Application Of Design Aspects In Online Learning Content

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Abstract There are many online learning materials found in universities in Indonesia that use face-to-face materials. Teaching materials used in the material in the class are transferred to the content of online learning material. There are many visual elements in learning material that only decorative function and have not been optimal in knowledge construction. This study will design an experiment with a focus on teaching material for lecture material that is dominant in the cognitive domain. Case studies on theoretical lecture material from social science. The comparison experiment will use two groups of students selected randomly. One group of students will be made into a control group and another group of students will be made into the experimental group. The effectiveness of the results will be measured by learning evaluation in the form of retention tests and transfer tests. This evaluation is related to the learning outcomes of the cognitive domain. This research is in the ongoing research phase. This paper is expected to trigger further discussion both in the methodology and content of the experimental features. The results of this study are expected to be used as a reference for lecturers in designing online teaching materials.

Keywords Online learning material, design aspect, user experience

1. Introduction

The development of digital information technology has created a digital network society and has an impact on all aspects of life. The higher education sector is also affected by the development of digital information technology. Distance learning is offered across space and time, so students get flexibility in different times and places and use a variety of learning resources. Distance learning has evolved from learning using correspondence tools to current technology known as online learning. In asynchronous online learning, lecturers prepare lecture material, then upload it to the Learning Management System (LMS) in their institutions. The content of the lecture material consists of content of teaching material and learning videos.

The content of teaching materials can be in the form of presentation slides, text documents, and other digital documents. While the learning video material is a video display of lecturers who are in charge of the subject. LMS is usually equipped with a learning evaluation section to test student abilities. However, there are still many contents of online learning materials in Indonesia that move the face-to-face model in the classroom. Learning video material uses a face-to-face teaching approach and positions students as passive spectators watching the learning. Lecturers prepare teaching material that is the same as teaching material when they teach face-to-face in the form of presentation slide material with minimal explanation of the material. This research will be focused on the content of teaching materials in online learning. Observations on teaching materials in several universities in Indonesia can be seen in Figure 1, Figure 2, and Figure 3.

Figure 1. Learning materials from online learning UGM (elisa.ugm.ac.id)

The second problem is that online learning material that has been developed by universities in Indonesia still does not utilize the effectiveness of design aspects in the construction

of knowledge for students. Management of oral, written and visual elements makes the design aspects have an important role.

Figure 2. Learning materials from online learning ITB (kuliah.itb.ac.id)

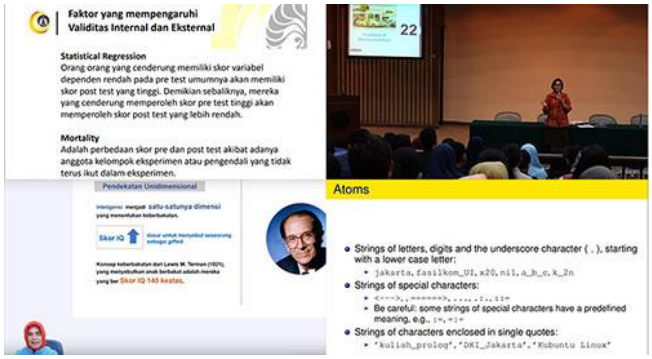

Figure 2. Learning materials from online learning UI (ocw.ui.ac.id)

In the most basic visual aspects, there is still a lot of content in the lecture material that does not use good design principles in its implementation. The use of contrast, typography, color, and good composition related to the explanation of learning material. Ease of reading information and culminating in clarity in the construction of student knowledge. Graphic elements have not been optimized for the ability to construct student knowledge. Many graphic elements in lecture material only function as decorative elements. If the graphic elements are designed and developed optimally, the graph elements can be improved at a later stage.

2. Literature review

Empirical studies conducted by Levin *et al*. [1] deals with visual aspects in general learning. This study examines five graphic functions, namely as a function of decoration, representation, organization, interpretation, and transformation. The results of the study indicate that the graph that functions as decoration does not show an influence on student learning. Plass *et al*. [2] conducted research related to emotional design in multimedia learning materials. The research aims to see the impact of shapes and colors on learning. The results of this study indicate emotional design can facilitate cognitive processes and learn by using a combination of color elements and shapes in the material. Individual form elements are a design factor that gives positive emotions, while colors have no effect. Simultaneously rounded shape elements and warm colors enhance understanding of the material. Lyra *et al*. [3] discuss the infographic aspects of distance learning. This research was conducted using a case study of two different approaches. The results of this study indicate that students who use infographic material have a positive correlation in learning comfort.

Research related to the communication function of graphic elements has been carried out by Levin [4], Carney and Levin [5] and Lohr [6]. Clark and Lyons [7] then summarize and describe the communication functions of graphic elements. Decorative function: aims to add aesthetic aspects, humor or motivation and has nothing to do with the material displayed. The representative function is a visual display of material content. The aim is to display material content in a realistic appearance. The mnemonic function aims as a visual aid that is associated with certain facts or concepts. These concepts and facts are related to the local language and culture and cannot be equally accepted for a global audience. The organizational function aims to describe the qualitative relationship of material content. The relational function aims to describe the quantitative relationship between two or more variables. Transformational functions aim to communicate the changes that occur in a period of time. Usually associated with stages or procedural tasks. The interpretive function aims to help students build an understanding of events and processes that are not visible or abstract.

3. Method

Theory courses are content that can be of the type of information on facts, concepts, processes, procedures or principles. Case studies of courses to be tested are branding courses. Lecture meetings generally consist of 14 meetings. Distance learning materials that will be made experiments are three lecture meetings at meetings 9, 10 and 11 with the reason that students get a foundation of knowledge from previous materials. The content of the material to be tested is the content of teaching materials. Comparative experiments will use two groups of students chosen at random with a minimum number of 30 people [8]. One group of students will be used as a control group and another group of students will be used as an experimental group. The control group uses learning materials with standard features that are generally used by institutions that are used as research objects while the experimental group uses learning materials with certain additional features. The effectiveness of the results will be measured by evaluating learning in the form of retention tests and transfer tests. This evaluation is related to the stages of cognitive learning achievement that will be achieved starting from the stages of remembering, understanding, applying, analyzing, evaluating and making [9].

Retention tests are tests that measure the ability to remember important parts of learning material that have been delivered. Transfer tests are related to the process of understanding the material. Transfer tests can be comprehensive transfer tests and problem-solving transfer tests.

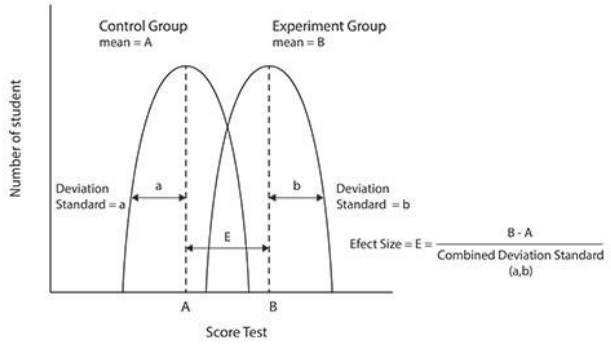

Figure 2. Effect Size

Each group will take the mean from the evaluation and calculate the standard deviation. Standard deviation is used to see the distribution of data and how close it is to the average value. High average scores and low standard deviations indicate that learning materials have been effective. To see how much difference is generated by the groups subjected to the experiment, an effect size is used. The effect size is obtained from the reduction in the mean value of the experimental group with the mean value of the control group. This value is then divided by the combined value of the two groups' standard deviations. Effect sizes that are below 0.2 indicate that there are no significant effects by applying certain features in the experimental group. An effect size of 0.5 is considered to have a moderate effect, while an effect size above 0.8 is considered to have a strong effect [8]. The calculation can be seen in Figure 2

4. Discussion

Good learning outcomes as a result of student activities during learning. From previous studies, good learning outcomes are the result of the cognitive activity of students compared to behavioral activities. So that the content of distance learning materials that are well designed can improve students' active cognitive processes. The application of experiments on distance learning content will be linked as material content that functions to construct knowledge for students. The content of the material to be tested is the content of the teaching material.

For the content of teaching materials will be examined the effectiveness of the features of teaching material content, namely:

1. Segmentation aspect: will students learn better if the material in the form of text is organized and managed using a layout arrangement that divides segments compared to using dense and continuous text material?

2. Multimedia aspects: will students learn better if the material is a combination of images and text compared to using material with only text elements?

The application of the features of aspects of segmentation and multimedia in experiments can be seen in Table 1.

Table 1. Experimental content in cognitive domains
Source: author's documentation

Group type	Use of features
Control group	Content of teaching materials in the form of black text material and white background without layout settings
Experimental group 1	Teaching material content in the form of black text material and white background with layout settings and differences in size and type of letters
Experimental group 2	Content of teaching materials in the form of black text material and white background with layout settings and differences in size and type of letters and color combinations added
Experimental group 3	Content of teaching materials in the form of a combination of drawing and text material that is both black and white background with layout settings and differences in size and type of letters. Material is an infographic.
Experimental group 4	Content of teaching materials in the form of a combination of image and text material with layout settings and differences in size and type of letters. Material is an infographic and uses color combinations

The control group uses learning material in the form of text-only with a white background without layout settings. This control group will be compared with several experimental groups. The first experimental group used the content of teaching materials in the form of black text material and white background. The difference is with the layout, size and font settings. The second group of experiments is similar to the content of teaching materials with the addition of color combinations in the teaching material content. The third experimental group uses the content of teaching materials in the form of a combination of image and text material with infographic display with good layout settings. The overall appearance is a black and white display. The fourth experimental group is a modification of the third experimental group with a colored display. Each of these experimental groups will be compared with the control group.

Table 2. Evaluation of cognitive domain learning
Source: processed and modified from Mayer [10]

Evaluation type	Description	Type of problem
Retention test	Measure the ability to remember important parts of learning material that have been delivered	10 multiple-choice questions
Comprehensive transfer test	Measure the ability to classify new examples at a more comprehensive level	1 essay problem
Troubleshooting transfer test	Measuring students in transferring topics learned to an unknown environmental context to present problem-solving tasks	1 essay problem

Testing is done with tests for each group. There are three types of tests to be measured namely retention tests, comprehensive transfer tests, and problem-solving transfer tests. This evaluation is related to the learning outcomes of the cognitive domain to be achieved starting from the stages of remembering, understanding, applying, analyzing, evaluating and creating. Retention tests aim to measure the ability to remember important parts of the learning material that has been delivered. The type of questions for this retention test is multiple-choice questions. Comprehensive transfer tests aim to measure students' ability to classify new examples at a more comprehensive level. Type questions are essay questions. And finally, the problem-solving transfer test. Aims to measure students in transferring the topics studied in an unknown environmental context and presenting problem-solving tasks. Type questions are essay questions. The evaluation of learning can be seen in Table 2.

These three types of evaluations will then be combined. Each experimental group will be seen the average value of the group and then will be compared with the average value of the control group. The two mean values will then be obtained by the value of the effect size to see whether the experimental group has an influence due to differences in the features of the learning material.

5. Conclusion

Teaching material which is a component in online learning materials needs to be planned well. Understanding of design aspects in online learning material and how user experience interacting with the material becomes a consideration in designing online learning materials.

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REFERENCES

[1] Levin, J. R., Anglin, G. J., and Carney, R. N. (1987): On empirically validating functions of pictures in prose in Willows, D.M., dan Houghton, H.A., ed, The psychology of illustration: I. Basic research, Springer, New York, 51–85.

[2] Plass, J.L., Heidig, S, Hayward, E.O, Homer, B.D., and Um, E. (2014): Emotional design in multimedia learning: Effects of shape and color on affect and learning, Learning and Instruction, 29, 128 – 140.

[3] Lyra, K.T., Isotani, S., Reis, R.C.D., Marques, L.B., Pedro, L.Z., Jaques, P.A., and Ig Ibert, B. (2016): Infographics or Graphics+Text: Which Material is Best for Robust Learning? Proceedings of the IEEE International Conference on Advanced Learning Technologies (ICALT).

[4] Levin, J.R. (1979): On functions of pictures in prose, Wisconsin Research and Development Center for Individualized Schooling, The University of Wisconsin Madison, Wisconsin.

[5] Carney, R, N., and Levin, J, R, (2002): Pictorial illustrations still improve students' learning from text, Educational Psychology Review, 14, 5 – 26.

[6] Lohr, L. (2008): Creating graphics for learning and performance: a lesson in visual literacy, Pearson Education, Inc., Upper Saddle River, New Jersey.

[7] Clark and Lyons (2011): Graphics for learning: proven guidelines for planning, designing, and evaluating visuals in training materials, Pfeiffer

[8] Cohen, J. (1998): Statistical power analysis for the behavioral sciences, Lawrence Erlbaum Associates.

[9] Bloom, B. S, Engelhart, M.D., Furst, E. J, Hill, W.H. and Krathwohl, D.R. (1956): Taxonomy of educational objectives, the classification of educational goals, handbook 1 cognitive domain, London: Longmans.

[10] Mayer, R.E. (2009): Multimedia Learning, Cambridge University Press, New York. Matlock, H., and Reese, L.C., 1960, Generalized solutions for laterally loaded piles., Journal of Soil Mechanics and Foundation, 86(5), 63–91.