The Effect of the Type Visualizing—on the Presentation Strategy of the Computer-Based Multimedia Learning—and the Learning Style toward the Student’s Ability in Applying Concept and Procedure of Object-Oriented Modelling

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Abstract
This research aims to investigate the effect of the type visualizing—on the presentation strategy of the computer-based multimedia learning—and the learning style toward the student’s ability in applying concept and procedure of object-oriented modelling. The type visualizing on the presentation strategy as an independent variable includes 2 treatments, static visualization and animation visualization. The student’s learning style (visual and verbal) act as a moderator variable. The instructional strategy on the multimedia learning follows Merrill (Component Display Theory) and the multimedia presentation format follows Mayer and Moreno (Seven Principles of Multimedia Learning). Learning with computer-based multimedia was conducted in the class with the research subject was the students of STMIK-STIKOM Bali who were in their fourth semester in the year 2011/2012. The experiment design used MANOVA factorial 2x2 design with the samples of 164 students spreaded in 6 different classes. Based on the data analysing, it is concluded that the student’s learning results (their ability to apply the object-oriented modelling concept and procedure) of a group of students who received learning by computer-based multimedia using animation visualization presentation were more superior rather than group of students with the static visualization presentation, anything the student’s learning style (visual/verbal).

Keywords: Multimedia learning, presentation strategy, static visualization, animation visualization, learning style, application of the concepts, application of the procedures, object-oriented modelling.

I. INTRODUCTION
Multimedia learning is one component of e-learning which acts as information/message/instruction delivery media. The technology of multimedia keeps developing and increase in using it [10][5]. The development of this technology both in hardware and software has enable well teaching techniques and practices in traditional classes (face-to-face instruction and chalk-and-talk) to be realized in learning through multimedia or multimedia learning (computer-based). This multimedia learning has important role in enhancing the learner’s experience in learning and understanding deeply in solving problems or the attitude in learning materials [16][24].

According to Clark (2008), there are 4 main elements that has to be paid attention in order for a learning can be effective, they are the learning result (the knowledge achievement), type of content, learning method, and delivery media. Thus in learning context through multimedia, the multimedia learning can be said as effective if it succeeds in integrating those 4 elements.

Besides that, the effectiveness of multimedia learning will increase if these are noticed in designing and producing: the preferences of learner’s learning style [2][18]; the availability of multimedia interactivities or learner control facility (stop and play buttons) in adapting based on the cognitive load of learners during the learning process [14][9][2][25]; the condition of topic (static/dynamic content type) which is presented [21][7] and the visualization content type (static visualization or dynamic/animation visualization) [12].

This research aims to investigate the effect of visualization type—on presentation strategy of computer-based multimedia learning—and the learning style to the student’s ability in applying concept and procedure of Object-Oriented Modelling (OOM). The OOM is a subject that learned to the students of computer system in STMIK-STIKOM Bali. The type of visualization on the multimedia presentation strategy acts as independent variable with two treatments, they are static visualization and animation visualization. The student’s learning style (visual/verbal) acts as moderator variable. The learning strategy follows Merrill (Component Display Theory) and multimedia presentation format follows Mayer and Moreno (Seven Principles of Multimedia Learning). The computer-based multimedia learning is conducted in the classroom with the research subjects are the fourth semester students of STMIK-STIKOM Bali in their academic year of 2011-2012. The experiment design uses Manova factorial 2x2 design with the size of samples are 164 students spread in 6 classes.

Literature Review
Cognitive Theory of Multimedia Learning
In [22], cognitive process is defined as a change in thinking, intelligence and the learner’s
language. This change happens because there is a learning process. Model of how human learns (or how human mind works) is presented in Figure 1. That model is known as cognitive theory of learning with multimedia [15][2].

According to Figure 1, there are 3 important cognitive processes: (1) Selecting words and images, as a first step to give attention to words and pictures which are relevant on the materials, which is presented in short term memory related to the five senses (sensory memory/senses), (2) Organizing words and images, as second step which mentally organize the selected materials in verbal and pictorial representation coherent with working memory, and (3) Integrating, as the final step which integrate verbal representation and pictorial one with another with prior knowledge in long term memory.

Information Presentation Principles in Multimedia Format

Presenting information in a multimedia format with animation visualization can promote the learner’s understanding if it is used in a consistent way by cognitive theory of multimedia learning [14][2]. Because of that, they highlighted seven principles in information presentation using animation in multimedia formats: (1) Multimedia principle, the learner learns better with animation and narration (audio) rather than only with narration; (2) Spatial and temporal contiguity principles, the learner learns better if the text is presented closely with the relevant animation portion, and the portion related to the narration and animation is presented at the same time rather than successively; (3) Coherence principle, the learner learns better from animation and narration if the words (text), sound and pictures which are not relevant are erased; (4) Modality principle, the learner learns better with animation and narration rather than with animation and text on screen; (5) Redundancy principle, the learner learns better with animation and narration rather than with animation, narration and text on screen; (6) Segmentation/interactivity and pretraining principles, the learner learns better if there are a proper facilities to manage the essential processing in order to avoid overloading on its cognitive system and the learner learns better if they are given material orientation session quickly (relevant) connected with the content which are learned before presentation begins; (7) Personalization principle, the learner learns better from animation and narration with conversational style rather than formal style.

The Effect of Visualization Type—on Presentation Strategy of Computer-Based Multimedia Learning—towards the Learning Results

In this research, presentation strategy of computer-based multimedia learning acts as independent variable with two treatments, they are static and animation visualization. Content that is given is the same for both treatment, which is Object-Oriented Modelling subject.

From those two different visualization types, the static visualization (the content which is presented simultaneously on screen) and animation visualization (the content is presented gradually on screen), the content with animation visualization gives facilities to the learners in managing the cognitive process precisely during the learning process to avoid overloading on their working memory rather than content with static visualization. By this, it is hoped that it can give a significant effect to the learner’s learning results.

Learning Style

Learning style is a preference of how the learners acquire information and process it into a meaningful knowledge.

Felder model is one of learning style model that has an impact on academic competence and retention. This model in scaling the learner’s learning style uses Index of Learning Styles (ILS) from Felder and [Soloman whose reability and validity has been tested for the students of engineering [13]. Felder/Soloman model has 4 dimension of learner’s learning style [3][6][13]:

1. Information Processing consisted of active (learn by trying things out, enjoy working in groups) or reflective (learn by thinking things through, prefer working alone with one or two familiar partners),
2. Perception consisted of sensing (concrete, practical, oriented toward facts and procedures) or intuitive (conceptual, innovative, oriented toward theories and underlying meanings),
3. Input consisted of visual (prefer visual presentations of presented material, such as pictures, diagrams, and flowcharts) or verbal (prefer written and spoken explanations, and
4. Understanding consisted of sequential (linear thinking process, learn in incremental steps) or global (holistic thinking process, learn in large leaps).
The optimal learning can be achieved if there is a match between the learner’s learning style and the teacher’s teaching style.

**The Effect of Learning Style towards the Learning Results**

In a learning, the existence of different learning style can give a significant impact to the learner’s learning results (the learning becomes ineffective) if these things happen: (1) The teacher’s teaching style is not match with some of or entirely learner’s learning style [18][4], and (2) In learning context with multimedia, the multimedia learning has not accommodate the different learning style of the students [2].

**The Interaction Effect Between Visualization Type—On Presentation Strategy Of Multimedia Learning—And Learning Style Towards The Learning Results**

Learning method consists of 3 kinds of strategy: (1) Organizational strategy, (2) Delivery Strategy, and (3) Management Strategy. The visualization type of content presentation strategy is included into a delivery strategy. Therefore that strategy has become a part of learning method/strategy. Referring to the managing strategy, it is possible to be an interaction between the learners with the content presentation. Related to that, [18] states that the interaction between learning style and learning strategy (strategy-by-learning-style) can have a significant impact in increasing the learners ability to acquire information/knowledge which are presented.

**II. METHODS**

**Research Variable and Experiment Design**

This research is a quantitative research with quasi-experimental approach. The purpose is to test the effect of independent variable to the dependent variable. The independent variable is visualization type onaccordance computer-based multimedia learning presentation strategy with two treatments, they are presentation with static visualization and animation visualization, and the learning style of the learner (visual/verbal) as the moderator variable. The dependent variable is results of learning which are the application of concept and procedure. The material learned is object-oriented modeling. Seeing that there are 2 dependent variables, then the Manova factorial experiment design 2x2 is used in this research.

**Research Subject**

The subject of this research is the fourth semester students of computer system in STMIK-STIKOM Bali which are 164 students spread in 6 different classes. The amount of students from both acts group who participated in this research are grafted on Table 1. The equivalence of both tested groups are based on the subjects grade that they achieved (by converting the grades into numbers) with the non parametric statistical analysis Mann-Whitney Test, and the result concludes that both groups are equivalent.

**Treatment Design**

The comparasion aspects of treatment design conducted computer-based learning with multimedia, which is multimedia learning with visual static and animation presentation are described in Table 2.

In its implementation, to each type visualizing: there are three class of student accepting same treatment; there are six module multimedia of same study (topic differ to each module); time of study at same week to each module; final tes at same week.

**Table 1. The Amount of Students Based on Treatment and Class Groups**

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>Class</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static Visualization</td>
<td>A</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Amount</td>
<td>85</td>
<td>51.8</td>
<td></td>
</tr>
<tr>
<td>Animation Visualization</td>
<td>D</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Amount</td>
<td>79</td>
<td>48.2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>164</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

*Note: n = amount of students*

**Measurement of Research Variable**

In this research, there are two kinds of variable whose data is acquired through measuring, they are dependent variable and moderator variable:

1. Dependent (performance) variable measured by final test by using the instrument developed by researcher. There are two kinds of dependent variables, they are the ability in applying concept and procedure of object-oriented modeling. This instrument is adapted and modified from the test (assignment) facilitated by [19]. The instrument has been validated (content validity) by two validators. The instrument has reallibilty coefficient (Alpha Cronbach) for the ability in applying concept is 0.67 and for the ability in applying procedure is 0.68.

2. Moderator Variable—Index of Learning Style (ILS)—is measured by instrument used by the researcher. This instrument is adapted from the instrument used to measure the learning style according to the Index of Learning Style (ILS) from Felder-Soloman [13].

**Data Collecting and Analysis Method**

The average score description for the learning result is stated in Table 3. The measuring results data of all research variables is then analysed using multivariate variance analysis technique (MANOVA).
Some statistic assumptions have been tested before doing analysis, specially for normalization and similarity of variance-covariance matrix [8].

III. RESULT

Analysis Result

The test/analysis result of MANOVA 2×2 for the effect of visualization type and learning style to the student’s ability in applying concept and procedure of object-oriented modeling is stated in Table 4. Based on those Table, it can be concluded as follow:

(1) On student’s ability in applying concept: there is significant effect of visualization type (animation vs static); there is not significant effect in different learning style (visual vs verbal); there are not significant effect on interaction between the factors of visualization type and learning style.

(2) On student’s ability in applying procedure: there is significant effect of visualization type (animation vs static); there is not significant effect of the different style of learning (visual vs verbal); there is not significant effect of interaction between factors of visualization type and learning style.

Discussion

The learning with Multimedia with animation visualization presentation is more effective than the presentation using static visualization, especially those who are related with the learning result. This result is concord with the results of previous research conducted by [12][20]. The superiority of multimedia learning with animation visualization compared with the static visualization can happen because the multimedia learning (animation) accommodate the information presentation principles in multimedia format [14][2], especially related with the multimedia principle, temporary contiguity principle and segmentation principle. Those principles are applied to manage the cognitive load of the students during cognitive process in learning.

There is not significant difference of learning result on multimedia learning between a group of students who have visual learning style and those who have verbal learning style. The absence of learning style influence to the student’s learning result in this research is in accordance with the results of previous research conducted by [26][17][11]. The absence of impact on student’s learning style factor (visual vs verbal) on multimedia learning towards the learning result can happen because the multimedia learning is quite successful in accommodating the preferences of the student’s learning style (visual/verbal).

There is not significant effect of interaction between Visualization Type—on Presentation Strategy—and Learning Style towards the learning result. The absence of that interaction is in accordance with the results of previous research conducted by [17][11]. The absence of that interaction between visualization type—on multimedia learning presentation strategy—and learning style is possible because of the learning style (visual vs verbal) is not significant effect to the learning result.

IV. LUSION

The students who follow the learning through interactive multimedia learning (student control) with computer-based with animation visualization presentation, the learning result in applying the concept (as procedure subordinate) and procedure of object-oriented modeling, is more effective than students who follow learning with static visualization presentation, despite the learning style had by the students (visual/verbal).

REFERENCES


### Table 2. The Comparison Aspects of Computer-Based Multimedia Learning Treatment Design

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Multimedia Learning with Static Visualization Presentation*</th>
<th>Multimedia Learning with Animation Visualization Presentation*</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content Presentation/Learning Materials (presentation)</td>
<td>The content segments which consists of several sub-segments which are displayed simultaneously on screen.</td>
<td>Content segment which consists of several sub-segments which are displayed gradually (sub-segment per sub-segment) on screen. The time of display per sub-segment is 1-3 seconds, and pause between sub-segments is 2-5 seconds.</td>
<td>One content of sub-segment consists of few words/sentences or half/all picture/diagram/table. On visualize animation; the content of sub-segment can be displayed in many formats.</td>
</tr>
<tr>
<td>Learner Control (learner control)</td>
<td>The availability of STOP and CONTINUE buttons as the controller of narration (voice).</td>
<td>The availability of STOP and CONTINUE buttons as the controller of sub-segment and narration (voice).</td>
<td>The controller button as representation of the existence of user interactivity with the multimedia learning besides other buttons,</td>
</tr>
<tr>
<td>Practice (practicing)</td>
<td>The availability of practice material of assignment. The material is displayed simultaneously on screen without narration.</td>
<td>The availability of practice/exercise material. The material is displayed gradually per sub-segment on screen without narration.</td>
<td>The lecturer along with the students discuss the exercise/practice questions given.</td>
</tr>
</tbody>
</table>

* Content adopted & modified from [23]

### Table 3. The Average Score Description for the Learning Result

<table>
<thead>
<tr>
<th>Group Treatment</th>
<th>Learning Style</th>
<th>The Ability in Applying Concept</th>
<th>The Ability in Applying Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>n</td>
<td>Mean</td>
</tr>
<tr>
<td>Static Visualization</td>
<td>Visual</td>
<td>58</td>
<td>2.6</td>
</tr>
<tr>
<td></td>
<td>Verbal</td>
<td>27</td>
<td>2.4</td>
</tr>
<tr>
<td>Animation Visualization</td>
<td>Visual</td>
<td>56</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>Verbal</td>
<td>23</td>
<td>2.7</td>
</tr>
</tbody>
</table>

Note: n = amount of students

### Table 4. Test Result of MANOVA 2x2 for the Effect of Visualization Type and Learning Style to Dependent Variable

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>DEPENDENT VARIABLE</th>
<th>Sum of Squares</th>
<th>Freedom Degrees</th>
<th>Mean Square</th>
<th>F</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>Applying Concept</td>
<td>1152.606</td>
<td>4</td>
<td>288.152</td>
<td>956.052</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>Applying Procedure</td>
<td>964.458</td>
<td>4</td>
<td>241.114</td>
<td>747.178</td>
<td>.000</td>
</tr>
<tr>
<td>Visualization Type (A)</td>
<td>Applying Concept</td>
<td>2.055</td>
<td>1</td>
<td>2.055</td>
<td>6.819</td>
<td>.010</td>
</tr>
<tr>
<td></td>
<td>Applying Procedure</td>
<td>1.886</td>
<td>1</td>
<td>1.886</td>
<td>5.844</td>
<td>.017</td>
</tr>
<tr>
<td>Learning Style (B)</td>
<td>Applying Concept</td>
<td>.872</td>
<td>1</td>
<td>.872</td>
<td>2.894</td>
<td>.091</td>
</tr>
<tr>
<td></td>
<td>Applying Procedure</td>
<td>.637</td>
<td>1</td>
<td>.637</td>
<td>1.973</td>
<td>.162</td>
</tr>
<tr>
<td>A*B</td>
<td>Applying Concept</td>
<td>.016</td>
<td>1</td>
<td>.016</td>
<td>.051</td>
<td>.821</td>
</tr>
<tr>
<td></td>
<td>Applying Procedure</td>
<td>7.30E-006</td>
<td>1</td>
<td>7.28E-006</td>
<td>.000</td>
<td>.996</td>
</tr>
<tr>
<td>Error</td>
<td>Applying Concept</td>
<td>48.224</td>
<td>160</td>
<td>.301</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Applying Procedure</td>
<td>51.632</td>
<td>160</td>
<td>.323</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>Applying Concept</td>
<td>1200.830</td>
<td>164</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Applying Procedure</td>
<td>1016.090</td>
<td>164</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: s = significant; ns = not significant; α = 0.05

B - 40