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The Learning Styles of Prospective Biology Teachers at Islamic University in Indonesia

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Annotation. The aim of this study was to investigate the learning styles of prospective biology teachers in Islamic universities (PBTs-IU) in Indonesia during the COVID-19 pandemic. 195 PBTs-IU were surveyed by using the Felder-Silverman Learning Style instruments. The results show that in online learning PBTs-IU practice and like dimensions of learning styles, such as in active – social oriented learning, in sensing – existing ways, concrete material, careful with details, in visual – pictures, and in sequential – sequential progress.

Keywords: *prospective biology teachers in Islamic universities (PBTs-IU), Felder-Silverman Learning Style (FSLS), active/reflective, sensing/intuitive, sequential/global, visual/verbal.*

Introduction

As of 15th of April 2020, the COVID-19 pandemic has caused 191 countries to close their schools, affecting 1.6 billion children. Unesco (2020) has written that the absence of Internet access and devices is the reason for the delay in distance learning. Entering the period of August 2020, the COVID-19 pandemic has shown an increase in the number of infections. Based on data released by the Indonesian COVID-19 task force, in August, the number of infected Indonesians was 225,030 people. The Government of

the Republic of Indonesia has released data that predicts that the COVID-19 pandemic in Indonesia will last a long time (Djalante et al., 2020). These conditions have forced the Indonesian Ministry of National Education to continue to impose distance learning for every level of education. Based on official information, the Ministry of Education and Culture (Kemendikbud) has currently prepared learning scenarios, including encouraging online learning for students. One of the learning programs that have been implemented is a learning programme is one that accommodates online learning. Online learning is very appropriate to be used during the COVID-19 pandemic (Abidah et al., 2020). Thus, online learning with various platforms, such as Google Classroom, is the most preferred application for use in learning.

Learning styles are based on the most effective teaching or learning for students (Pashler et al., 2009). Changes in learning platforms due to the COVID-19 pandemic have changed the learning styles of students. The change in learning style will affect the acceptance of content and student attitudes in science learning (Cheng, 2014). For example, changes in learning styles are increasingly being incorporated into technology-enhanced learning (Graf et al., 2007). However, this condition needs to be re-proven, along with the COVID-19 which causes learning patterns to change from face-to-face to online learning. A real contribution is made if an investigation of learning styles and adaptive system development is carried out. Because learning styles are motivated by a learning style model which states that students have different ways that they prefer to learn. A further benefit is knowing how the learner's learning styles contribute to the teaching plan. This makes learning easier and leads to better achievement. Furthermore, students have difficulty learning if the learning style applied is not in accordance with their habits (Felder & Silverman, 1988; Felder & Soloman, 1997). Thus, these explanations strengthen the argument that the importance of research on student learning styles to be known by teachers.

Learning with Google Classrooms

In the 21st century, educators in higher education should use learning management systems in the learning process as a form of learning transformation from traditional systems to e- learning. The learning management system places a virtual learning environment as a tool for delivering teaching materials, processes, and evaluation in e-learning (Reshad, 2018). This concept is supported by continuous Internet access and collaboration in social networks, media, and games (Reshad, 2018). Finally, learning management systems are the main technology to support learning in higher education (Abazi et al., 2018).

Google Classroom has provided affordances for blended learning in higher education (Kumar et al., 2020). Its authors suggest exploring how Google Classroom is perceived and adopted in higher education. The use of a learning management system with Google classes is that it can increase student participation (Heggart & Yoo, 2018; Kumar et al.,

2020), students can access learning materials, discuss, provide feedback at any time (Dash, 2019).

Intention to use a learning management system is affected from perceived usefulness, perceived ease of use, and social norms. At the same time, besides managing learning with Google Classroom which is one of the main technologies to support learning in higher education (Abazi-Bexheti et al., 2018), there are other benefits and conveniences that students receive by learning to use computers (Yalcin & Kutlu, 2019). Because it is obvious that e-learning facilities such as Google Classroom are effective in helping learning in class (Bhat et al., 2018; Heggart & Yoo, 2018; Brown, 2018). Therefore, higher education managers must intensively provide communication and information technology infrastructure, train skills in using learning management systems, and write positive rules for using communication and information technology (Bervell & Umar, 2017).

Learning with Google Classrooms in Indonesia shows that learning has been well managed by the teacher, where students have high learning independence and moderate critical thinking skills (Rahmad et al., 2019). Furthermore, the use of Google Classroom in Indonesia has also been used to improve the quality of learning (Sudarsana et al., 2019). These findings can be seen from the results of investigations about learning during the COVID-19 pandemic that have been carried out by Rahiem (2020; 2021). The results of these investigations have shown that the student's learning experience and outcomes are good after using WhatsApp and Google Classroom. However, the study findings need to be proven by conducting other studies. Thus, this study proves that the use of Google Classroom and social media such asWhatsApp during the pandemic in Indonesia can also be well received by prospective biology teacher students (PBTs) at the Islamic University in Indonesia.

The Felder and Silverman Learning Styles

The Felder and Silverman Learning Style Model (FSLSM) with 4 dimensions of learning (Felder & Solomon, 2019) has been used by many researchers and in technology-based learning systems (Deborah et al., 2014). The four dimensions are active/reflective, sensory/intuitive, sequential/global, and visual/verbal.

Active/reflective. This type refers to an active or reflective approach in information processing, so that active learners tend to try everything and the best way to learn it is when they learn through practical activities. Active students always like to make friends and like teamwork and collaboration (Huang et al., 2012). On the other hand, unlike active learners, reflective learners prefer to think about their own topic, and take a step back, and examine the situation from a different perspective; they tend to be theorists (Khenissi et al., 2016).

Sensory/intuitive. The characteristics of students who like sensing are that they tend to learn facts and solve problems using familiar standard methods and approaches, and they do not like surprises and unexpected changes. They love details, and they don't like

surprises or unexpected effects. In contrast to sensing, intuitive learners are interested in finding relationships and opportunities and are more innovative and creative in sensing; they prefer innovation and resist repetition. They become bored with details and welcome complexity (Khenissi et al., 2016).

Sequential/global. The characteristics of students who like this dimension are that they learn sequentially and gradually. Students who like this also like to group information with logical steps in solving problems (Huang et al., 2012; Khenissi et al., 2016). In contrast, students with global learning styles understand things better overall.

Visual/verbal. Visual learners prefer to receive content visually, such as through pictures, diagrams, and photos. The next trait is to see what they have done, but if they say something simple, they will forget it. On the other hand, verbal learners remember what they have heard better; they prefer to receive material textually; effective learning for this group is when they explain something to others (Huang et al., 2012; Khenissi et al., 2016).

Felder and Silverman's Learning Style Model has been chosen by others as the most appropriate model for open learning (Fasihuddin et al., 2017), and technology-based learning systems (Deborah et al., 2014). For example, El-Bishouty et al. (2019) used Felder and Silverman's learning styles in online learning to determine the validity of course analysis tools and being able to increase learning activities. Furthermore, Cheng (2014) has also used the Felder-Silverman questionnaire to investigate students' learning styles in relation to their acceptance of and attitudes towards using support tools for learning in higher education. Shaw (2012) conducted research on the relationships among learning styles, participation types, and learning performance for programming language learning supported by an online forum, and this study showed that support from online forums and students' active participation, and increases learning performance as measured by student learning scores. Jena (2018) has conducted research to develop a model used to detect student learning styles, and the findings of this study show that by using social media, the Felder-Silverman learning styles can be used to detect these student learning styles. However, this explanation shows that there has not been any research on the use of the Felder-Silverman Learning Style in the field of biology learning at Islamic universities.

The study of learning styles in Indonesia was found to have been carried out by previous researchers. Widharyanto and Binawan (2020) conducted a study to describe the students' learning styles from the two elements of Java, Papua, Flores, Dayak, and Batak ethnics, and the result of the study showed that the findings revealed some similarities and unique differences in their learning strategies. Ghufron & Suminta (2020) examine the influence of the epistemic beliefs that consist of belief in knowledge and belief in learning on field-dependent and field-independent learning styles, and the result of the study showed that the belief in learning has a significant and positive effect on the field-dependent and field-independent learning styles. Zulfiani et al. (2020) determine students' profiles of learning styles, levels of higher-order thinking skills, and the effect of differences in students' competence to various HOTS instruments using the science

adaptive assessment tool application, and the result of the study showed that the achievement of the high order thinking skills score was influenced by the type of learning styles, even though it had averaged a very small correlation. However, this explanation also shows that there has not been any research on the use of the Felder-Silverman Learning Style in the field of biology learning at Islamic universities.

Integrated Learning at Islamic University in Indonesia

Islamic university in Indonesia has applied the integrated learning (Decision of Directorate General of Islamic Education, Ministry of Religion of the Republic of Indonesia, Number 2498, year 2019). The using of integrated instruction has been applied in IAIN Batusangkar, and the study about the using of integrated instruction was conducted by Haviz (2016) and Haviz et al. (2012). This instruction has also improved student achievement in 21st century skills (Haviz et al., 2018; Haviz, 2020; Haviz & Maris, 2020; Haviz et al., 2020a; Haviz et al., 2020b; Haviz et al., 2020c). But, since the pandemic COVID-19 integrated learning has moved from face-to-face learning to online learning. However, this study will investigate whether the change in the learning assumed to cause the learning style of PBTs-IU.

Aims and Research Question

This study was to investigate the learning styles of prospective biology teachers at Islamic university (PBTs-IU) during the pandemic COVID-19. This study explores the problems: (a) What are semantic groups associated with the index of learning styles question for PBTs-IU? (b) What is the most representative question for each dimension of the learning styles according to frequency analysis for PBTs-IU?

Methods

This study used a survey mixed method, with an explanatory sequential design (Creswell, 2014). The reason for choosing this design is because this study will be more complete after quantitative findings are followed by qualitative findings. The PBTs-IU have studied online learning by using WhastApp, Google Classroom and Google Meet as learning media. The PBTs-IU studied for 16 meetings and were taught by the same lecturers. The lecturer designs the learning material then uploads it to Google Classroom. So, that PBTs-IU can study the material before the learning process is carried out. Online face-to-face meetings were conducted using Google Meet for 4 meetings, namely meetings 1, 7, 10, 15, and other meetings were held with the Google Classroom. Communication and interaction between lecturers and students have been carried out with the WhastApp.

In quantitative phase, data were obtained from 195 prospective biology teachers at Islamic University (PBTs-IU) who are studying at the Biology Education Department

of IAIN Batusangkar, West Sumatra, Indonesia. These PBTs-IU come from six different classes. The number of male students was 19 people and the number of female students was 176 people. The participants have ages range from 18 to 22 years, with an average age of 18.5 years. The distribution of participants in four grades was: first grade (N = 56 PBTs-IU), second grade (N = 45), thirds grade (N = 51), and fourth grade (N = 43). The complete data on the demographic participant characteristics are listed in Table 1.

The FSLS instrument was used to collect the data. The instruments that have been used have been translated from English to Indonesian. The instrument has been designed and provided in a Goole form, which contains eight pairs of learning styles; active-reflective, sensing-intuitive, visual-verbal, sequential-global. These four pairs of learning styles have one or more semantic groups, and each semantic group is described in several questions. The total number of questions is 44 questions (Table 2). In this study, we have conducted the validity and reliability test. To check the goodness of the translated instrument, the validity content was conducted by three experts. The result of the study showed that the instrument was valid with a simple revision. The revision about the use of words and numbers on an item. The instrument was revised before being used to collect the data. The reliability test was conducted using Cronbach's Alpha. The score of Cronbach's Alpha for FSLS is: *active/reflective* = 0.50, *sensing/intuitive* = 0.53, *visual/verbal* = 0.62, and *sequential/global* = 0.53. The descriptions of the results of this study showed that the ILS instrument is suitable for investigating PBTs-IU learning styles.

Table 1

Demography Characteristic of Participant (N = 195)

PBTs-IU Demographic	PBTs-IU Participants
First Grade	56 (28.72%)
Second Grade	45 (23.08%)
Thirds Grade	51 (26.15%)
Fourth Grade	43 (20.51%)
Male	19 (9.74%)
Female	176 (90.26%)
Average Age	18.5 years

Semantic group analysis associated with the learning style index for PBTs-IU was done by adding up each respondent's answer choices. Then the number of answers is converted into a percentage. The frequency of the numbers in percentage describes the level of learning styles practiced by PBTs-IU. Also, the five most representative questions for a dimension of the learning style according to frequency analysis for PBTs-IU is done by adding up each respondent's answer choices. After being converted into percentages, then ranking is carried out to obtain a learning style rating of 1-5.

Table 2

Instrument of Semantic Groups Associated with the Index of Learning Styles (ILS) Question

Style	Semantic Group	ILS Question (answer a)	Style	Semantic Group	ILS Question (answer b)
Active	trying something out	1, 17, 25, 29	Reflective	think about material	1, 5, 17, 25, 29
	social oriented	5, 9, 13, 21, 33, 37, 41		impersonal oriented	9, 13, 21, 33, 37, 41
	existing ways	2, 30, 34		new ways	2, 14, 22, 26, 30, 34
Sensing	concrete material	6, 10, 14, 18, 26, 38	Intuitive	abstract material	6, 10, 18, 38
	careful with details	22, 42		nor careful with details	42
				spoken words	3, 7, 15, 19, 27, 35
Visual	Pictures	3, 7, 11, 15, 19, 23, 27, 31, 35, 39, 43	Verbal	written words	3, 7, 11, 23, 31, 39
				difficulty with visual style	43
	detail oriented	4, 28, 40		overall picture	4, 8, 12, 16, 28, 40
Sequential	sequential progress	20, 24, 32, 36, 44	Global	non sequential progress	24, 32
	form parts to the whole	8, 12, 16		relations/ connections	20, 36, 44

From: Graf et al. (2007)

In the qualitative phase, interviews were conducted with PBTs-IU. Interviews were conducted to verify and re-confirm the quantitative findings, in addition, in-depth interviews were conducted to deepen the research findings to obtain valid conclusions. Interviews were conducted after learning was complete. Interview questions are adapted to the four dimensions of FSLS: active/reflective, sensing/intuitive, sequential/global, and visual/verbal. Data were obtained by conducting in-depth interviews with 28 PBTs-IU (8 men and 20 women). Triangulation was carried out to analyse the results of the PBTs-IU in-depth interviews. Stages such as verification, display and conclusion describe the data that has been collected and obtained good information.

Results

Semantic Groups Assosiated with the Index Learning Style for PBTs-IU

Table 3 showed that the score of learning styles for PBTs-IU was found to be> 50%. This finding also showed that the highest score of learning styles for PBTs-IU was found among students in class 2016 with a learning style sensing with the semantic group of existing ways (72.6). The lowest score of learning styles for PBTs-IU was found in students of class 2019 with an intuitive learning style with a semantic group not careful with details (9.3) and a verbal learning style with a semantic group difficulty with visual style (9.3).

Table 3

Semantic Groups Associated with the Index of Learning Styles for PBTs-IU

Style	Semantic Group	Score of learning styles for PBTs-IU (%)			
		First Grade (*N=56*)	Seconds Grade (*N=45*)	Thirds Grade (*N=51*)	Fourth Grade (*N=43*)
Active	Trying something out	46.43	48.89	51.76	50.7
	Social oriented	66.67	62.22	59.48	68.99
Reflective	Think about material	**53.57**	**51.11**	47.06	49.3
	Impersonal oriented	27.38	37.78	40.52	29.46
Sensing	Existing ways	72.6	64.44	66.01	54.26
	Concrete material	50.6	68.15	65.36	66.67
	Careful with details	67.86	68.89	61.76	65.12
Intuitive	New ways	39.29	42.59	45.1	48.45
	Abstract material	29	22.22	24.51	25
	Not careful with details	25	15.56	17.65	9.3
Visual	Pictures	64.12	62.42	62.75	66.38
Verbal	Spoken words	36.61	37.04	39.87	37.6
	Written words	41.96	51.11	40.52	38.37
	Difficulty with visual style	16.07	13.33	17.65	9.3
Sequential	Detail oriented	31	26.67	37.25	27.13
	Sequential progress	67.86	69.33	61.57	71.63
	From parts to the whole	43.5	39.26	52.29	51.16
Global	Overall picture	**62.8**	40.11	37.76	40.01
	Non-sequential progress	14.29	8.89	17.65	6.98
	Relations/connections	39.3	45.19	**52.29**	42.64

The results of this study indicated that PBTs-IU that have a score of learning> 50% have been found to have active learning styles with semantic social oriented. The semantic social-oriented score was 66.67; 62.22; 59.48, and 68.99. The results of the same study also showed that PBTs with a score of learning> 50% were found to have a style of learning sensing. All semantic sensing has a score> 50%. For example, the score for existing ways is 72.6; 64.44; 66.01, and 54.26. The score for concrete material is 50.6; 68.15; 65.36, and 66.67. Scores for being careful with details are 67.86; 68.89; 61.76, and 65.12. The same results were also found in visual learning styles with semantic pictures. On the semantic pictures, the score of learning PBTs was found to be 64.12; 62.42; 62.75, and 66.38. The same research results were also found in sequential style learning, with semantic sequential progress. The score for this semantic is 67.86; 69.33; 61.57, and 71.63. These explanations have shown that the semantic group is associated with the index learning style for PBTs: active-social oriented, sensing-existing ways, concrete material, careful with details, visual-pictures, and sequential-sequential progress.

The Most Representative Question for Dimension of the Learning Style According to Frequencies Analysis

The result of the most representative question for each dimension of the learning style according to the frequency analysis for PBTs-IU is written in Table 4. There are five rankings for each style of learning, with 195 PBTS participants filling out the questionnaire (Table 4).

In the active / reflective style, ranks 1–5 have been found to be semantically and socially oriented. All scores are > 50%. The highest score (97.78) was found in question "21. I prefer to study; (a) in a study group". The lowest score (88.37) is found at "13. In classes I have taken; (a) I have usually gotten to know many of the students". These findings show that all PBTs-IU have a socially oriented learning style.

In sensing / intuitive style, semantic concrete material, learning style question in ranks 1 and 2 is "18. I prefer the idea of; (a) certainty (91.11; 90.7)". Another semantic finding is careful with details, with learning style question 42. "42. When I am doing long calculations; (a) I tend to repeat all my steps and check my work carefully (90.7; 84.44, and 82.35)". These findings show that PBTs-IU like the concrete material learning style and are careful with details.

In the visual / verbal style, semantic pictures were ranked 1–5.The highest score of learning style question is found at "19. I remember best; (a) what I see (93.33)". Then followed by a learning style question "43. I tend to picture places I have been; (a) easily and fairly accurately (90.7)". The last ranking is the learning style question "11. In a book with lots of pictures and charts, I am likely to; (a) look over the pictures and charts carefully (86.05)". These findings show that PBTs-IU like the pictures learning style.

Table 4

The Five Most Representative Questions for Dimension of the Learning Style According to Frequencies Analysis for PBTs-IU

Style	Rank	Semantic Group	Learning Style Question	%
Active / Reflective	1	social oriented	21. I prefer to study; (a) in a study group	97.78
	2	social oriented	9. In a study group working on difficult material, I am more likely to; (a) jump in and contribute ideas	97.67
	3	social oriented	13. In classes I have taken; (a) I have usually gotten to know many of the students	96.08
	4	Social oriented	13. In classes I have taken; (a) I have usually gotten to know many of the students	92.86
	5	social oriented	13. In classes I have taken; (a) I have usually gotten to know many of the students	88.37
Sensing / Intuitive	1	concrete material	18. I prefer the idea of; (a) certainty	91.11
	2	concrete material	18. I prefer the idea of; (a) certainty	90.7
	3	careful with details	42. When I am doing long calculations; (a) I tend to repeat all my steps and check my work carefully	90.7
	4	careful with details	42. When I am doing long calculations; (a) I tend to repeat all my steps and check my work carefully	84.44
	5	careful with details	42. When I am doing long calculations; (a) I tend to repeat all my steps and check my work carefully	82.35
Visual / Verbal	1	Pictures	19. I remmeber best; (a) what I see	93.33
	2	Pictures	43. I tend to picture places I have been; (a) easily and fairly accurately	90.7
	3	Pictures	19. I remmeber best; (a) what I see	89.3
	4	Pictures	43. I tend to picture places I have been; (a) easily and fairly accurately	86.67
	5	Pictures	11. In a book with lots of pictures and charts, I am likely to; (a) look over the pictures and charts carefully	86.05

Style	Rank	Semantic Group	Learning Style Question	%
Sequential/ Global	1	sequential progress	32. When writing a paper, I am more likely to; (a) work on (think about or write) the beginning of the paper and progress forward	95.35
	2	sequential progress	32. When writing a paper, I am more likely to; (a) work on (think about or write) the beginning of the paper and progress forward	91.11
	3	sequential progress	24. I learn; (a) at a fairly regular pace. If I study hard, I'll "get it."	91.11
	4	sequential progress	24. I learn; (a) at a fairly regular pace. If I study hard, I'll "get it."	90.7
	5	sequential progress	32. When writing a paper, I am more likely to; (a) work on (think about or write) the beginning of the paper and progress forward	88.24

In Sequential / Global, semantic sequential progress has been found at ranks 1–5. Score learning style question ranking 1 has been found at "32. When writing a paper, I am more likely to; (a) work on (think about or write) the beginning of the paper and progress forward (95.35)". This learning query style was also found in rank 2 (95.35) and rank 5 (88.24). Another learning style question found in ranks 3 and 4 (91.11; 90.7) is the sequential progress is "24. I learn; (a) at a fairly regular pace. If I study hard, I'll "get it."". These findings suggest that PBTs-IU favor sequential progress. These explanations have shown that the most representative question for each dimension of the learning style according to frequencies analysis were active-social oriented, sensing-concrete material dan careful with details, visual-picturers dan sequential-sequential progress.

The results of the interview are in line with the findings of research that has been conducted using quantitative methods. The result of interview showed that PBTs-IU prefer socially oriented learning, concrete material, pictures, and overall pictures. The transcript of the interview with PBTs about active / reflective learning styles is written below.

Researcher: What is your preferred learning style during the learning process in class? Can you explain?

PBTs-IU: I like studying together in class. Because of this, I find it helpful to have explanations from some friends in class. If there is material that I don't understand or don't understand, then I will still ask other friends.

The interview transcript shows that PBTs-IU have a socially oriented learning style. In the following section, an excerpt from the interview transcript has been written about the sensing / intuitive learning style.

Researcher: Do you also provide concrete explanations when studying in class, or simple explanations, or just plain explanations?

PBTs-IU: Yes .. I really like the explanation of the material that is clear and more concrete, whether the explanation is from the lecturer or from friends in class. If not, I have a hard time mastering the subject matter. I need a more concrete explanation to master the subject matter.

The transcript of the interview has also shown that PBTs-IU also have the concrete material learning style. In the following section, an excerpt from the interview transcript has been written about the visual / verbal learning style.

Researcher: Do you also like visual or verbal learning styles? Do you like learning styles that use image media?

PBTs-IU: Yes … I really like learning styles that are accompanied by clear visuals or material that is presented with pictures. For example, there are books with pictures, schemes or other diagrams. Because these pictures are easier to remember and understand.

The transcripts of interviews have also shown that they like learning other pictorial or visual materials, such as graphic schemes and others. In the following section, excerpts of interview transcripts about sequential / global learning styles have been written.

Researcher: Do you like learning in sequential progress or overall pictures, such as a lecturer starting learning by asking you to write something first or the lecturer giving a clear outline of what you are going to do?

PBTs-IU: It really helps if the lecturer starts the lesson by giving a complete explanation of what I will do, such as writing down the material outline, material information outline or even the lecturer has prepared the material completely.

The interview transcripts have also shown that PBTs-IU really like the overall pictures learning style. They answered the question by mentioning that they liked the lecturer, who explained in full about what they were going to do. PBTs-IU also answered that they liked lecturers ,who explained the material completely. These answers show that there is an overall pictures learning style.

Discussion

The results of this study showed that the digital transformation of teaching and learning is being accelerated by the COVID-19 lockdowns. This involves the rapid and widespread adoption of e-learning, as many schools, colleges, and universities are closed – and teaching and learning is being widely accessed online (Rospigliosi, 2020). The crisis-response migration methods of universities, faculty and students, challenges and opportunities were discussed and it is evident that online learning is different from emergency remote teaching, online learning will be more sustainable, while instructional activities will become more hybrid, provided the challenges experienced during this

pandemic are well explored and transformed to opportunities (Adedoyin & Soykan, 2020). Virtual Learning Environments (VLEs) are becoming commonplace in Higher Education (Herodotou et al., 2020).

The findings from the studies on learning with Google Classroom during the pandemic in Indonesia show that the application of Google Classrooms as a learning platform for teaching can be applied and accepted by students, and the use of Google Classrooms has led to better student learning outcomes (Tinungki & Nurwahyu, 2020). The same results have also been found when social media, such as WhatsApp, is used in the learning process. For example, research conducted by Mumford and Dikility (2020) and Rasheed et al. (2020). Mumford and Dikilitas (2020) has investigated the growth of reflective thinking skills in prospective teachers, and the results of this study show that prospective teachers need guidance in using technology to encourage reflection in learning. Furthermore, the use of technology, such as the use of social media, is positively related to student involvement and student creativity in postgraduate research training (Rasheed et al., 2020; Kamal & Radhakrishnan, 2019).

The findings indicated that the learning styles of PBTs-IU has also changed due to the use of the Google Classroom platform. When associated with the Felder-Silverman Learning Style, the findings of this study lead to the use of a visual-picture learning style. This finding is in line with the research conducted by Jafari and Abdollahzade (2019). The research has found that there is a relationship between the Felder-Silverman (FSLSM) learning style model and the type of game played with the media used when learning is carried out.

The results show that in online learning PBTs-IU practice and like dimensions of learning styles, such as in active – social oriented learning, in sensing – existing ways, concrete material, careful with details, in visual – pictures, and in sequential – sequential progress.This finding was obtained after being confirmed in the two research questions, namely the index of learning style associated with the semantic group and the most representative question for the dimension of the learning style according to frequency analysis. This finding is in line with the findings of previous researchers. For example, the findings of El-Bishouty et al. (2019) have shown that when online learning is carried out, the visual-pictures, and sequential-sequential learning styles are dominantly carried out by students.

The findings also indicated that research on student learning styles is important to determine the direction of learning to be carried out by the teacher. Research on the development of learning styles is therefore in high demand (Moser & Zumbach, 2018). The results of this study indicated that differences in students have different learning styles, which lead to the selection and use of learning strategies by teachers. Because students with different learning styles use different strategies to learn (Graf et al., 2010), and studying the learner model is important to determine the direction of educational research (Abyaa et al., 2019). The Felder and Silverman Learning Styles Model has been

selected as the most appropriate model for open learning (Fasihuddin et al., 2017). the appropriate contents for users in an e-learning system based on their learning styles and personalities (Denphaisarn, 2014; Hsu et al., 2020).

Conclussion

This study found that semantic groups associated with the index learning style for PBTs were active-social oriented, sensing-existing ways, concrete material, careful with details, visual-pictures, and sequential-sequential progress. This study also found that the most representative question for each dimension of the learning style according to frequency analysis were active-social oriented, sensing-concrete material and careful with details, visual-picturers and sequential-sequential progress. So, it was concluded that the learning styles of PBTs-IU during pandemic COVID-19, such as social oriented learning, existing ways, concrete material, careful with details, pictures, and sequential progress.

Based on the results of the study, Felder and Silverman Learning Styles Model has been selected as the most appropriate model for open learning. Because this models is easy to use in the learning. Also, the teachers or lecturers must improve their teaching methods to accommodate the students learning styles. Because student achievement can be improved by matching students' learning styles.

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Indonezijos Islamo universiteto būsimųjų biologijos mokytojų mokymosi stiliai

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Santrauka

Šio tyrimo tikslas – nustatyti Islamo universiteto būsimųjų biologijos mokytojų (angl. *PBTs-IU*) mokymosi stilius COVID-19 pandemijos metu. Šiame tyrime naudotas mišrusis metodas pagal aiškinamąjį nuoseklųjį tyrimo planą. Duomenims rinkti naudotas Felderio-Silvermano mokymosi stiliaus (angl. *FSLS*) testas. Taikytas ir interviu metodas duomenims apie studentų mokymosi stilius papildyti. Kiekybiniame etape duomenys buvo gauti iš klausimyno, kurį užpildė 195 būsimieji biologijos mokytojai po mokymosi internetu, kurio metu buvo naudojama *WhastApp*, *Google Classroom* ir *Google Meet* kaip mokymosi priemonės. Siekiant papildyti kiekybinį tyrimą, kokybinio etapo metu buvo renkami duomenys iš interviu. Duomenų analizė atlikta naudojant aprašomąją statistiką ir trianguliaciją. Rezultatai rodo, kad mokydamiesi internetu PBTs-IU praktikuoja mokymąsi pagal mokymosi stilių dimensijas: aktyviajame – socialiai orientuotą mokymąsi, jutiminiame – esamus būdus, konkrečią medžiagą, atidumą detalėms, vaizdiniame – paveikslėlius, nuosekliajame – nuoseklią pažangą.

Esminiai žodžiai: *Islamo universiteto būsimieji biologijos mokytojai (angl. PBTs-IU), Felderio-Silvermano mokymosi stilius (angl. FSLS), aktyvus/refleksyvus, jutiminis/intuityvus, nuoseklus/globalus, vizualinis/žodinis.*

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