Designing Educational Games on E-learning SMANAS Based Learning Experience Design

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***Abstract*— E-learning has been increasingly promoted in education as alternative for learning method and teaching. There are many platform open source used for applying e-learning in the school such as chamilo. Chamilo is type of learning management system who support multimedia for learning process, but some user used just for creating course, quiz, and upload material. Eventhough educational game being popular multimedia for facilitating learning process. Learning Experience Design (LXD) offer solution for difficulting development learning experience by apply educational game on e-learning. Purpose of the research are develop educational game on e-learning SMANAS based learning experience design case study System of Linear Equation in Three Variables (SPLTV) and evaluate user experience of the educational game using User Experience Questionaire (UEQ). The result of our study confirm that first, educational game suitable for e-learning environment. Second, educational game give excellent impressions of the group attractiveness, perspective, efficiency, dependability, stimulation and novelty. It means educational game based Learning Experience Design engaged student to get learning experience.**

Keywords— learning experience, User Experience Questionnaire (UEQ), Learning Experiene Design (LXD), e-learning, educational game

I. INTRODUCTION

Preliminary research conducted in one of school in Bandung. Nasional Senior High School provides information regarding the use of e-learning is still limited to a few features. Frequently used features of side teacher's activity are create course, upload teaching materials, and create questions for examination. While the student's activity such as join group classroom, download material, assign examinations and doing the task. In addition, media of learning used in e-learning is still limited such as documents, power point slides. Teacher's feedback against the results of the task is still lacking. Noticeable lack of use of the certificate and the badge as a tribute to students who have completed the learning material. Submission of description and learning objectives on e-learning still hasn't been carried to the students. So that students didn't know the goals after used of e-learning. In addition factor infrastructure is lacking support and expertise using the technology became a problem in the use of e-learning. Learning experience one of the factors of the increase in the utilization of e-learning as a medium of instruction in schools. In 2013, government regulation said that students have good learning experience have five aspects of the learning that is observed, ask yourself, gather information or experimental, process information or a ssociations and communicate.

Learning experience design is part of the User Experience Design (UXD) which brings together the science of learning, human-computer interaction, and design thinking [1]. Learning Experience Design makes the students as the goal of the design process of learning. Nowadays, e-learning is supposed to be able to provide the best experience for users and to design learning becomes fun. Creating instructional design required the views of students there into match with the student's desired by achievment [2].

Learning Management System is sytem to develop e-learning environment for education. Many LMS open source such as moodle, chamilo, dokeos, etc. There are we can use for learning in the school. Development of the e-learning industry 4.0 are gamification, going mobile , tracking, and analysis. There are can be making fun learning experience for student.

Content will be use in this game is math course because of students needs different learning experience when they learn about it. Designing educational game using construct 2 and platform chamilo as a e-learning. The purpose of this research is to designing educational game based e-learning environment using Learning Experience Design (LXD), evaluate user experience of the educational game using User Experience Questionaire (UEQ) and develop gamification on e-learning environment.

II. LITERATURE REVIEW

A. Benefit Educational Game for Learning

The video game is an effective tool for teaching because it contains the principles of learning and effective instructional techniques used in reinforcement on the difficult level [15]. Educational game being highly interactive and immersive environment. The most important aspects in developing the game in modeling and predicting individual behavior, the study of player computational models in games [18]. Student performance increases if game content adapts to student's abilities [19]. Then, research found that game studies more effective for improvement cognitive understanding

and application level knowledge [20]. Besides it, video game improved hand-eye coordination, processing emotional and . Benefit educational game for learning can be first, enhancing motivating student like student want get have fun when they do learning process and they will get gift if they get best score. Secondly, engaging scenario of game every game build with storyboard that can be engage student to play on many difference environment and character. Thirdly, getting educational goals it means students get earn new skill because they get many challenge on every level. Last, it can evaluate learners it means student will be know weakness of their learning process [3].

B. Educational Game and E-learning

E-learning is a tool or computer-based education system that enables learning on a time and place to suit the wishes of the user. E-learning delivered though the internet. E-learning gives students the ability to customize learning method with learning style of learners, allowing people to resume the busiest careers and gain new qualifications [4]. MOOC is one of the e-learning products that provides the opportunity for users to enjoy learning videos from each country by utilizing the 21st century learning methods users get a pleasant learning experience when using e-learning to influence the character of users in the future [21].

C. Integrating E-learning into Learning Experience Design

Learning Experience Design (LXD) is an instructional design, educational pedagogy, neuroscience, social sciences, design thinking, and UI/UX [11]. Learning Experience Design is the process of facilitating the development of skills (skills, proficiency) by providing learners with a series of learning activities (experience) are systematically supported by content, feedback, and technology [12]. In this part begin to develop the environmental impact of e-learning-based LCMS, the use of the term user experience as a learning experience at this time to answer the needs of the market of mobile learning [13]. Now, platform e-learning provide many feature for learning process but the model for design learning design not yet. Below on Table I is the development of a learning path on LXD[11].

TABLE I. LEARNING PATH

No	***Element Design***	***Activity Description***
1	Learning activity description	Explain step by step student's activity do and result
2	Learning activity instruction	Giving a sequence procedural and instruction.
3	Online portfolio content	Using content combination such as video, photo, location, notification and document.
4	[Free form text field] multiple choice check box	Identification activity to answer using multiple choice or question answer.
5	Assesment	Making quiz and final scoring.
6	Badges	Identification learning path to give award through gamification process.

D. Gamification on e-learning

Chamilo is one of platform e-learning provide gamification. Gamification on chamilo can create badges to give feedback for student after they done learning process on e-learning. Benefit of gamification in e-learning makes better learning experience, learning environment, and instant feedback for student [22]. It means badges isn't result but tools for used fun gimmick and give positive feelings [23].

E. Tools for evaluate user experience

User Experience Questionnaire (UEQ) is a tool-related survey data processing user experience that is easily applied, reliable and valid, which can be used to complement the data from other evaluation methods with quality assessment subjective [5].

UEQ allows the rapid assessment of the user's experience of interactive products. Questionnaire scale designed to handle a comprehensive impression of the user experience. The format of the questionnaire response supports the user to immediately reveal feelings, impressions and attitudes that emerged when wearing a product [6].

Measurement of attitudes towards the user experience more positive than that identified in the interview, and there is a nuanced detail measurement [7].

Evaluation of e-learning using UEQ this will benefit practitioners of UX, HCI educators, programs and learning resource centre administrator, and developer of the learning management system. The results of this evaluation may also be beneficial to universities and secondary schools that use computer-based learning environment or e-learning [8].

UEQ contains 6 scale with a total of 26 items are as follows [9].

a) Attractiveness: the General Impression of the user over the product, like or dislike.

b) Efficiency: the possibility of the use of products with fast and efficient,

c) Perspicuity: ease of understanding the use of usually products.

d) Dependability: the feeling of being in control of the user interaction, security and meet expectations.

e) Stimulation: an interesting and fun from the use of the product, users want more motivation to wear it.

f) Novelty: innovative and creative product design, attracting the attention of the user.

III. DESIGN AND IMPLEMENTATION SYSTEM

Basically the research aims to design and implement Learning Experience Design (LXD) then research method used is the mix method. On the research method used is the stage of the ADDIE model for research development.

A. Analysis System

- A functional needs analysis will be developed are described in some of the process include:

- Students can see the narrative before using e-learning.
- Students are able to see the course description.
- Students are able to see the course progress.
- The material is divided into several levels.
- Use of forums as a means of discussion a learning experience and goals to be achieved by students.
- The use of educational games in the learning process.
- Students getting badges from the results of the study.
- Use of interactive quizzes.

B. *Design System*

The design uses the approach of Learning Experience Design (LXD) with five stages of development, namely, the requirement of strategy, structure, and sensory. implementation process LXD using collaboration feature on e-learning platform there are

1. Sensory : course description, course program, learning path and badges
2. Interaction : using media for learning process there are video, document, quiz, discussion, educational game and badges.
3. Structure : Learning objectives using course description there are goals activity, score, content, and method.
4. Requirement : Design curriculum of System of Linear Equation in Three Variables (SPLTV) on math course.
5. Strategy : using questionaire about learning experience after playing educational game on e-learning.

While the storyline of the system described in the flowchart is illustrated by Fig. 1. In this part begins with a student login on e-learning in Nasional Senior High School and then students choose material systems of Linear equations Three Variables (SPLTV). Before starting the learning students are required to understand the learning objectives that will he accomplished. So that students can learn in accordance with ability and the purpose of each.

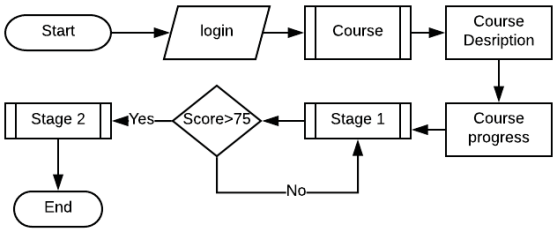

Fig. 1. Flowchart system

Gamification design in this e-learning using badges to give feedback for student. They will get coin if they reach standard score and fun gimmick to make learning being have a fun Fig. 2.

Fig. 2. Gamification

C. *Implementation System*

Here some of the e-learning with Learning Experience Design (LXD). In Fig. 3 is the first display of materials on e-learning. There are four menu on e-learning there are course description, course progress, elimination material, and determinant.

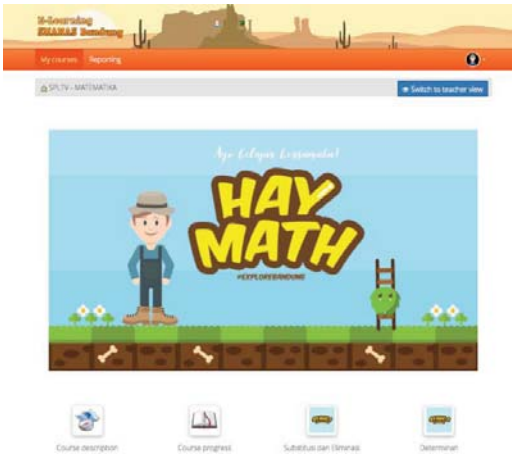

Fig. 3. Learning Path

Fig. 4 displays an explanation of descriptions of learning and learning experience activities that will be performed by students on the material SPLTV.

Fig. 4. Course description.

Fig. 5 displays the target which must be obtained in the student study material SPLTV.

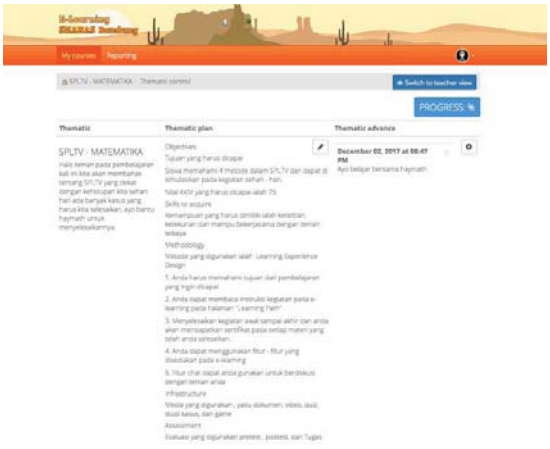

Fig. 5. Course progress

Fig. 6 Discussion page students ask questions about the material that understood yet during learning process in e-learning.

Fig. 6. Group Discussion

In Fig. 7 the student will watching a video about the introduction and implementation of SPLTV in daily life.

Fig. 7. Video

In Fig. 8 the final evaluation and reflection of learning that has been followed by students. Quiz that we used using essay question, they inform student to solve problem like they have met in their life. They must count food they bought using mathematic.

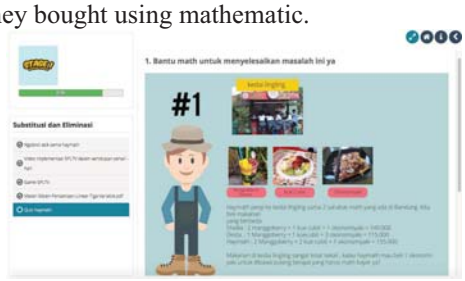

Fig. 8. Quiz

In Fig. 9 show implementation educational game on e-learning platform chamilo. The educational game using web for connected with chamilo.

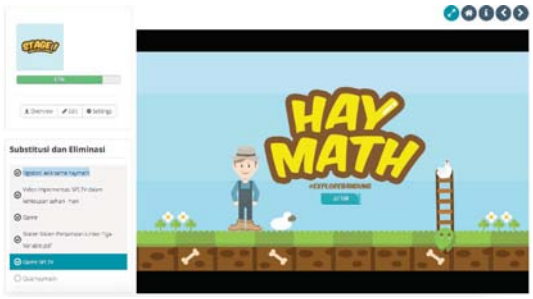

Fig. 9. Integration educational game on e-learning.

In Fig. 10 tells storyboard of educational game, Haymath as the main character in the game has the goal of being able to get to Tangkuban Perahu and get an award as a true adventurer with only a map. To be able to get there there are four places that must be passed, namely the floating market, farmhouse, d'ranch, and ecocamp. At every place he must help the work there to get a ticket to get into Tangkuban boat. At each level it represents the implementation of math lessons on the spltv material one of them and groups the same variables.

Fig. 10. Educational game from level 1 - 4

IV. RESULT AND ANALYSIS

Analysis of testing using the questionnaire User Experience Questionnaire (UEQ), assessment of the media using Learning Object Review Instrument (LORI) version 1.5 and blackbox testing. Media assessment by the teacher using the validation results of expert LORI shows e-learning educational game deserves to be used with the highest is on the quality of the material reaches 90% and lack are on the accessibility aspects. Access accessibility is considered less because of e-learning educational games developed is still on the desktop version.

In Fig. 11 questionnaire consists of 26 UEQ statement concerning top e-learning products used by students. Testing conducted at the Nasional Senior High School at grade X science class.

	1	2	3	4	5	6	7		
annoying	○	○	○	○	○	○	○	enjoyable	1
not understandable	○	○	○	○	○	○	○	understandable	2
creative	○	○	○	○	○	○	○	dull	3
easy to learn	○	○	○	○	○	○	○	difficult to learn	4
valuable	○	○	○	○	○	○	○	inferior	5
boring	○	○	○	○	○	○	○	exciting	6
not interesting	○	○	○	○	○	○	○	interesting	7
unpredictable	○	○	○	○	○	○	○	predictable	8
fast	○	○	○	○	○	○	○	slow	9
inventive	○	○	○	○	○	○	○	conventional	10
obstructive	○	○	○	○	○	○	○	supportive	11
good	○	○	○	○	○	○	○	bad	12
complicated	○	○	○	○	○	○	○	easy	13
unlikable	○	○	○	○	○	○	○	pleasing	14
usual	○	○	○	○	○	○	○	leading edge	15
unpleasant	○	○	○	○	○	○	○	pleasant	16
secure	○	○	○	○	○	○	○	not secure	17
motivating	○	○	○	○	○	○	○	demotivating	18
meets expectations	○	○	○	○	○	○	○	does not meet expectations	19
inefficient	○	○	○	○	○	○	○	efficient	20
clear	○	○	○	○	○	○	○	confusing	21
impractical	○	○	○	○	○	○	○	practical	22
organized	○	○	○	○	○	○	○	cluttered	23
attractive	○	○	○	○	○	○	○	unattractive	24
friendly	○	○	○	○	○	○	○	unfriendly	25
conservative	○	○	○	○	○	○	○	innovative	26

Fig. 11. UEQ Question

Table II displays the average value of each statement in the positive position of the negative, zero or positive.

TABLE II. UEQ SCALE

UEQ Scales	
Attractiveness	2.185
Perspicuity	2.222
Efficiency	2.250
Dependability	2.157
Stimulation	2.417
Novelty	2.269

Fig. 12 shows the average value of the entire statement of views from his group. Simulation aspect getting higher presentation because the gamification of educational game makes student fun to playing.

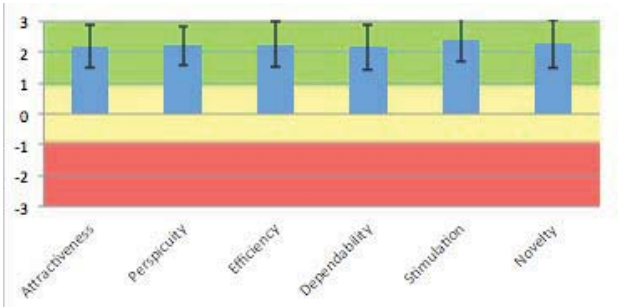

Fig. 12. Graphic value average *impresion* of group

TABLE III.
AVERAGE, VARIANCE, AND STANDARD DEVIATION

Item	Mean	Variance	Std. Dev.	No.	Left	Right	Skale
1	2.9	5.5	2.3	27	annoying	enjoyable	Attractiveness
2	2.6	4.7	2.2	27	not understandable	understandable	Perspicuity
3	1.7	8.5	2.9	27	creative	dull	Novelty
4	1.9	4.4	2.1	27	easy to learn	difficult to learn	Perspicuity
5	2.1	6.6	2.6	27	valuable	inferior	Stimulation
6	2.9	4.4	2.1	27	boring	exciting	Stimulation
7	2.9	4.9	2.2	27	not interesting	interesting	Stimulation
8	2.3	4.4	2.1	27	unpredictable	predictable	Dependability
9	2.2	9.2	3.0	27	fast	slow	Efficiency
10	2.0	7.8	2.8	27	inventive	conventional	Novelty
11	2.9	6.6	2.6	27	obstructive	supportive	Dependability
12	1.7	4.3	2.1	27	good	bad	Attractiveness
13	2.1	4.7	2.2	27	complicated	easy	Perspicuity
14	2.1	5.3	2.3	27	unlikable	pleasing	Attractiveness
15	2.4	4.9	2.2	27	usual	leading edge	Novelty
16	2.7	6.0	2.4	27	unpleasant	pleasant	Attractiveness
17	1.9	6.4	2.5	27	secure	not secure	Dependability
18	1.9	5.7	2.4	27	motivating	demotivating	Stimulation
19	1.6	5.3	2.3	27	meets expectations	does not meet expectations	Dependability
20	2.1	4.1	2.0	27	inefficient	efficient	Efficiency
21	2.3	6.4	2.5	27	clear	confusing	Perspicuity
22	2.4	4.5	2.1	27	impractical	practical	Efficiency
23	2.2	5.7	2.4	27	organized	cluttered	Efficiency
24	1.7	4.4	2.1	27	attractive	unattractive	Attractiveness
25	2.1	5.2	2.3	27	friendly	unfriendly	Attractiveness
26	3.0	3.2	1.8	27	conservative	innovative	Novelty

Table III show the scale of assessment on each statement are answered by students. Based on the results of the testing that has been done at the Nasional Senior High School students in Bandung, then retrieved the conclusion that educational game e-learning have met the learning experience of students. Seen from the results of testing products to students and validation expert material. Products evaluation have 6 aspects namely charms, clarity, efficiency, precision, simulation and novelty with the median values obtained 2.1 – 2.4. The highest scoring present on aspects of stimulation. E-learning content combined with educational games, videos, quizzes, forum, and documents content provide the stimulation for students working on each of the stages in the learning process

CONCLUSION

Result of questionnaire analysis of product assessments indicated user experience after using educational game on e-learning. Educational game can pass implementation on platform chamilo. Judgments on this aspect of the appeal, clarity, efficiency, appropriateness, novelty and stimulation are in the range of 2.1 – 1.4 contains the excellent groups. This means the educational games in e-learning provide a fun learning experience. Students can feel the attraction for learning, clarity in the delivery of the material combined with the media, and occurrence of communication between students in e-learning. Reccomendation for the next research that educational game on e-learning more effectively for mobile platform.

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