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Cybergogy as a digital media to facilitate the learning style of millennial college students

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Abstract

This research was aimed to test the effectiveness of AR-based digital learning materials in improving the learning of the students. The development method used in this research is the ADDIE (Analysis, Design, Development or Production, Implementation or Delivery, and Evaluation) model. The subjects in this developmental research are the lecturers of the educational technology department as media experts, the lecturers of the nonformal education department as the subject expert, and the students of the nonformal education department of the academic year 2018 as the users. The specification of the innovative product to be developed is augmented reality as a digital media in learning the family education subject. The result of the research that AR-based digital learning materials have gained excellent results as it has proven to help students in learning effectively. The average score in the experimental group after participating in learning with Augmented Reality media, the average score was improved to 92,55. Whilst in the control group, the average learning with the old/conventional paradigm, the average score recorded at 86,75.

Keywords: Cybergogy, Teaching Media, Augmented Reality

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1. Introduction

One of the performance measures in the education process is the approach used by teachers to deliver learning materials to students. Nowadays, several methods have been developed by experts, each with particular advantages and disadvantages. The approach referred to here is the pedagogy of andragogy, heutagogy, and paragogy, which with rapid technological advances such as gadgets and others is leading to a new approach known as cybergogy. The application of education technology has created a modern paradigm of cyber-learning; one of its core elements is to incorporate the fundamental concepts of pedagogy and anthropology to find a new learning process. Information technology is dedicated to helping adults, and young people learn through the promotion and technological realization of self-centred learning and interactive learning in a virtual world. In every learning environment, learners who engage in their learning tasks will participate in behaviour, intelligence, and emotion. The Cybergogy learning model can be incorporated into problem-based learning. With problem-based learning, the world has a positive effect on learning across online platforms (Jazeel 2020; Yin et al. 2020; Yusuf and Yusuf 2018).

One of the efforts to provide the best learning experience for students is to use various learning resources. The existence of these resources will facilitate the progress of learning to achieve learning objectives. These resources can be arranged in the form of information presented in various types of media that will help students get better learning outcomes. The teaching content is included as part of the learning resources. They play an essential role in supporting students to achieve learning goals. Learning materials are a set of learning tools that contain learning materials, limitations, methods, and evaluation procedures that are designed systematically and attractively to achieve goals (Wahyuni, Hadi, and Adisahputra 2019). Educators will find it easier to deliver learning material with the help of the media. Thus students will be facilitated and be able to study comfortably. One way of delivering learning materials is by utilizing digital technology, such as augmented reality. Augmented reality will help students access various learning materials because it contains two or more content in the form of text, images, sound, animation, video, and others.

Through the use of digital learning, students are driven to develop their HOTS (Higher Order Thinking Skills) abilities. Their thinking will be more organized because they will bank their ideas and opinions based on the structure of the knowledge. Students are trained to find, analyze, evaluate, curate, and act on the best available information available on the internet and other sources (Yusuf and Yusuf 2018). Student skills that can be developed through digital learning are critical thinking, developing collaborative networks, finding ways to resolve conflicts, being able to make the right decisions, being tolerant of other people's differences, and having the patience to solve problems, and with the spirit of achieving goals (Rheingold 2014).

Based on the needs analysis during pre-survey conducted in the Nonformal Education Department of 2018 class, we found that there are some obstacles occurred in the learning process, namely: (1) the outcomes of family education courses are not optimal; (2) millennial students have varied learning behaviours, one of which is they are gadget-minded, using gadgets more in during class; (3) students do not have the self-determination in learning according to their needs. Most classes are so far still using lecture, question, and answer, and presentation methods; (4) digital augmented reality teaching contents are not available to be used by lecturers until now; thus the learning styles of millennial student have not been able to be accommodated causing students challenging to comprehend the learning materials. Researchers developed a pre-survey. Related to various problems found during the pre-survey, the developer aspires to develop learning materials based on augmented reality to facilitate

millennial student learning styles. The developed learning media is expected to accommodate students' learning styles, especially for millennial students. It becomes one of the essential elements to accelerate the understanding process of students' learned material. Besides, the accessibility of this learning material makes students more independent in learning. The ease of learning that can be done independently will have a positive influence on the development of student knowledge. The main characteristic of a life-based curriculum is that it is oriented towards the needs of students in developing their abilities. The learning process is adapted to the development of students' abilities by using various resources to achieve learning outcomes and develop students as whole human beings.

1.1. Augmented Reality (AR) in Education

Augmented Reality (AR) is an innovation to build two-dimensional or three-dimensional virtual objects into the real environment; then explore virtual objects in real-time. This framework is closer to the native environment(Fidan and Tuncel 2018). According to Azuma in Tobar-Muñoz, Baldiris, and Fabregat (2017), augmented reality has three characteristics: (a) executing real-time intelligence, (b) combining real and virtual objects into the real environment, and (c) adjusting objects real and virtual to each other.

Sánchez, Redondo, and Fonseca (2012) explained that Augmented Reality (AR) is a hybrid media innovation where mechanical advances with media systems have changed the way users connect and get all kinds of substances. The popularity of Augmented Reality is now experiencing significant advances in society. This progress is in line with other benefits in the form of cost savings because students do not have to be present to see objects directly in the field.

Kesim and Ozarslan (2012), augmented reality can be collaborated with learning, entertainment, or edutainment by updating the user's acuity and interaction with the real environment. Users can view two / three-dimensional virtual images in a real environment augmented reality can be collaborated with learning, entertainment, or edutainment by updating the user's acuity and interaction with the real environment. Users can view two / three-dimensional virtual images in a real environment.

Research by R.M. Garrido (2015) found that augmented reality has an essential role in facilitating users in understanding the educational heritage using the Augmented Reality mobile application. As Augmented Reality has facilitated learning and made it more fun, users or students show fair and positive responses.

1.2. Educational Technology in Developing Personal Capabilities

The ease of learning independently with technology has a positive influence on students in developing their knowledge. The main characteristic of the life-based curriculum is oriented towards the needs of students in developing their abilities. Three essential things that must be held in life-based learning include (a) emphasis on strength-based recognition rather than technique; (b) uphold truth and values including belief, care, freedom, thought and resilience; (c) affirmation to students as individuals who get various sources of learning and take assignments for their learning (Staron 2011).

The existence of technology in the learning process supports the development of students' abilities. Capability development is the personal development of students so that they have developing abilities and talents. Every learning can be integrated with everyday life, work and learning in any space, any

situation, and anytime. Furthermore, learning can occur in the broader life (Rohman and Asmaranty 2018).

Educational technology is designed not only to improve student learning skills and subjective well-being but also to enhance subject knowledge and skills or to support collaboration and self-regulation. These overall objectives can be achieved by inquiry-based learning (self-learning approach) in four main areas: cognitive, metacognitive, motivational, and emotional. The use of augmented reality technology is one of the innovations in the application of inquiry-based learning (Panadero 2017).

Educational technology also develops capabilities; students are equipped with five life skills, including personal, analytical thinking, social, academic, and vocational skills. These skills are needed by students so that in living life, they remain conscious as a creature who needs to socialize and think with logical considerations (Ulfatin and Mukhadis 2017).

2. Methods

The development media used in this research is the ADDIE model (Allen 2017). ADDIE stands for Analysis, Design, Development or Production, Implementation or Delivery, and EvaluationThe selection of the ADDIE model is based on the ADDIE development model that is considered useful, dynamic, and supports the application of learning developed by researchers. The ADDIE model consists of five components that are interrelated and structured systematically from the first to the fifth step. Besides that, the application is systematic and very simple when compared to other design models; this makes the model easy to understand and apply.

The initial step in the development of digital augmented reality learning materials is based on the research and development design presented in the flow diagram. The process of developing this innovation starts from analyzing the learning needs of students, the potential that needs to be explored, and the problems faced by students in family education courses. The next process is product design, which is a systematic process that starts from setting learning goals, designing scenarios (short videos) containing material content in family education courses, designing learning tools, designing teaching materials, and evaluating the learning outcomes. The design of the learning model/method is still conceptual and will underlie the next development process. In the development step, the conceptual framework is executed into a product in the form of digital learning materials that are ready to be tested. Following the test, a validation by media experts was made, which in this case is conducted by educational technology lecturers from Surabaya State University, Mrs Utari Dewi, M.Pd, who assessed the feasibility of the media. Once the input from media experts was received, the materials were revised. Revisions are made agreeing to the assessment comes about or needs that were not met by the new model/method. The next step is implementation; in this step, learning materials that have been developed were applied in an actual setting, a real classroom. The learning material was delivered using the new model/ method developed, and then an evaluation is carried out to collect feedback for the application of the next model/method.

The sort of information utilized in this considers maybe a mixed-method, which is the kin of multi-method investigate in which either exclusively different subjective approaches or exclusively different quantitative approaches are combined (Schoonenboom and Johnson 2017). Qualitative data were obtained from experts' comments and suggestions, while the quantitative data were collected from validation tests by material experts and media experts. Quantitative data in the form of scores are then analyzed and converted into qualitative data. The results of this conversion serve as a benchmark to determine the feasibility of developing digital learning materials. Furthermore, assessment data on

learning outcomes are collected from the pre-test and post-test in the form of quantitative data. Whilst the student responses assessment was obtained from quantitative data which was then converted into qualitative data. Instruments or data collection tools used are in the form of observation, interviews, questionnaires (for material experts and media experts validation; questionnaire for product test assessments or responses), and documentation (learning outcomes). This study used a parametric statistical test. Subjects in this study were students majoring in Non-Formal Department 2018 class A and B as the users.

The data from this study are in the form of responses from material experts, media experts, and students on product quality in terms of material and media aspects. Comments, suggestions, revisions, and observations during the trial process were analyzed using descriptive and qualitative approaches and concluded as input to improve or revise that have been developed. Meanwhile, data in the form of response scores from material experts, media experts, and students collected through questionnaires were analyzed using descriptive and quantitative methods by the categorization system. The steps used to determine the quality criteria for the developed product are as follows: data acquired from the questionnaire were converted into interval data in this way: "Excellent" = 5, "Good" = 4, "Fair" = 3, "Poor" = 2, "Very Poor" = 1.

3. Results and Discussion

Students majoring in Non-Formal Department 2018 class A and B as the users and subjects in this study. Students majoring in Non-Formal Department 2018 class A as a control group and class B as an experiment group. The following are the characteristics of each group:

Table 1. Characteristics of the control and experimental group

No.	Control Group	Experiment Group
1.	Students majoring in Non-Formal Department 2018 class A	Students majoring in Non-Formal Department 2018 class B
2.	Student age range: 22-20	Student age range: 22-19
3.	There are 5 (five) male students, while 15 female students.	There are 4 (four) male students, while 16 female students.
4.	The learning method used a cybergogy approach with augmented reality media	The learning method used a conventional approach through discussions and lectures.

3.1 Results of Learning Innovation Product Testing

1) Results of First Testing

Based on the product development plan described in the method development section, the product development process of augmented reality-based learning materials is carried out through 7 (seven) steps, including practice tests. The product tests are carried out through two types of tests: validation test and limited field test. The validation test is carried out by experts consisting of material experts and media experts. This step is the first test conducted on a draft product that has been developed. This test was done twice, which consisting of: (a) learning videos comprising of 5 (five) videos about family functions, including affective, reproductive, economic, socialization, and family care; and (b) digital textbooks to improve students' critical and adaptive thinking skills.

The results of the validation test conducted by experts are described below.

a. Validation test on the learning videos

There are several indicators or assessment criteria used to validate the learning videos that have been developed, namely: (1) the content aspect, including readability level, completeness, and coherence; (2) the constructed aspect, including font type, clarity of sound, exciting animation, message delivery level. These indicators are outlined in the form of validation instruments provided to the validators. The validator fills in the scores on the validation sheet according to their respective perceptions based on the Likert scale (score range 1-4). The results of an assessment of each validator are compiled. Then the results are divided by the number of validators. The following table summarizes the data collected from the experts conducting the validation test.

Table 2. The results of the validation of the learning video draft

No.	Type of video	Content			Construct			
		I-1	I-2	I-3	T1	T2	T3	T4
1.	Video 1: Affective-function learning material	4	3	4	3	3	4	4
2.	Video 2: Socialization-function learning material	4	3	4	3	3	3	4
3.	Video 3: Economic-function learning material	3	4	4	4	4	3	4
4.	Video 4: Reproductive-function learning material	4	3	4	3	4	4	4
5.	Video 5: Family care-function learning material	4	3	4	3	4	4	4

Information:

I-1: Readability level (easy to understand/not)
I-2: Completeness (complete/not)
I-3: Coherence (coherent/not)
T1: Font type (easy to read/not)
T2: Clarity of sound (clear/not)
T3: Attractive animation (interesting/not)
T4: Message delivery (communicative/not)

The results of the validation test, it can be concluded that based on the content and construct aspects; the learning videos are of high suitability level. However, some aspects are still not optimal, including the completeness of the contents and clarity of sound in the video. The validators suggest to enhance the contents of the message in the developed video and to use a font type that is easy to read.

b. Validation test on the augmented reality-based digital textbooks

The validation test on the augmented reality-based digital textbooks is conducted by material experts who validated the content of the material or the book, and media experts who validated the construction of the book. Indicators used in the content assessment include (1) the content aspect, consisting of readability level, completeness, and coherence; (2) the construction aspect, including font type, interesting visualization, message delivery level. The validator fills in the values on the validation sheet according to their perception based on the Likert scale (score range 1-4). The assessment results from each validator are then compiled and divided by the number of validators. The detailed validation test results are as follows.

Table 3. Data on augmented reality-based digital textbooks validation test

Type of works	Content			Construct		
	I-1	I-2	I-3	T1	T2	T3
Digital textbooks	3	2	3	3	4	4

Information:

I-1: Readability level (easy to understand/not)
I-2: Completeness (complete/not)
I-3: Coherence (coherent/not)
T1: Font type (easy to read/not)
T2: Attractive visualization (interesting/not)
T3: Message delivery (communicative/not)

Based on the validator's evaluation, both the content and construction aspects are considered not optimal. There are several things to be addressed, including the selection of the words; thus, it will be easily understood by the readers. The contents of the book need to be improved and supplemented with interesting visualizations or pictures.

2) Product Revisions

As explained in the previous chapter, the product revision step in the development process of augmented reality-based digital textbooks innovation was performed 3 (three) times. The team carried out the first revision to ensure that the draft model was worth testing. The second revision was to improve the draft based on the input from expert validation results. Whilst the third (final) revision is conducted following the second input collected from experts. Some revisions that have been made by the development team based on input from experts are as follows.

a. Learning videos revision, including the completeness of contents and the easiness of applying augmented reality. The contents of the message conveyed in the video were rated as insufficient by the validator. Thus, the development team then added more information or remarks to each video session.
b. The revision of augmented reality-based digital textbooks was made on the completeness of content and visualization. According to the validator's notes on the book product, aspects that need to be revised are word selection and visualization. Based on this input, the development team then made several improvements by adding some pictures or relevant flowcharts in the book.

3) Results of Second Testing

The second assessment is a limited field test which is testing a product in a particular group that has similar characteristics to the target group that uses this product. The limited field test was conducted on groups of students enrolled in family education courses. In this limited field test, the developer intended to measure the applicability level of the product on the target group and some problems that need to be improved. The issues that need to be improved, among others, are:

a. In group activities, some mobile phones of the students cannot support augmented reality applications.
b. In classroom learning activities, room settings need to be arranged in such a way, especially for large classes, so that the students can interact more democratically and able to communicate well with each other.

The next step is the application of digital teaching materials in the pilot class. The number of participants in the trial class was 20 students from offering A8 and B8. These trial participants were not included in the experimental class. And then product revision, the product is refined once again when there are still problems found on the product. Extensive trials were conducted with the experimental class, whereas the control class did not get any intervention.

Figure 1. Students are using learning innovation product

Table 4. Student validation questionnaire

Variable	Maximum score	Score	%	Remark
Product aspects	895	1017	85,2	Excellent
Effectiveness for students	1050	1200	84,75	Excellent

Based on Table 4S, the average student (85.2%) graded the resulted product as excellent, whereas the effectiveness aspect of the product was rated 84.75% (good category). Thus, it can be concluded that the content of AR-based digital learning materials resulted in excellent outcomes as it is proven to have facilitated students in learning effectively.

4) Evaluation of Learning Score

The average score of the experimental group before learning intervention was 85.25. After participating in learning with the Augmented Reality media, the average score was 92.55. The average learning outcomes before intervention in the control group was 76.55. Following the learning with the old paradigm, an average of 86.75 was recorded (Table 4).

Table 5. Learning Outcomes

Score	Experiment		Control	
	Pre-test	Post-test	Pre-test	Post-test
Average	85.25	92.75	75.75	85.40
Maximum	95.00	100.00	80.00	94.00
Minimum	76.00	86.00	70.00	75.00

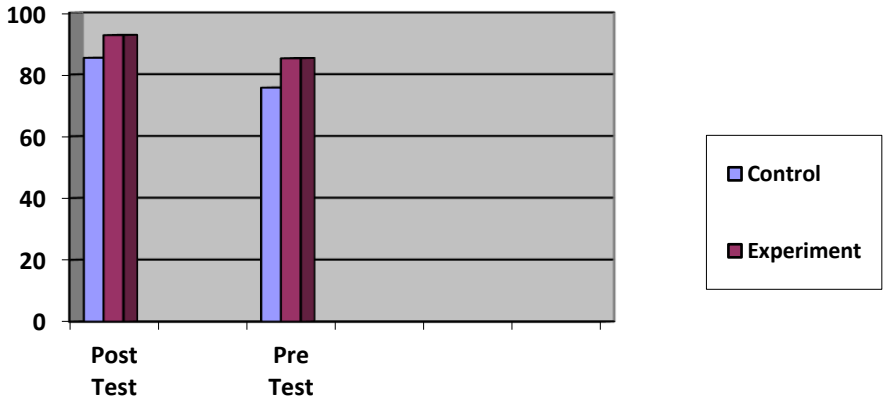

Figure 2**.** Improved learning outcomes of the class (Pre-test and Post-test score)

Learning objectives are the focal point of every learning activity. All components in education have a strategic role in achieving learning objectives. Students are also required to have creativity in learning so that the learning objectives will be feasible to be achieved. Lecturers are one of the learning resources who are obliged to provide a creative learning environment for the students. One of the activities that must be done by lecturers is the selection of learning materials. The selection is made based on the rationale that specific methods can not be used to achieve individual goals. The lecturer will fail to achieve the teaching objectives if the method selection is carried out without a thorough overview of each teaching method's characteristics.

The learning material that was delivered using augmented reality-based digital technology utilization is one of the innovations to facilitate millennial students' learning style, which is currently oriented in the use of gadgets. Previously, teaching was mostly done through lectures, presentations, questions, and answers, while today's students are connected to any world quickly by using a smartphone. Therefore the old learning/conventional methods are no longer relevant. Students can access various learning resources that are widespread in cyberspace. Thus it is not appropriate for students to find learning resources only in a physical classroom. Consequently, the main task of the lecturer is only to provide direction and facilitate the process.

Through these augmented reality-based digital learning materials, students are allowed to learn by installing an application, which contains digital books equipped with examples of family functions in the form of short films with a duration of 10-12 minutes. Students will be able to benefit from the visualization of family functions by scanning the barcode contained in a printed book. Accordingly, there are some of the products produced here, namely digital books, printed books, and learning videos. An effective learning method is one that able to provide as many opportunities as possible for students to learn how to learn, not merely a transfer of knowledge. As concluded by some studies, transformative learning based on memorizing learning, this can strengthen the role of students in utilizing all the potential of the environment and student meetings in the course as learning assets. (Hardika 2016). It was further explained that the role of the lecturer is as a facilitator in building students' self-determination in learning.

Augmented reality is one of the educational technology innovations that have the potential to advance the quality of education and learning activities. This technology is combined with other

innovations such as portable gadgets in helping users interact and imaginative innovation; this is known as Mobile Augmented Reality (MAR) (Nincarean et al. 2013).

Cai, Wang, and Chiang (2014) showed that the use of computer-assisted devices such as augmented reality in the learning process could have a positive impact on students to achieve. Apart from that, students also enjoy exploratory experiences. Thus, learning materials that are collaborated with digital technology based on augmented reality are expected to be able to become energy that will excite students in their learning activities.

Wahyudi, Wibawanto, and Hardyanto (2017) showed that augmented reality media could help students to be more active in learning both inside and outside the classroom. Augmented reality makes the learning process more practical and more effortless. This results in this study also supported by Diegmann and Schmidt-Kraepelin (2015) that the augmented reality technology can improve the abilities of students including increase motivation, attention, creativity, concentration, interactivity, and information accessibility, student-centred learning, and improve collaborative learning, the development of spatial abilities, memory. Augmented reality has the potential to shape students for the work environment in the long term so that it does not only have a positive impact on classroom learning and foster peer-to-peer learning (Riva et al. 2016).

Rezende, Albuquerque, and Ambrosio (2017) augmented reality increased student-centred learning. Combining both the AR and the inquiry-based learning demonstrate offers a proactive and social encounter that will offer assistance interface subjects to understudy lives as the most characteristic of the life-based educational programs. AR provides ways of individualizing instruction in a gathering setting, and the innovation bolstered freedom which liberated the educator to act as a facilitator. AR moves forward the capacity to investigate and assimilate current information and unravel issues, demonstrating that AR can bolster student-centred Learning situations as understudies are empowered to investigate information and illuminate issues independently. AR can back a student-centred Learning approach by providing teachers with modern conceivable outcomes to individualize their lessons, agreeing to students' capabilities and by empowering understudies to memorize more autonomously from teachers.

This research related to the learning style of millennial students in college. Millennials and Gen-Z as "digital natives," who have been uncovered to and utilize computerized innovations all through their lives. Computerized locals learn by doing, incline toward visualizations, and to multi-task. The carefully proficient, counting computerized locals, are hypothetically versatile and rapidly learn how to utilize unused advanced assets (Baghdasarin 2020).

The irrefutable truth is that the new era, no matter whether it has a place to the bunch of advanced learners or not, cannot be prepared within the conventional ways. Instructors ought to adjust academic approaches and execute new tools and innovations within the learning handle to keep the relationship and communication between them and learners. A computerized learning environment that's enhanced with an assortment of technologies is fitting for them. The part of teachers is to make a bonafide environment, utilizing available innovative advances that learners see as their common foundation. Advances continuously play a noteworthy part within the instruction framework, since they offer superior openings for making intelligently, personalized learning materials and exercises that are compliant with the particular needs and characteristics of learners. They can incite inspiration, learners' commitment to their learning. Augmented Reality is considered to be one of the innovations able to alter (Kiryakova, Angelova, and Yordanova 2018).

4. Conclusion

The approach used by educators in presenting learning material to students is one of the factors for the success of the education process. Currently, many approaches are developed by experts, each of which has its advantages and disadvantages. The approach referred to here is the pedagogy of andragogy, heutagogy, and paragogy in which the rapid development of technology such as gadgets and others leads to a new approach known as cybergogy. In this study, researchers developed AR-based digital teaching materials as a product of implementing the cybergogy approach. This media is then tested for its effectiveness in improving student learning, especially in the material on family functions. The development method used in this study is the ADDIE model (Analysis, Design, Development or Production, Implementation or Delivery, and Evaluation).

Based on the results of the study, it is explained that AR-based digital learning has provided excellent results. This is indicated by demonstrated to be viable in helping understudies in learning. The standard score within the test bunch after taking an interest in learning with Augmented Reality media was higher than the old paradigm/conventional methods average score in the control group. It is indicated that the cybergogy approach can be implanted in problem-based learning, the potential that needs to be explored, and the problems faced by students in family education courses. With problem-based learning, students also get a positive influence through the help of virtual platforms.

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