqman, Tariq, and Ahmad Warraich (2014) to manage the students learning environment, teachers must have to focus on the learning behavior of students instead to pay attention on their pre-occupied teaching styles. It means that teachers should modify their method beyond the chalk, walk and talk method to recognized learning behavior of students. Another suggestible method for teacher is to move away from their authoritative behavior because most of the students, regardless of gender differences, prefer independent learning which denotes that they do not only rely on the provided material and lectures while they prefer to learn on their own. Otherwise, teacher ought to use authoritative behavior for avoidant learning that do not prefer to be and participation in class room. Such student would even influence other or at least could be an irritated for those students who have participative and collaborative learning behavior. From the review of literature above, MOOC was an asset to explore and be used by students who study the subject Physics 1 to overcome the decreasing grades among them. MOOC could be an effective method to help the students solve questions with high thinking order. We have recognized the weakness of using MOOC in learning from previous research. So, from that we have improved our project. The cooperation from Physics 1 lecturer was important to ensure the effectiveness of using MOOC and motivate the students. This helped the students to adapt with the online module in MOOC slowly and reliably.

METHODOLOGY

ADDIE Model was used as a parameter throughout the completion of this study. Methodology was done according to the five phases in this parameter which consists of Analysis, Design, Development, Implementation and Evaluation. In analysis phase, three main objectives were determined. The objectives are identifying the problem that students face in the process of learning and teaching subject Physics 1, developing an online module in the MOOC platform for the subject Physics 1 and evaluate perception of students after using the online module in MOOC. It was determined that this online module in MOOC is focused on students who are taking Physics 1, academic year 2015/2016 and 2016/2017 Centre of Diploma Studies University Tun Hussein Onn Malaysia which comprise 4 courses. The courses involved are Diploma in Applied Science, Mechanical Engineering, Electrical Engineering and Civil Engineering.

RESULTS AND DISCUSSION

The design phase comprise of some basic steps before creating the content of the module. The steps are basic setup checklist, outcomes which includes course objectives and learning outcomes, storyboard, content layouts and appearance. In the development phase, there are a total of 7 chapter videos uploaded in this open learning platform.

A various range of colors was used with a bright background which can help outstand the fonts and animations. The animated video duration for each chapter in this online module is approximately 5 minutes long. These videos for are accompanied by an audio so it would not be entirely unexciting and all these developments are included to help the audience capture the message. The second questionnaire is prepared for 60 students who have already used the online module which is where their perception towards this module can be evaluated. This questionnaire has 2 section where Section A is their personal details and Section B is their evaluation on this module based on 5 categories which are, User-friendly element, Interactive element, Design element, Usage element, Convenient element. A Likert-type scale was used again in this survey form to score each aspect.

Evaluation of Teaching and Learning Environments Factors that Affect the Performance in Physics 1

The likert scale (see Table 1) which consist from strongly disagree which is scale 1 until strongly disagree which is scale 5. There are 4 factors for evaluation which consist of Interest and self-motivation category (see Table 1), Learning style (see Table 2), Lecturers (see Table 3), Studying environment (see Table 4).

Table 1: Likert scale for the items in questionnaire

1	2	3	4	5
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

Table 2: Interest and self-motivation category

No.	Item	Mean value
1.	Student enjoy to learn Physics 1	3.48
2.	Students always want to attend Physics 1 classes.	3.49
3.	Students have a desire to increase your grades in Physics 1.	3.69
4.	Student will still complete their work when they are absent from Physics 1 classes.	3.45
5	Students believe the knowledge gained studying Physic 1 can be applied on a daily basis.	3.27
6.	Students are confident enough teach the subject Physics 1 to your friend	3.24

Table 3: Learning style category

No.	Item	Mean value
1.	Student prefer studying alone	3.30
2.	Student are not shy to ask questions in class	3.46
3.	Student do their revision for less than 4 hours in a week	3.11
4.	Student always finish their works given in Physics 1 class to understand this subject better.	3.47
5.	Students complete their assignments with full effort and hard work.	3.44
6.	Student use memorizing method for the examination as you think this is the best strategy for examination.	3.39
7.	Student always ask their lecturer to give an explanation if they do not understand.	3.54
8.	They do a lot of additional exercises of Physics 1 which can be found in the module or past year papers	3.41

Table 4: Lecturer category

No.	Item	Mean Value
1.	Students believe that lecturer plays a bigger role towards their interest in Physics 1.	3.80
2.	Their lecturer always succeeds In delivering the contents of a topic very well.	3.59
3.	Their lecturer uses interactive multimedia items during a lesson.	3.37
4.	Their lecturer uses a language which is easy to understand during lesson	3.48
5.	The illustrations, examples and explanations given by your lecturer are interesting.	3.46
6.	Their lecturer uses different method to teach for respective topics.	3.53
7.	Their lecturer always delivers the content related to the Physics 1 syllabus and examinations	3.61
8.	Their lecturer always helps out students who do not understand in the Q&A session.	3.55

Table 5: Studying environment category

No.	Item	Mean Value
1.	A clean class provides comfort during Physics 1 lesson.	3.79
2.	The facilities like whiteboard is fully used during/for lesson and are complete in each class.	3.75
3.	The projector fully used during/for lesson and are complete in each class.	3.73
4.	The air conditioner is fully used during/for lesson and are complete in each class.	3.79
5.	The physics 1 class is conducted in a spacious and comfortable environment.	3.56
6.	An uninterrupted internet connection can be obtained to complete an online activity.	3.29

Based on Table 1, 4 above, the highest mean value is for the lecturer category and the lowest mean value is 3.11 which is learning style category. Since majority of students spend less than 4 hours to study this subject, it can be concluded that their learning style is not effective and the lecture plays a big role to instill students interest in Physics 1.

Evaluation of Percentage of Views Online Module for Each Chapter in Physics 1

Table 6: Percentage of views and students completed, frequency of views and comments for each chapter in Physics 1

Content of subtopic	Total percentage of students view (%)	Total percentage of students completed (%)	Frequency of views	Comments
Measurements and Units	100	100	73	4
Vector	100	100	67	2
Kinematics	100	100	63	3
Dynamic of particles	100	56.67	75	37
Rotational and Circular motion	100	100	61	3
Work, Energy and Power	100	100	67	2
Simple Harmonic Motion	65	100	50	4

The Table 2 above shows that the lowest percentage of view for Simple Harmonic Motion chapter where there could be a possibility that their internet connection was interrupted. As for the percentage of completion according to each chapter, Dynamic of particles (Chapter 4) could not be completed by many students due to the technical errors in the online module itself.

Comments For Online Module In Open Learning

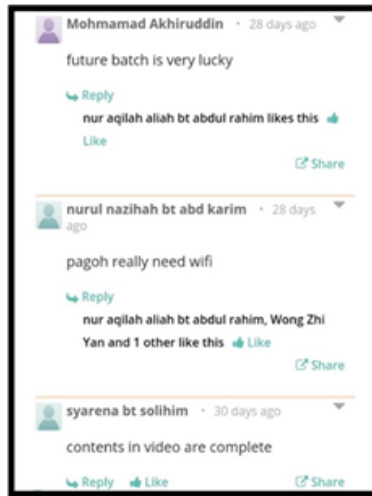


Figure 1. Comments for Chapter 1 in Physics 1 online module



Figure 2. Comments for Chapter 2 in Physics 1 online module

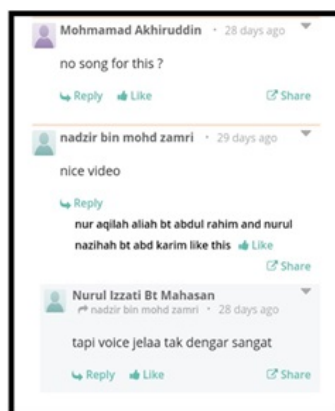


Figure 3. Comments for Chapter 3 in Physics 1 online module

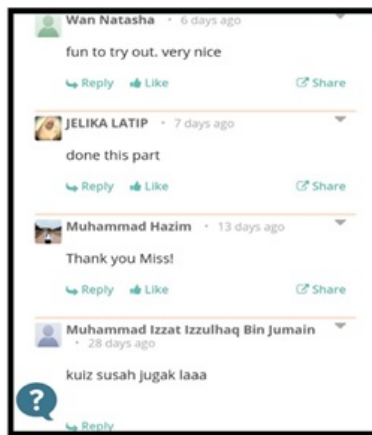


Figure 4. Comments for Chapter 4 in Physics 1 online module

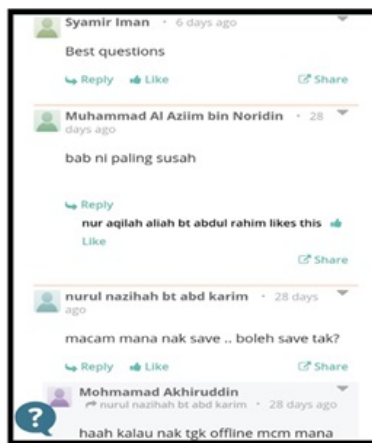


Figure 5. Comments for Chapter 5 in Physics 1 online module

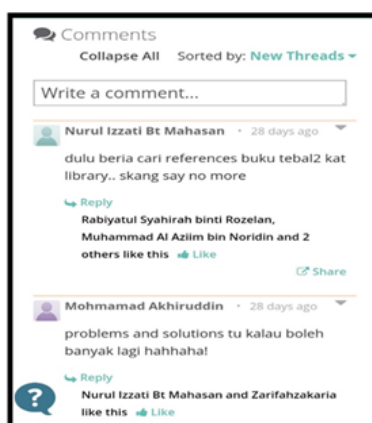


Figure 6. Comments for Chapter 6 in Physics 1 online module



Figure 7. Comments for Chapter 7 in Physics 1 online module

Figure 1 until Figure 7 above are the comments for Chapter 1 until Chapter 7 respectively for the online module created in Open Learning. Majority of the students have given positive feedbacks on this module in terms of a good video content, a complete module according to syllabus and a suitable corresponding quiz questions. As for the negative feedbacks from students are mostly on technical terms where a proper network connection is not available in the UTHM Pagoh campus for students to access this module effectively. Other technical terms are the background voice was not very clear and the music was not played in the video for Chapter 3 in this Physics 1 online module.

Evaluation Regarding the Use of Physics 1 Online Module in MOOC

Table 7: Data collected from user-friendly element

No.	Item	Mean value
1.	The content of short notes and video is easy to understand	4.20
2.	Easier to access module with navigation menu	4.21
3.	The options in the navigation menu is clear	4.26
4.	The option button is functional	4.38
5.	This application is easy to be controlled and accessed	4.33

Table 8: Data collected from interactive element

No.	Item	Mean value
1.	Application element is very interactive in terms of video and notes.	4.39
2.	The online module created is interesting for you.	4.18
3.	The number of the multimedia are adequate in every topic.	4.34
4.	Anyone can interact with each other in this module’s page such as they can share information and their point of view.	4.44
5.	Student can get immediate result of your quiz or tutorial.	4.25

Table 9: Data collected from design element

No.	Item	Mean value
1.	The font size is easier to be read	4.46
2.	The quality of pictures are clear	4.15
3.	The quality of audio is clear and can be heard	4.31
4.	Every video can be access and watch conveniently	4.02
5.	The video’s animation are attractive	4.30

Table 10: Data collected from usage element

No.	Item	Mean value
1.	Information provided is easy to understand during revision	4.31
2.	The content information is accurate and based on syllabus	4.23
3.	This module is the best choice to refer for your revision	4.15
4.	Those questions and problem solving that prepared in every chapter are very useful to understand better	4.43
5.	The contents of module helps you to improve memory	4.30

Table 11: Data collected from convenient element

No.	Item	Mean value
1.	Information is easy to understand	4.41
2.	This application is easy to use	4.15
3.	This module can be used to refer a topic studied during lecture	4.26
4.	The notes and exercises in this module is relevant to what is learned and taught	4.34
5.	This module is suitable to be as an exercise because tutorial questions prepared are based on the questions which is usually comes out during examinations	4.18

Based on Table 8, 9, 10, 11 above, the highest mean value is for the design element where the mean value is 4.46 for the first item. It can be concluded that students agreed that the size of font in the module easier to read. The lowest mean value among these 5 elements is 3.02 which is for item number 4 in design element as well. This concludes that most of the students had problem while using and viewing the video uploaded in the online module. It could possibly be because of the unstable and limited internet connection in University Tun Hussein Onn Malaysia, Pagoh campus.

CONCLUSION, RECOMMENDATIONS AND IMPLICATIONS

The first objective of this research was achieved as the problem that students face in Physics I course was identified when a questionnaire about their perception towards Physics 1 subject was distributed. The questionnaire comprises of 4 categories which are learning styles, interest, lecturer and study environment. The data gained from this survey was analysed using SPSS version 21 and the result indicated that item 3 in learning styles category got the highest scale number which is number 2 and the mean value for this item is 3.11. Students have disagreed with the statement which denotes that students study four hours per week for this subject. This concludes that students do not study enough for this subject. The second objective of creating an online module was achieved where a Physics 1 online module in MOOC was created to gain the interest of students towards learning this subject as well as to help them to learn and understand better. A second questionnaire was distributed to the students who have used the online module developed in MOOC and the third objective of gaining students perception towards the online module was also achieved. This questionnaire was also analysed using SPSS version 21 and as a result of this second survey, all the five elements have succeeded in gaining higher percentage of positive feedback. This proved that students have exclusively agreed that this online module have helped them in understanding a topic better. This is because students can watch the animated video anywhere and anytime repeatedly at no cost and they can download the examples of problems and solutions that was prepared in every chapter as well. The contents and information in this online module is relevant to Physics 1 syllabus in University Tun Hussein Onn Malaysia. As a conclusion, this online module can help lecturers in the teaching aspect, where theoretical based teaching can be minimized and interactive based learnings and exercises can be focused more in class.

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