Available Online at http://www.journalajst.com

ASIAN JOURNAL OF SCIENCE AND TECHNOLOGY

ISSN: 0976-3376

Asian Journal of Science and Technology
Vol. 09, Issue, 02, pp.7447-7451, February, 2018

RESEARCH ARTICLE

DEVELOPING CASE-BASED (CREATIVE, ACTIVE, SYSTEMATIC, EFFECTIVE) INTERACTIVE E-MODULE AS THE ALTERNATIVE TO TRANSFORMATION GEOMETRY LEARNING MEDIA TO SUPPORT STUDENT'S LEARNING AUTONOMY AND COMPETENCE

***Zainal Abidin and Sikky El Walida**

Mathematics Education Departement, Faculty of Teacher Training and Education Sciences, University of Islam Malang, Indonesia

ARTICLE INFO

Article History:
Received 27th November, 2017
Received in revised form
08th December, 2017
Accepted 20th January, 2018
Published online 28th February, 2018

Key words:
Developing,
Interactive e-module,
Transformation geometry.

ABSTRACT

This study aims to produce an interactive e-module based on some criteria e.g. creative, active, systematic, and effective (CASE) as an alternative to transformation geometry learning media to support student's learning autonomy and competence. This is development research with four-D development model, namely defining, designing, developing, and disseminating. The results of the defining stage (needs analysis during preliminary study) show that most students are more interested in transformation geometry lectures that utilize instructional material in the form of interactive electronic modules (e-modules) that enable the students to study independently and easily understand. The results of the designing stage are to design the initial draft of an interactive e-module of transformation geometry with the following systematic: introduction (preface, e-module usage, material description, prerequisites, learning objectives), learning activities which include material descriptions and sample questions, exercise questions, competency tests, training answer instructions, feedback, and referral lists. On the developing stage produces the draft of the e-module about transformation geometry. The draft of the e-module has been designed and developed systematically by adhering to the principles of instructional material development in learning. The test result to the draft of e-module (limited trials) gains overall average score of 3.30, which means that the students assess the product of the interactive e-module transformation geometry is good.

INTRODUCTION

Mathematics taught at the university level, particularly in the Mathematics Education study program, is divided into some fields of study, namely algebra, mathematical analysis, geometry, and calculus. In geometry study itself, there are some fields being discussed such as Euclidean geometry, analytical geometry and transformation geometry. For transformation geometry that combines algebraic material, Euclidean geometry and analytical geometry, it is one of the most important field studies of high-level mathematics learning due to its wide application in many fields including science. In addition, the course of transformation geometry is one of the important components of mathematics learning which must be mastered by students of Mathematics Education study program as teacher candidates who will integrate this study as the basis for the teaching of mathematics at high school. The transformation geometry study is likely different from other fields of mathematics because by nature it develops concepts, theorems, and algorithms intuitively. The transformation geometry cannot be separated from the deductive reduction of concepts, theorems and algorithms.

****Corresponding author:*** **Zainal Abidin,**
Mathematics Education Departement, Faculty of Teacher Training and Education Sciences, University of Islam Malang, Indonesia

Teaching through deductive reduction of transformation geometry concepts may lead into difficult and tedious learning. Therefore, for students to understand this course easily independently, it is necessary to develop teaching materials that are easy to learn by the students independently, namely in the form of modules. With the module, the material will be described in detail and clearly starting from the description of the materials, question samples, summary of exercise questions, instructions to the answers of each exercise, and competence test. So that students are able to understand the materials of transformation geometry systematically easily. To overcome the minimum use of learning materials in the learning process, it is necessary to develop a model of teaching materials that concern with different student's skills and characteristics, support individual and autonomous learning behavior, thus at the end will facilitate the student's learning progress. According to Dick and Carey (1990), learning materials should be able to be utilized and learned entirely by the learners themselves. The material should be able to provide an opportunity for the learners to learn it without relying too much on the teacher's or lecturer's explanation and instructions. A module should become as a medium or a learning tool that contains materials, methods, limitations or scope of learning materials, instructional activities, exercises and evaluation methods designed systematically and appealing

to the users in order to achieve the expected competencies and can be used independently (Hamdani, 2011). The main objective of teaching materials in the form of modules is that the readersare able to absorb the materials independently (Daryanto, 2013). According to Prastowo (2011), the module is a systematic instruction with easy-to-understand language so that learners are able to learn independently with minimal guidance from the instructor. To reduce student's learning monotony with particular module, it needs to be combined with electronic media, which is well-known as electronic module (e-module). Deep learning may take place as it is integrated with the e-module, and it is expected to produce better outcomes. The development of instructional materials in any forms, including electronic one, is intended to assist and facilitate learners learn more effectively. Therefore, the process of developing materials should be based on various theories such as how to people learn, how people teach, and theories on learning activities. In other words, understanding how people learn, teach, and learning activities is a condition as the basis for learning development activity. Good teaching materials should provide tools that may enable users to see the significance and use them in practical way. For digital teaching materials in electronic form, it provides opportunities for innovation, albeit only to the small parts of the teaching materials (Prastowo, 2011).

According to Darmawan (2012), the development of science, technology and information has brought new changes and paradigms in learning materials and learning methods. Products from technology and information have provided alternative teaching materials that can be used and accessed by the learners in digital form as well such as e-modules. Computer-based ineteractive learning may enable learners to learn with high motivation because of their interest in multimedia systems. Wena (2010) reinforces the condition that learning activities that utilize teaching materials with computer media will make the process of learning activities become more interesting and challenging for the learners. According to Prastowo (2011), interactive teaching materials are creative, innovative and adaptive teaching materials for technological development and can make learners happy and comfortable so that learning activities become effective and efficient. According to Hamid (2012) that learning requires fun and empowering interactions which can be upheld by combining the principles of education and entertainment (edutainment), so that students feel entertained and experience less boredom in the learning process. The form of entertainment can be any object, equipment or form of activities that make the students feel happy to participate in learning activities.

Munir (2013) added that learning using information and communication technology may help educators in delivering the teaching materials and, on the other hand, the learners in understanding the learning materials. Through multimedia teaching materials including interactive e-module, the material can be modified to be more interesting. An interactive e-module teaching material is one material of which the publishing process is in digital form consisting of texts, images or combination of both. E-module, or electronic module, is a teaching material that is presented systematically so that its use can be learned (by the students or users) with or without facilitator or teacher (Prastowo, 2011). One of the criteria of interactive e-module is the self-instructional, meaning it may trigger the learners learn independently by utilizing the module (Asyhar, 2012). The development of the interactive e-modules by considering some characteristics, e.g. creative, active, systematic, and effective (CASE) is expected that the teaching material can lead the learners creatively, actively, systematically and effectively participate in learning in order to gain maximum knowledge and understanding through the material. Learning autonomy is given to the learners with the aims that the learners have responsibility to organize and self-discipline, and they can develop the ability to learn on their own preference. Such attitudes need to be possessed by learners as it is the characteristic of the maturity of the educated person (Rusman, 2012). In the context of autonomous learning, learners should thrive to understand the content of the materials outside of the class, searching for their own sources of information, and solving their own difficulties. In learning, learners should take more initiative to conduct their own learning activities. However, self-study does not always mean the student learns alone; they can learn and discuss with peers and friends, or other learning resources in solving the difficulties or problems in the subjects. The purpose of this research is to develop the CASE-based interactive e-module for geometry transformation learning media that can support the learning autonomy and of Mathematics Education students.

MATERIALS AND METHODS

This research is a research development which is intended to develop and test specific products (Sugiyono, 2013; Borg and Gall, 1989; Plomp, 1997). The significance of this research development is to bridge the gap between researchers who produce educational theory and practitioners as users of educational products. In this study, the development model used is the Four-D model proposed by Thiagarajan et al (1974) which covers defining (preliminary analysis, learner analysis, task analysis, concept analysis, and indicator formulation), designing (media selection, format selection, and initial design creation), developing, and disseminating stages. The subjects of the study were the students of Mathematics Education Department of Islamic University of Malang, University of Kanjuruhan Malang, Institute of Teacher Training (IKIP) Budi Utomo and University of Wisnuwardhana Malang, as many as 338 people and four lecturers with the expertise on transformation geometry from the four institutions.

Data collection was conducted through some mechanisms namely: (1) questionnaire distribution, (2) literature review, and (3) documentation. Questionnaires were distributed to collect identification data of students' needs and identification of lecturers' needs related to interactive e-module for transformationgeometry. The literature review was accommodated to explore theories related to media, modules, interactive e-modules, and information and communication technologies. Documentation was conducted to track and identify the curriculum related to the geometry transformation. Data analysis techniques used were quantitative and qualitative analysis techniques. Quantitative analysis is with percentage descriptive statistics (Sugiyono, 2013), while the qualitative analysis in this model is by using the interactive analysis model of three components of analyses that are data reduction, data presentation, and conclusion and verification, of which activities are done in an interactive form with data collection process as a process (Miles and Huberman, 1986).

FINDINGS AND DISCUSSION

In this development research, the development of interactive e-module for transformation geometry was accommodated in accordance with four-D model consisting of defining, designing, developing, and disseminating. The results of this study were described in accordance with the four-D steps. In the defining stage (preliminary study), it includes preliminary analysis, learners' analysis, task analysis, concept analysis, and indicator formulation. The final preliminary analysis was conducted for literature study, preparing the questionnaires and distributing the questionnaires to examine the needs of the students in studying the geometry transformation. Another questionnaire was distributed to gain information about the needs of the lecturers in the implementation of learning process. Students' analysis was conducted to describe the characteristics as well as the motivation of the students in studying the transformation geometry subject. Task analysis was conducted to describe all the tasks required to study transformation geometry so that the students are able to find formulas, concepts, and principles on each material. For the concept analysis stage, it was conducted to describe all the concepts related to the transformation geometry course. The formulation of the indicator was done to describe all indicators which students have achieved after the students learn the e-module and then continued the formulation of the learning objectives that every student should achieve after learning process by utilizing the e-module.

The study involved 338 students and four lecturers from four universities in Malang, East Java, Indonesia. From the result of questionnaire involving 338 students and four lecturers was conducted on preliminary study which was conducted to collect the primary identification data of student requirement and identification of students' characteristic and data of lecturer requirement identification related to the course of transformation geometry. The data collected from these activities was further used as a basis for product design and development. Needs analysis is intended to find the gap between what is expected with the actual conditions (Sanjaya, 2008). The initial identification of needs is used as a tool to identify problems to determine the right course of action. In this study, the identification of needs was conducted to obtain information related to the students about the lecture of the transformation geometryso far, is there any problem, what is the cause, whether the way lecturers used so far is favored, and whether the way out of providing materials in the form of interactive e-module is something needed. Based on the result of questionnaire analyses on the students' needs and characters shows that 60.36% of students are happy with the course of transformation geometry. Approximately 71.30% of students want to study the transformation geometryin earnest and strive to improve learning outcomes. To improve the competence, 71.89% of students want the lecture modelsor approaches employed by the lecturers should be varied so that the students do not feel bored to particpate the learning process. If in the lecture of transformation geometry developed instructional materials in the form of interactive e-module which utilize computer and information technology most (54.58%) Students are very supportive, some again (41.75%) support, and only small part (3.85%) less supportive. As it was confirmed to those who are less supportive to the lesson, they asserted that they have less mastery of information technology, so they are worried about not being able to utilize well.

Based on the result gained through questionnaire for lecturers' needs, it shows that most lecturers (75.00%) in the area of transformation geometry often dominate the teaching process by considering the students as learning objects, but most lecturers (75.00%) express their support to the development of interactive e-material for transformation geometry composed in the form module. According to the data, it is reasonable to develop an interactive e-module for the transformation geometry. Although it seems there are some students who lack the computer technology, but this can be overcome by the development of e-modules that does not too complicated procedures. Corroborating the results, in general students argue that it is necessary to develop the interactive media as the learning materials to support easier learning independence and process. The most interesting media for students is media that utilize computer or information and communication technology. This is supported by the opinion stated by Rusman (2012) that the computer may stimulate learners to be active in learning and liked the learners who can be used positively as a learning tool. But in the implementation,the students will still require the presence of lecturers, so that the division of lecturers and material roles becomes clear (Wena, 2010). Regarding the condiction to the preliminary study, the development of interactive e-module products is suitable for students. The result of identification of student's characteristics shows that the student's attitudes, interests, and motivation are generally good to the materials of transformation geometry. The characteristics will greatly support the success of teh development of interactive e-module products in the field of transformation geometry by facilitating and assisting the researchers in preparing and implementing product development.

In designing stage (product development), it includes media selection, format selection, and initial design. The selection of media was conducted to describe the proper media used to design the development of the teaching materials of transformation geometry, and the selected media is expected to enable students to understand this resource. Based on the purpose of this study, the media used to develop this teaching material is an interactive electronic module (e-module). The selection of the format was carried out to describe the form of the format used in developing the subject matter of the transformation geometry. Based on the purpose of this study, the format used to develop teaching materials is CASE-based teaching material that focuses on creativity, activeness, systematic, and effectiveness. In detail, creative means a series of instructional contents that lead the readers or learners to be able to create their own ideas to solve problems in the module. Active means the content of learning materials require the learners to actively develop ideas in solving the problems. Systematic means that every step in the materials is presented analytically and logically so as to form a systematic teaching materials. Effective means the description of teaching materials is presented in an effective form of writing so that learners can easily understand and solve the problems. The initial design of the development of the teaching materials, the preparation was accommodated including the introduction (preface, e-module manual, material description, prerequisites, and learning objectives), learning activities that include material description and sample questions, (interactively) questions, summaries, competence tests (interactively), practice and test tips, feedback, and referral lists.

The result of the initial design was used as an alternative to student learning media in the course of transformation geometry, i.e. in the form of CASE-based interactive e-module of transformation geometry. The results of the analysis of learning materials produce learning topics, namely: (1) Introduction (vector, matrix, function, analytical geometry); (2) Transformation ideas; (3) Slide (translations); (4) Half rotation; (5) Reflection; and (6) Rotation. Developing stage (product development) was carried out by developing the product by considering the results of the designing stage. This is in accordance with the opinion by Seels and Richey (1994) who stated that the development is a process of translating or describing the design specifications into physical form, or with other expressions, development means the process of producing lesson materials. At this stage, product development was carried out by drafting the CASE-based interactive e-module for transformation geometry. The e-module was compiled in a complete, clear, and interesting way, to make it easier for the students to learn independently without depending on others. The e-module was created by using the Kvisoft Flip Book Maker and Quiz Maker programs, which create the views of the e-module such as printed module appearances. Packaging the e-module is in the form of compact disc (CD) along with the manuals. The e-modules can be operated offline using a computer that has Adobe Flash Player software installed. This e-module has characteristics as a learning module with components, including introduction (preface, e-module usage, description of material, prerequisites, learning objectives), learning activities including material description and sample questions, exercise questions (interactively), summaries, competency tests (interactively), practice and test tips, feedback, and references. The final result of this phase is the compilation of prototype the CASE-based interactive e-module for transformation geometry.

The presentation and packaging of the e-modules was in the form of CD compiled with the manuals. The e-modules can be operated offline by using personal computer (PC). The results of developing the e-module for transformation geometry include external and internal covers; preliminary view includes the introduction, e-module manual, and components of each module containing introduction, learning activities including material description and questions samples (interactively), summary, competency test (interactively), feedback, and references. From product development, limited trial was carried out to a small group of students. The trial was conducted involving small group of 30 students, and it was obtained an overall average value of 3.30, which means that the feedback from the participants is good. This e-module for transformation geometry discusses six units of learning modules, namely (1) Introduction (vector, matrix, function, and analytical geometry), (2) Transformation Ideas, (3) Slide (translation), (4) Half Rotation, (5) Reflection, and (6) Rotation. The materials were structured systematically in order to assist the students in understanding the materials of transformation geometry. This is in accordance with the statement by Munir (2013) that the module in learning has some roles, namely: (a) to explain the learning materials or objects, from abstract to concrete; (b) to learn the learning material repeatedly; learning materials can be repeated at other times without having to create again; (c) to overcome the limitations of time, space, and sensory ability of the learners and educators; (d) to increase motivation and passion of the learners; (e) to develop the ability of the learners to engage directly with the environment and other learning resources; (f) to allow self-learning within the learners according to their abilities and interests; and (g) to enable the learners to measure or evaluate their own learning outcomes.

Conclusion and Suggestion

Conclusion

This is a development research with Four-D development model covering some stages of defining, designing, developing and disseminating. The results of the defining or preliminary study stage show that based on the results of the student's needs analysis, most students are more interested in transformation geometry courses using instructional materials in the form of interactive e-modules that allow the students to have independent reading (self-governing study habits). Therefore, it is necessary to develop an easy-to-understand teaching material, which is an interactive e-module for transformation geometry. The results of the designing stage cover the initial draft of the interactive e-module for transformation geometry with the following systematic, namely: introduction (preface, e-module instruction, material description, prerequisites, and learning objectives), learning activities that include: material description and sample questions (interactively), summary, and competence tests (interactively), practice and test tips, feedback, and references. In developing stage, the prototype of the interactive e-module development was created. The development process considers some aspects, namely creativity, activeness, systematic, and effectiveness (CASE) as the bases to develop an interactive e-module. The draft of the interactive e-module for transformation geometry was designed and developed systematically by adhering to the principles of learning development. The draft e-module was then tested on a limited basis involving some students. The results of the trial obtained an overall average value of 3.30, which means that students as the users assess the interactive e-module for transformation geometry is good and acceptable.

Suggestions

In relation to the results of this study, researchers as the developers suggest some aspects, namely the possibility to increase students' activeness and creativity by developing the teaching materials so that the learning outcomes will be better. In addition, for wider use to other context, there should be special consideration on the similarities of environmental characteristics as illustrated in this study.

REFERENCES

Asyhar, R. 2012. *Kreatif Mengembangkan Media Pembelajaran.* Jakarta Referensi.

Borg, W. R. & Gall, M. D. 1989. *Educational Research: An Introduction*. London: Longman, Inc.

Darmawan, D. 2012. *Inovasi Pendidikan: Pendekatan Praktik Teknologi Multimedia dan Pembelajaran Online.* Bandung: PT Remaja Rosdakarya.

Daryanto. 2013. *Menyusun Modul.* Yogyakarta: Gava Media.

Dick, W. & Carey, L. 1990. *The Systematic Design of Instruction.* Glenview, Illinois London, England: Scat, Foresman & Company.

Hamdani. 2011. *Strategi Belajara Mengajar*. Bandung: Pustaka Setia.

Hamid, S. 2012. *Mendesain Kegiatan Belajar-Mengajar Begitu Menghibur, Metode Edutainment Menjadikan Siswa Kreatif dan Nyaman di Kelas.* Yogyakarta: Divapress.

Miles, B.W & Huberman, A. M. 1986. *Qualitative Data Analysis: A Sourcebook of New Methods.* Beverly Hills: Sage Publications.

Munir. 2013. *Multimedia: Konsep dan Aplikasi dalam Pendidikan.* Bandung: Alfabeta.

Plomp, T. 1997. *Educational & Training Systems Design: Introduction.* Enschede: University of Twente, Faculty of Educational Science and Technology Enschede.

Prastowo, A. 2011. *Panduan Kreatif Membuat Bahan Ajar Inovatif.* Jogjakarta: DIVA Press.

Rusman. 2012. *Belajar dan Pembelajaran Berbasis Komputer (Mengembangkan Profesional Guru Abad 21).* Bandung: Alfabeta.

Sanjaya, W. 2008. *Perencanaan dan Desain Sistem Pembelajaran*. Jakarta: Kencana.

Seels, B. B. & Richey, E. C. 1994. *Instructional Technology: The Definition and Domains of The Field.* Washington DC: AECT.

Sugiyono. 2013. *Metode Penelitian Kuantitatif, Kualitatif dan R & D (Reasearch and Development)*. Bandung: Alfabeta.

Thiagarajan, S.; Semmel, D. S.; Semmel, M. I. 1974. *Instructional Development for Training Teacher of Exceptional Children*. Indiana: Indiana University.

Wena, M. 2010. *Strategi Pembelajaran Inovatif Kontemporer (Suatu Tinjauan Konseptual Operasional)*. Jakarta: Bumi Aksara.

****