THE EFFECTS OF INQUIRY-BASED LEARNING AND LEARNING STYLES ON PRIMARY SCHOOL STUDENTS' CONCEPTUAL UNDERSTANDING IN MULTIMEDIA LEARNING ENVIRONMENT

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Abstract. *This research aimed to identify the effects of inquiry-based learning on the conceptual understanding of students with various learning styles in the multimedia learning environment. This research was factorial experiment with the quasi-experimental design. There were total of 157 primary school students in Bali, Indonesia being involved as the subjects of the study. There were two instruments used in this research. The first instrument was a questionnaire adapted from Index of Learning Style (ILS) developed by Felder and Soloman for measuring the verbal-visual learning styles. The second instrument was the conceptual understanding test for measuring students' conceptual understanding in the form of multiple-choice test. The research discovered three findings as follows: (1) there is a significant difference in terms of conceptual understanding between students who are taught by inquiry-based learning and direct instruction strategy, (2) there is a significant difference in terms of students conceptual understanding between visual and verbal students, (3) there is a significant interaction between different learning strategies (inquiry based learning and direct instruction strategy) and students' learning styles (visual verbal) toward students conceptual understanding.*

Keywords: *conceptual understanding, inquiry-based learning, learning style, multimedia learning.*

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Introduction

Learning is a complex process which needs to be proven empirically. It is not only seen from the teachers and students' perspective, but also how technology works in instructional process. Educational technology and instructional strategy are correlated with the philosophy of science in the effort of providing solutions for learning issues to improve scientific inquiry (Cilesiz & Spector, 2014). One of the concepts of philosophical-based learning is meaningful learning (Arends, 2013). According to Jansen and Merwe (2015), a meaningful learning is a model in a 21st century learning context. A meaningful learning requires the learning outcome that also produces graduates who have the critical thinking ability, problem-solving skill, and who will be of service in the future. Further, in the context of meaningful learning, a learning process that encourages conceptual understanding is a strong foundation that can facilitate students to have a higher level of thinking (Degeng, 1988; Llewellyn, 2013; Reigeluth, 1999; Reigeluth, Beatty, & Myers, 2017).

Another problem that commonly arises in meaningful learning is the students' low achievement (Anderson & Krathwohl, 2001). Natural science as one of the subjects taught in elementary schools is considered to be difficult for students (Jonstone, 1991; Llewellyn, 2013). This perception was supported by research findings which stated that a number of misconception occurred in natural science subject (Akbas & Gencturk, 2011; Thompson & Logue, 2006). One of the misconceptions took place in the topics of photosynthetic and organ systems of the human body (Laksana, Degeng, & Dasna, 2017; Svandova, 2014).

The importance of the conceptual understanding in learning has reinforced the use of inquiry-based learning (Choi, Lee, & Jung, 2008; NRC, 2000). Inquiry-based learning has regarded as the foundation of an inductive

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approach that is highly suitable to be applied for developing students' conceptual understanding (Prince & Felder, 2007). Therefore, as cited in NRC (2000), inquiry-based learning is superior in changing one's conception according to the constructivist view. The inquiry-based learning has commonly been used during learning since it has many advantages to the development of students' conceptual understanding and reasoning skill in its problem-solving function (Kischner, Sweller, & Clark, 2006).

There are various kinds of inquiry-based learning strategies. One of them that is applicable for beginners is 5E inquiry model (Acish, Yalcon, & Turgut, 2011; Laksana, 2017). Such model includes the engage, explore, explain, elaborate, and evaluate (Bybee, 2006). A concept attainment learning model is appropriate for a learning concept with a clear set of attributes. This strategy has been proven to allow students to develop their definitions and understandings based on the approach used (Magee & Ryan, 2012).

There are three types of inquiry learning strategy, namely guided inquiry, free inquiry, and modified inquiry (Spencer & Tracy, 2012). Among those three, guided inquiry has been highly recommended since it is more superior to the other types of inquiry strategies (Bunterma et al., 2014). Kirschner, Sweller, and Clark (2006) have pointed out another reason for the importance of guidance stating that students learn a little amount through a constructivist approach. Most teachers try to apply the constructivist approach by providing appropriate guidance. Another study has also suggested that guided inquiry is highly recommended to be implemented in learning, especially for young learners in primary school level (Bunterma, 2014; Koksal & Berberoglu, 2014; Laksana, 2017).

Ideally, the application of inquiry strategy requires hands-on activities, in which the students actively investigate real phenomena (Levitt, 2002). Hands-on activities in scientific learning cannot be separated from the availabilities of learning instruments and materials, as well as the consideration of time that includes the preparation stage. The hands-on activities for beginners could also cause harm such as accident so that there is a limited option for hands-on activities. Hence, a deeper investigation in learning management alternative, namely an integration of media technology or multimedia in the implementation of learning is necessary to be done (Spencer & Tracy, 2012).

The advancement of computer-based multimedia technology has a potential to create learning materials that could support the learning process (Mayer, 2007). Such advancement allows the learning media in an inquiry class to be designed based on real phenomena either in the form of laboratory fact video or daily life video (Bass, Contant, & Carin 2009). Some inquiry processes, such as identification of the problem, hypothesis, experiment, observation and evaluation, classification, explanation, and drawing conclusion has been proven that it could be well facilitated by using the aid of a computer (Bransford, Brown, & Cocking, 2000; Chinn & Silver, 2002).

The advantages of using computer-based media in learning via inquiry strategy are a shorter period of the experiment, the more complex design of the experiment, and more focus on theoretical aspect (Chinn & Silver, 2002). Further, Spencer and Tracy (2012) have stated that, by using a computer, the accuracy of the experimental activities and results (either a real or simulation phenomenon) could be controlled by the learning designer so that it could be adjusted with the theory.

Besides, the efficiency in designing the conceptual visualization, either static or dynamic, is one of the superiorities of computer-based media in supporting the theoretical aspect. It is supported by Bass et al. (2009) who has stated that the best way for elementary or secondary school students to be able to learn science is through experiences. However, it is not practical, economical, or safe. Simulation of experiences using a computer could be an effective alternative. Other findings also has pointed out the importance of multimedia learning integration into inquiry strategies (Bruckermann, Aschermann, Bresges, & Schlüter, 2017). The integration of multimedia technology with inquiry-based learning has a potential to improve students' conceptual understanding (So & Kong, 2008; Turkmen, 2006). Hence, it is essential to perform a study about the development of a learning design that integrates multimedia into inquiry-based learning to enhance students' conceptual understanding (Hong, Hwang, Tai, & Tsai, 2017).

Learning and teaching process does not only relate to the strategy of information delivery that is limited to an integration of multimedia, more importantly, students' characteristics also need to be a concern (Reigelut et al., 2017). The characteristics of young learners' learning style are different from adults' (Bransford et al., 2000). In accordance with Piaget's theory of cognitive development (Piaget, 2000) stating that young learners (aged 7-11 years) have had the ability of logical thinking, but only about concrete objects. They still have difficulties to think abstractly (Piaget, 2000). In line with such problem, a certain strategy is necessary for a certain learning condition, which leads to effective, efficient, and interesting results of learning (Degeng, 2013; Reigeluth et al., 2017). A learning condition includes the characteristics of the field of study and the students' characters. One important character to be studied is students' learning style. In relation to multimedia learning, verbal-visual learning style

has a strong disposition to be explored. Such kind of learning style relates to the process of receiving information into students' cognitive structures (Mayer, 2007; Mariano, 2014).

Based on the aforementioned explanation, inquiry learning strategy is potential to be a significant strategy for improving elementary school students' conceptual understanding. Students with different learning styles would obtain different learning benefits so that it is necessary to perform a research about inquiry strategy. The influence of verbal-visual learning style is highly relevant to be explored since it has a strong correlation with the designing of teaching materials in the multimedia learning environment. Thus, it is important to investigate the effects of inquiry based learning and learning styles in multimedia learning environment on the improvement of students' conceptual understanding.

Problem of Research

This present research aimed at examining learning styles as one of the factors that affects students' conceptual understanding in multimedia learning environment. Verbal and visual styles play a key role to the inquiry based learning and direct instruction. Specifically, the research problems were formulated as follows: (1) is there any significant difference on the students' conceptual understanding between those who are treated by using inquiry based strategy and direct instruction in multimedia assisted instruction? (2) is there any significant difference on students' conceptual understanding between those who have verbal and visual dimension, (3) is there any significant effect of the interaction between the learning strategy (inquiry-based learning and direct instruction) and learning styles (verbal and visual) toward students' conceptual understanding?

Research Focus

This research focuses on (1) finding out the effects of the learning strategy (inquiry based learning and direct instruction) toward students' conceptual understanding, (2) finding the effect of the learning styles upon the students' conceptual understanding.

Methodology of Research

General Background of Research

This present research utilized quasi-experimental design. It is based on the consideration that the inability of the researcher to conduct individual randomization. This design was also chosen because the participants were taken from four intact classes. In this respect, the randomization was done through cluster sampling

Therefore, this research divided students into two groups namely experimental and control group. This research was a quasi experimental design. In addition, this research utilised the two-factor analysis experiment. With that rationale, intact groups were used. Both the experimental and control group consisted of two classes. This research was conducted from January to July 2017.

Table 1.   Scheme of factorial experiment 2x2.

		Learning Strategy	
		Inquiry based learning	Direct instruction
Learning Style	Verbal	Group 1	Group 2
	Visual	Group 3	Group 4

Table 1 provides a clearer picture of the effect of the variables used in this research. By utilising this design, the main and interactional effect from each variable could be shown clearly in accordance to what is stated in the research hypothesis. The main effect of the variables were divided into two types, namely (1) the main effect of

the learning strategy without considering the learning styles, and (2) the main effect of the learning styles without considering the learning strategy. The interactional effect provides information in regards to the interaction between the learning strategy and the learning styles to the dependent variable that becomes the focus of the research.

Sample of Research

The participants were selected by considering the population of the research, they are fifth graders from all elementary schools in South Kuta, Bali, Indonesia. The schools involved covered those that were categorized as favourite and non-favourite schools. From all participants, the researcher decided the sample through cluster sampling. There were total 157 primary school students involved in this research coming from 4 classes in two different schools. The distribution of the subjects can be seen in Table 2.

Table 2.   Distribution of the participants.

School Name	Class	Treatment	Number of Students					
			Involved			Following full		
			M	*F*	*n*	*M*	*F*	*n*
SDN 4 Jimbaran	VA	IBL	18	24	42	17	23	40
	VB	DI	27	15	42	26	13	39
SDN 6 Jimbaran	VA	IBL	25	19	44	25	15	40
	VB	DI	19	23	42	17	21	38
	N		89	81	170	85	72	157

Note: M (Male), F (Female); IBL (Inquiry Based Learning); DI (Direct Instruction)

Instrument and Procedures

This research was conducted through several stages, they cover : (1) developing and trying out the instruments, (2) administering the pre-test of conceptual understanding, (3) administering the questionnaire about verbal-visual learning style, (4) conducting two different instructional strategy, (5) conducting the posttest, and (6) analysing the data.

There were two instruments used to measure the research variable that became the primary unit analysis, they are: (1) questionnaire to receive students' learning style, (2) achievement test to measure students' conceptual understanding.

The questionnaire used in this research was a result of adaptation from Index of Learning Styles (ILS) developed by Felder and Solomon (Felder & Silverman, 1988; Felder & Spurlin, 2005). The questionnaire consisted of 44 questions that measure 4 learning style types: sensing-intuitive, verbal visual, active-reflective, and sequential-global. Each learning style is measured from 11 items in the ILS questionnaire. Specifically, the researcher adapted the 11 items that measure the students verbal-visual dimension. An adaptation was conducted due to this dimension was originally developed and tried out to secondary schools and universities (Felder & Silverman, 1988; Felder & Spurlin, 2005) with different context from Indonesia. The reliability test showed the score was 0.832. This reflected that the instrument was reliable to measure the learning style. In addition, contructed validity was tested by using factor analysis. This showed that the factors were valid. This test was conducted by involving 346 primary school students as participants.

On the other hand, an achievement test was conducted to measure students' conceptual understanding. The form of the test was a multiple choice test. This test was developed by the researcher, thus C2 operational words from Bloom's taxonomy were used (Anderson dan Krathwolh, 2001). In addition, there were 20 item in total for the test. For this test, there were 199 participants involved. The reliability from alpha Cronbach test showed that the conceptual understanding was 0.977 with 20 questions were valid where the range was from 0.216 -0.425.

This research examined the effect of inquiry based learning by using 5E model and direct instruction in

multimedia learning environment. It focused on natural science subject in primary school with specific course on "human organ system, photosynthesis, and objects characteristics". Moreover, this was conducted in 4 weeks that cover 8 meetings in total.

Table 3-a.   Activities based on 5E model in multimedia integrated inquiry strategy.

Phase	Teacher Activity in 5E Model Inquiry with Multimedia
Engage	1. Raising students curiosity and attract their interests by displaying an infographic model of a topic on multimedia 2. Determining students' prior knowledge of a certain concept 3. Inviting learners to express their thought 4. Inviting learners to question themselves
Explore	1. Encouraging interaction among learners by grouping them and ask them to explore a topic in multimedia displays (using tablet, laptop, smartphone) 2. Questioning learners to lead them to make arguments 3. Giving students time to have a cognitive conflict
Explain	1. Encouraging learners to use their daily experience and those that they got during the engage and explore phases to construct an explanation. 2. Delivering questions that help learners to give explanation 3. Asking for supporting evidence regarding their explanation 4. Giving learners time to compare their ideas with other students and revising their work 5. Introducing some terminologies and giving alternative explanation after the learners express their ideas through multimedia displays
Elaborate	1. Focusing learners attention to the relation between the new concept and their experience 2. Encouraging learners to use what they have learned during the activity 3. Giving reinforcement to the learners with the use of scientific terms and description which have been introduced previously (displayed in infographic mode) 4. Asking questions to help learners conclude their ideas based on evidences and data gathered
Evaluate	1. Observing and assessing learners understanding, performance, and skills 2. Interviewing learners regarding the assessment and improvement 3. Encourage learners to assess themselves

Inquiry strategy in multimedia learning environment had a different phase or steps from direct instruction. These two strategies are different in terms of its syntax. Table 3-a and 3-b present the syntax of the two strategies in multimedia learning environment.

Table 3-b.   Activities based on direct instruction in multimedia integrated inquiry strategy.

Phase	Teacher Activity in direct Instruction with Multimedia
Presentation	Teacher delivers the objective of the study and motivates students to learn Teacher confirms students initial knowledge and concept needed for the learning Teacher presents the core information, theme, and demonstrate how to use multimedia Teacher confirms students' knowledge and clarifies the wrong concept
Practice	Teacher delivers assisted exercise to students with the utilization of multimedia Teacher assigns an independent exercise
Evaluation	Teacher checks students' independent exercise
Monitoring and feedback	Teacher gives feedback based on the evaluation and repetition as necessary Teacher assigns a homework for students as an apperception of the following meeting

Data Analysis

Two analyses were done in this research, i.e. 2x2 factorial analysis of covariance (ANCOVA) and descriptive analysis. The factorial ANCOVA analysis aimed to test the research hypothesis where, (1) there are significant effects of the educational strategy (inquiry based learning and direct instruction) toward students' conceptual understanding, (2) there are significant effects of the learning styles upon the students' conceptual understanding, and (3) there is an interactional effect between the educational strategy and learning styles toward students' conceptual understanding. Descriptive analysis was performed to describe the students' conceptual understanding and the standard deviation.

Results of Research

A hypothesis test was done via a 2x2 factorial Analysis of Covariance (ANCOVA), in which the scores of conceptual understanding pre-test were utilized as a covariate. Three hypotheses were tested in this research. The summary of descriptive statistics and ANCOVA test results can be seen in Table 4 and Table 5.

Table 4 shows that the average score of conceptual understanding of the student group that has visual learning style and learned by using inquiry learning strategy after being controlled by the covariate variable was 78.77. The average score of conceptual understanding of students who have visual learning style and learning via direct instruction after being controlled by the covariate variable was 50.77. Meanwhile, the average score of conceptual understanding of the student group that has verbal learning style and learned by using inquiry learning strategy after being controlled by the covariate variable was 57.22. The average score of conceptual understanding of students who have verbal learning style and learning via direct instruction after being controlled by the covariate variable was 70.60.
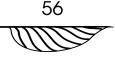
Table 4.   Descriptive statistics of the research findings.

Learning Strategy		*M*	*SD*	*n*
Direct instruction group	Verbal Learning Style	70.60	10.14	25
	Visual Learning Style	50.77	9.57	52
	Total	57.21	13.46	77
Inquiry group	Verbal Learning Style	57.22	8.47	27
	Visual Learning Style	78.77	10.51	53
	Total	71.50	14.20	80
Total	Verbal Learning Style	63.65	11.42	52
	Visual Learning Style	64.90	17.26	105
	N	64.49	15.55	157

The first hypothesis testing showed the results of 2x2 factorial ANCOVA test as shown in Table 5 reveals that there was a significant different between students who learned by using inquiry strategy and those who learned using direct instruction strategy (*F* value = 24.976, *p* = .0001).

Table 5.   Calculation on 2x2 factorial ANCOVA test results.

Source	Type III SS	*df*	*MS*	*F*	*p*
Corrected Model	28579.594[a]	4	7144.899	118.956	.0001
Intercept	49373.474	1	49373.474	822.022	.0001
Conceptual understanding Pre-test	5617.539	1	5617.539	93.527	.0001

Source	Type III SS	df	MS	F	p
Learning strategy	1499.593	1	1499.593	24.967	.0001
Learning style	763.013	1	763.013	12.703	.0001
Learning strategy * Learning Style	16290.644	1	16290.644	271.224	.0001
Error	9129.642	152	60.063		
Total	690675.000	157			
Corrected Total	37709.236	156			

a. R Squared = .758 (Adjusted R Squared = .752)

The results of a further study of *LSD* are presented in Table 6. The results of the *LSD* further study show a significance value less than 0.05 and the posttest average value of inquiry group was better than the direct instruction group (71.50 > 57.22; as shown in Table 4).

Table 6.   LSD test on learning strategy.

Learning strategy		Mean Difference (I-J)	Std. Error	p
Direct instruction	Inquiry	-6.581*	1.317	.0001
Inquiry	Direct instruction	6.581*	1.317	.0001

*. The mean difference is significant at the .05 level.
b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments)

The results of analysis on the second hypothesis can be identified from the results of 2x2 factorial ANCOVA test as presented in Table 5. The analysis results pointed out that a significant difference was found between the conceptual understanding of students with visual learning style and the students with verbal learning style (*F* value = 12.073). The results of the *LSD* advanced study are presented in Table 7. Such results showed a significance value less than 0.05. The students who have visual learning style have better average posttest value than the students who have verbal learning style (64.90 > 63.65; as shown in Table 4).

Table 7.   LSD test on learning style.

Learning Style		Mean Difference (I-J)	Std. Error	p
Verbal Learning Style	Visual Learning Style	5.190*	1.456	.0001
Visual Learning Style	Verbal Learning Style	-5.190*	1.456	.0001

*. The mean difference is significant at the .05 level.
b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments)

The third hypothetical test results revealed that the interaction between inquiry strategy and learning style has an influence on students' conceptual understanding. The results of ANCOVA test presented in Table 4 showed such influence of interaction (*F* = 271.224).

Discussion

The discussion covered three main things. The first discussion was about the influence of the learning strategies (inquiry strategy and direct instruction strategy) on students' conceptual understanding. Second, the discussion is

about the effect of learning styles (verbal and visual dimensions) on students' conceptual understanding. Lastly, the discussion is about the effect of the interaction between learning strategy and learning style on students' conceptual understanding.

The first research finding showed that students with inquiry strategy and students with direct instruction strategy have a significantly different conceptual understanding. The results revealed that inquiry strategy is better than direct instruction strategy. Inquiry strategy is effective in strengthening students' conceptual understanding since, in applying the strategy, the teacher gave questions that range from the easiest to the most complex. Therefore, students could build the construction of stronger understanding. Besides, the inquiry strategy allows students to find answers and build a deeper understanding independently and to share conceptions in groups of scientific discussion. Also, this strategy requires a teacher to explain the concept based on the materials sourced from textbooks, scientific journals, or the internet in order to construct more in-detail students' conceptual understanding. Additionally, the elaboration stage of this strategy allows a teacher to make a new conceptual connection from experience, find similarities and differences, and create a simple flowchart showing the process of a topic in order to make it easier to be understood and memorized by the students. Furthermore, the multimedia exploration allows students to access their understanding in anytime so that they could present the concept in their words.

The research findings were in line with the results of the research about the superiorities of inquiry strategy in improving students' conceptual understanding, which was conducted previously (Bruckermann et al., 2017; Kirna, 2010; Pandey et al., 2011; Sever & Guven, 2015). Inquiry strategy encourages students to have more group activities. Inquiry strategy includes several learning activities, namely elicitation of students' initial ideas (pre-inquiry), review of students' initial ideas (while inquiry), negotiation of definition (post-enquiry), a conceptual application in a new situation, and drawing conclusion and reflection. The component of inquiry is group activities, such as exploring, hypothesis testing, data collection, and providing an alternative explanation based on empirical evidence found by the students. The activities performed by the students assisted them to give more meaning to the learning process in their cognitive structures (Bass et al., 2009; Bransford et al., 2000).

Additionally, the teacher's role in inquiry strategy is as a facilitator, and the teacher develops a structure on cognitive knowledge based on the ideas of the students (Pandey et al., 2011). Hence, inquiry strategy provides a larger portion of students' independent learning activities. It is supported by Bransford et al. (2000) who has emphasized that students' initial experience and hypothesis hold an important role in learning, while the cognitive research showed that students' previous knowledge affects all aspects of their information processing.

In this research, the inquiry learning was accompanied by teacher guidance. The teacher guided the students by directing the discussion by providing investigation questions. Additionally, the teacher also assists the students by giving real cases in order to help students in exploring their fundamental knowledge. The results of this study are in agreement with the inquiry learning concept, i.e. learning with an inductive approach (Felder & Prince, 2007). Inquiry learning as an inductive approach is applied to develop students' conceptual understanding. Further, the inquiry strategy cannot be given independently as it challenges the students to connect their world with the topic in the curriculum. During its implementation, the inquiry does not only aim for personal competency, but also for improving students' involvement in their communities and creating social interactions (Bruckermann et al., 2017). Thus, the learning strategy was implemented with supervision since the students were still in elementary school level (Magee & Ryan, 2012). Another finding also revealed that guided inquiry provides more advantages than other inquiries or strategies that do not provide guidance and scaffolding (Arnold et al., 2014; Bunterma et al., 2014; Kawalkar & Vijapurkar, 2013; Laksana, 2017; Lazonder & Harmsen, 2016).

The research findings are also in line with the results found by NRC (2000) stating that inquiry strategy could develop the necessary conceptual understanding and thinking ability in solving problems. Besides, Joyce et al. (2009) showed the superiorities of inquiry strategy, namely enhancing scientific skill, creative thinking ability, independent learning, appreciating multi-definition, and developing awareness of tentative knowledge. Inquiry learning strategy is highly suitable for changing students' conceptions in accordance with the constructivist view.

This research also revealed that an integration of multimedia with learning encourages the effectiveness of learning. The multimedia is designed to be used by the students in the inquiry group. Each stage of inquiry is integrated with the multimedia, which includes a video about a concept such as the human blood circulation process. Such result is in agreement with the previous finding stating that multimedia technology makes learning more efficient (Heinich, 2002; Spector, 2009; and Wang, 2008). Also, Spector (2012) has performed a study presenting that an integration of multimedia technology in learning is potential to improve learning efficiency and outcome. Such potential could be seen on augmented reality-based learning and game-based learning, as well as multimedia-based learning.

Learning multimedia are components that can be used to support the learning process. It is based on a perception that learning can be better, effective, and pleasant if it is backed up by learning media that could attract students' interest and attention (Clark & Mayer, 2003; Degeng, 2013). Multimedia are highly prospective and very suitable to be used during learning (Passerini, 2007, Reigeluth, 1999; and Reigeluth & Carr-Cheliman, 2009). The utilization of multimedia cannot be separated with various studies that integrated technology with multimedia in a particular learning strategy. Many researchers have highlighted the importance of an integration of technology with multimedia and recommended to use multimedia which is supported by an inquiry strategy that is based on the learning environment (Kim et al., 2007).

The second finding of this research was in relation to the learning style variable and its connection with students' conceptual understanding. Such finding presented a significant difference between the conceptual understandings of students with visual learning style and those with verbal learning style. It was found from the inquiry group that the students with visual learning style have better conceptual understanding than the students with verbal learning style. However, such fact was not found in the direct instruction group. On the contrary, in direct instruction group, the students with verbal learning style have better conceptual understanding than the students with visual learning style.

Such finding is in good agreement with Felder & Solomon (2007; Mayer, 2007) who explained that visual learners have the ability to strongly remember by looking at pictures, diagram, a flow diagram, timeline, film, and demonstration. Students with visual learning style who learned using either inquiry strategy or direct instruction strategy could make a conceptual map, a flowchart of the process, find keywords, and visualize their understanding so that they have more holistic understanding compared with those with verbal learning style.

Nevertheless, when the teacher role is dominant, especially in direct instruction group, the students with verbal learning style could understand the words, write, and understand the teacher explanation more easily than the students with visual learning style (Huit, Monneti, & Hummel, 2009; Mayer, 2007). It is shown by the research finding that even though the multimedia given to inquiry and direct instruction groups is similar, the teacher has a more dominant role in presenting information when it comes to direct instruction strategy.

Learning by using inquiry strategy and multimedia is beneficial for students with visual learning style since they could connect one concept with another and try to find their similarities and differences during the exploration and elaboration stages. Multimedia, especially in the form of pictures, provides an opportunity for students with visual learning style to easily understand the topic they learn (Clark & Mayer, 2003).

The research findings are in line with other results which state that the academic achievement level of students with visual learning style is higher than that of students with verbal learning style (Choi et al., 2008; Felder & Brent, 2005; Litzinger, 2007). Conforming to such matter, Clark & Mayer (2003) reported that the provision of multimedia technology containing visual stimulus results in better understanding of students with visual learning style than those with verbal learning style. Hence, students with visual learning style have a better conceptual understanding when studying in a multimedia learning environment, yet the students with verbal learning style also could follow the lesson without difficulties (Pallapu, 2007).

Another finding in this research also revealed that a significant effect of the interaction between learning strategy and learning style was found on students' conceptual understanding level. Such interaction concluded that students with verbal learning style had a better conceptual understanding when learned by using a direct instruction than the inquiry strategy. Meanwhile, students with visual learning style had a better understanding when they learned by using inquiry strategy than direct instruction.

The direct instruction is beneficial for students with verbal learning style since they have ta better ability to understand sentences and words, either spoken or written, rather than students with visual learning style (Becker, 1998; Huit, 2009). In conformity to such findings, Parkinson & Redmond (2002) found that students with verbal learning style could acoustically understand a complex text, show a higher reading ability, and better language ability than the students with visual learning style. On the other hand, a direct instruction method is not beneficial for students with visual learning style as their needs to understand a topic through imagination, picture, graphic, and the conceptual map is not fulfilled since most of the materials are delivered in speaking although multimedia use accompanies it.

Students with visual learning style benefit greatly from inquiry learning strategy because they could connect one concept with another through a diagram, a flow of process, and a conceptual map during the exploration and elaboration processes. Hence, they could obtain a holistic understanding, even more, when accompanied by multimedia (Felder & Solomon, 2007). This is also supported by Hong et al. (2017) who found that there was a significant improvement of students who learn through inquiry based learning and technology assistance like iPad. Riding & Douglas (1993; Wang, 2008) found that students with visual learning style are more superior compared with the stu-

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dents with verbal learning style in learning that involves diagram, and motion and pictures, while the students with verbal learning style are better than those with visual learning style in learning with text. Visual learners use more diagrams to illustrate their understanding than the verbal learners. Meanwhile, inquiry learning strategy is not beneficial for students with verbal learning style. There was a low amount of spoken explanation given in this research. The students learned independently and in small groups most of the time. Mayer (2007; Pallapu, 2007) pointed out that the use of multimedia in learning is advantageous for students who have visual learning style since it could support the construction of their knowledge in understanding the concept.

Conclusions

The research revealed different conceptual understandings were found between students who learned using inquiry strategy and those who learned using direct strategy in multimedia learning. The conceptual understanding of students that learned using inquiry strategy is higher than those who obtained direct instruction strategy. This is because : (1) students started to construct a firmer concept when teacher delivered series of questions ; (2) the elaboration process comprised the relation between the new concept and students' experience ; (3) students' experienced was re-accessed through multimedia exploration so that they expressed the concept on their own language

Second, there are different conceptual understandings between verbal learners and visual learners. The conceptual understanding of visual learners is better than that of verbal learners. It was because the visual learners have longer retention from looking at pictures, diagram, flow, movies, or demo.

Third, different learning strategies (inquiry and direct strategies) and learning styles (verbal and visual) show an influence of interaction on students' conceptual understanding. The interaction pattern indicates that learning strategy and style strengthen the conceptual understanding of visual learners, yet they slow down the conceptual understanding of verbal learners. The information on the developed multimedia should be used for students who have verbal learning style. Based on the findings on this research, multimedia should be designed not inhibit the verbal style. It could be adapted since the visual learners were not inhibited from the multimedia.

As for future researchers, it is important to (1) conduct deeper investigation on other aspects of learning achievement such as the retention to conceptualize learning, application of the concept, analysis, synthesis, and creation, (2) the developed multimedia in this research functions very well for fifth grader students. However, the effectiveness of its usage should be seen more deeply specifically for students in grade I,II, III. Besides, an empirical study on different course subject like social science is necessarily to be done

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