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Student Achievement Analysis: Implementation of Discovery-Based Virtual Learning in Culinary Academy

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Abstract. This study aims to analyze the effect of using DVL on student achievement. This study used a 2x2 factorial design. This research's data analysis technique is divided into two types, namely the prerequisite analysis test and hypothesis testing. The research results concluded that students who learn with DVL are significantly higher than Direct Instruction (DI). The next result is that students who have high initial knowledge get high learning achievement scores. Meanwhile, this study's results also showed a significant interaction between the learning model and initial knowledge of student achievement in foodborne disease competencies.

Keywords: Covid-19, Discovery-Based Virtual Learning, Direct Instruction, Learning Achievement, Foodborne Disease Competencies.

INTRODUCTION:

WHO explained that a coronavirus is a group of viruses that can cause disease in animals or humans. Several coronavirus types are known to cause ionic respiratory tract infections in humans ranging from cold viruses to more serious ones such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS) (WHO, 2020). Student protection and educational facilities are critical. Preventive action is needed to prevent the potential spread of Covid-19 in school environments. However, care must also be taken to avoid stigma against students and staff exposed to the virus. It is important to remember that Covid -19 does not differentiate between borders, ethnicity, disability status, age, or gender. The educational environment must always be a friendly, respectful, inclusive, and supportive environment for all. Measures taken by schools can prevent the entry and spread of Covid -19 by students and staff who may be exposed to the virus while minimizing distraction and protecting students and staff from discrimination (UNICEF, 2012).

The Minister of Education and Culture issued Circular Number 15 of 2020 concerning Guidelines for Organizing Learning from Home in an Emergency Situation of the Spread of Covid -19 (Pembelajaran Secara Daring Dan Bekerja Dari Rumah Dalam Rangka Pencegahan Penyebaran Corona Virus Disease (COVID- 19, 2020). Designing effective and meaningful learning in choosing the right learning model takes the teacher's ability to master a learning model that will be applied because it will help an effective student-centered learning process. (Dimkpa, 2015). The success of a learning activity process can be seen from the learning

achievement of students. Value as learning achievement as a measure of teacher performance in the learning process and value as learning achievement for students in the success of the learning process. In choosing a learning model, the teacher must choose a creative and innovative learning model. Choosing the right learning model will affect the learning situation where the learning atmosphere will be more enjoyable. Thus students will find it easier to achieve what has been the goal in the learning process (Ofoghi et al., 2016).

Learning outcomes are collections of words, pictures, or diagrams meant to tell others what the teacher wants to achieve for students. Learning outcomes that are related to the desired outcome rather than the process to achieve these results, specific and measurable, not broad and intangible, related to what students need to know, or do, or feel (CBU, 2020). The cognitive learning domain, with examples of the level of sophistication and common verb associations, namely remembering, understanding, applying, analyzing, evaluating, creating (Anderson & Krathwohl, 2001; Cedefop, 2017). To increase learning achievement, it is necessary to choose a learning model that focuses on students. The use of discovery learning models will change a learning process focused on the teacher to switch to student-centered learning situations. The Discovery learning model is a learning model that makes students active in finding, solving a problem through the teacher's guidance. Students will be directed to find information, process, and discuss it in their respective groups. (Seel, 2012).

A learning model is a tool designed in such a way as to help students develop critical thinking skills and gain knowledge with a deep level of understanding of a material (Kauchak, 2012). The learning model is designed in such a way that it will be used as a guide for teacher actions in class when carrying out the teaching and learning process to increase student learning achievement. Meanwhile, E. Brown & Oakville (2016) explained that discovery learning is an active learning style in which students actively participate in the learning process rather than accept knowledge passively. The hope is that students can interact with their environment by exploring and manipulating objects or conducting experiments supported by learning theories (E. Brown & Oakville, 2016). One type of teaching that is of interest in STEM education (science, technology, engineering, and mathematics) is learning that actively engages students in inquiry and discovery.

Discovery learning emphasizes a focus on students' ideas and contributions to their own learning. It recognizes students as active collaborators in developing a collective understanding with teachers and peers instead of the more passive role of students as recipients of knowledge passed on to them from the teacher (Hoffman, 2013). The following are 6 phases of discovery learning syntax according to Ismayati & Nurlaela (2015), consisting of (1) stimulation by giving questions, motivation to read literacy, and other activities that refer to the material. In this case, the teacher helps students explore material ; (2) problem statement (problem identification) by encouraging students to identify as many problems as possible, then one of them is selected and formulated in a hypothesis; (3) data collection (data collection) by encouraging students to accumulate relevant literacy to prove the hypothesis; (4) data processing (data processing) by helping to encourage students in data processing; (5) verification by encouraging students to find concepts or theories through authentic examples; (6) stimulation generalization (giving stimulation to make conclusions) by encouraging students to come to the front of the class to convey conclusions (Ismayati & Nurlaela, 2015).

The choice of teaching equipment is the main determinant of how the expected learning outcomes will be realized. Thus, selecting the optimal teaching tool can be a very effective action to improve classroom learning (Edalati, 2016). One of the main principles of science and technology is to teach students the idea of discovering, engaging in critical thinking (Ariyanto et al., 2020), ask questions and develop problem-solving skills (Arsana et al., 2019). Therefore, curricula for science and technology should be developed to educate science-literate students to ask questions and solve their problems (Joy, 2014). Sakshi (2011) describes online learning covering various technologies such as the world wide web, email, chat, group and new text, audio, and video conferences delivered via computer networks to spread education. This helps learners to learn at their own pace, at their own convenience (Sakshi, 2011). Online education requires a lot of resources and careful planning. In this sense, the teacher acts as a facilitator rather than imparting knowledge, content, and ICTs are

considered resources that enhance student learning experiences. Learners learn through e-learning tools available to all. E-Learning has brought back the joy of learning through the delivery of innovative and interactive content and has proven to be more attractive to students.

Meanwhile, Radha et al. (2020) Describe that E-learning has become a compulsory component of all educational institutions such as schools, colleges, and universities in and around the world due to the Covid-19 pandemic crisis (Radha et al., 2020). This deadly situation has reversed the offline teaching process. E-learning provides effective teaching methods that produce the best in students. The coronavirus pandemic necessitates a dramatic change in how to educate. Distance or online learning has become the norm, and several national and international academic societies have combined resources to ensure that education occurs during this difficult time (Schneider & Council, 2020). The development of interactive e-learning methods is considered the main mode of evolution of the local and international education system. Most of the studies have revealed the widespread benefits of this technology and provided examples of its application and evolution in the education system (Eftimie, 2012). By combining learning models and e-learning technology, it is hoped that Discovery-based Virtual Learning can improve student achievement.

Referring to the background description above, there are three hypotheses to be proven in this study. First, there are differences in learning achievement between students learning using Discovery-based Virtual Learning (DVL) and Direct Instruction (DI). Second, there are differences in learning achievement between students with high initial knowledge and low initial knowledge. Third, there is an interaction between the learning model and initial knowledge on learning achievement.

METHOD

This experimental type of research was conducted to analyze the effect of DVL on the learning achievement of foodborne disease competencies in the subject of food safety hygiene and sanitation. More details on the experimental design in this study are shown in Table 1.

Table 1. Research Experiment Design.

Experiment	O_{1A}	X_1	Y_1	O_{2A}
			Y_2	O_{2B}
Control	O_{1B}	X_2	Y_1	O_{2C}
			Y_2	O_{2D}

$O_{1A,1B}$ is the pre-test results, while $O_{2A,2B,2C,2D}$ are knowledge. Symbols X_1 and X_2, respectively indicate the treatment of the experimental and control classes. Meanwhile, Y_1 and Y_2 each indicate the student's Initial Knowledge score. Based on the experimental design above, the research analysis design is shown in Table 2.

Table 2. Research Analysis Design.

Learning model	**Initial Knowledge**	
	High (B_1)	**Low (B_2)**
DVL (A_1)	$A_1 B_1$	$A_1 B_2$
DI (A_2)	$A_2 B_1$	$A_2 B_2$

Information:

$A_1 B_1$: The learning achievement of students learning to use DVL in the high initial knowledge group.

$A_1 B_2$: The learning achievement of students learning to use DVL in the low initial knowledge group.

$A_2 B_1$: The learning achievement of students learning to use DI in the high initial knowledge group.

$A_2 B_2$: The learning achievement of students learning to use DI in the low initial knowledge group.

This study's design is 2x2 factorial. The sorting factor of the initial knowledge moderator variables, namely high initial knowledge and low initial knowledge. Students are classified as students with high initial knowledge if they get a value ≥ of the group median. Students are classified with low initial knowledge if they get ≤ the group median. Students who will enter the high Initial Knowledge group category are

students with ratings 1 to 17. Meanwhile, students with ratings of 18 to 34 will enter the low Instruction Initial Knowledge group. The subjects in this study were divided into two groups: (1) the Bologna 1 group, which was taught using the Discovery-Based Virtual Learning teaching model, totaling 32 students; (2) the Bologna 1 group, which was taught using the direct teaching model were 32 students.

This research's data analysis technique is divided into two types, namely the prerequisite analysis test and hypothesis testing. The prerequisite analysis test was divided into two stages: the normality test using the one-sample Kolmogorov-Smirnov test and the homogenity test using the Levene's test. After the analysis prerequisite test is fulfilled, it is followed by testing the hypothesis using the two-way Anava test. The Food Safety, Hygiene, and Sanitation course teaches the conditions and actions needed to ensure food safety from production to consumption (Kamboj et al., 2020). Food can be contaminated during slaughter or harvesting, processing, storage, distribution, transportation, and preparation. This contamination causes foodborne disease.

RESULTS AND DISCUSSION

Result

1. Test the prerequisite analysis

Before analyzing data with certain statistical techniques, there are still some conditions that should be met. The prerequisite test in this study consisted of a normality test and a homogenity test. Both tests are carried out because parametric statistics require that the data for each variable to be analyzed must be normally distributed and homogeneous. The normality test is calculated using the Kolmogorov Smirnov test using the SPSS program (Hidayatullah et al., 2020). This test tends to be used to detect whether the sample comes from a population that spreads normally or not. It is important to avoid errors in seeking information on the sample tested to make the wrong decision (Artaya, 2019). The results of the normality test can be seen in Table 3.

Table 3. The Results Of The Normality Test of Learning Achievement Scores On The Competence Of Foodborne Disease.

Group		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Pre-test	DI	0.252	32	0.705	0.829	32	0.149
	DVL	0.173	32	0.158	0.928	32	0.338
Post-test	DI	0.190	32	0.488	0.906	32	0.896
	DVL	0.165	32	0.268	0.927	32	0.316

Learning achievement data is normally distributed if the significance value obtained from normality testing is> 0.05. From Table 3, it can be seen that the results of the normality test of the pre-test learning achievement scores of the control and experimental classes are the significance values of 0.705 and 0.158. The normality test scores of post-test learning achievement of the control and experimental classes, namely the significance value of 0.488 and 0.268. So it can be concluded that the pre-test and post-test learning achievement scores of the control and experimental classes using the Kolmogorov-Smirnov test have a significance> 0.05, meaning that the pre-test and post-test scores of learning achievement in the control and experimental classes are normally distributed.

The data tested for homogenity were data on the students' initial ability (pre-test) and learning achievement (post-test) of students from the two samples. This study's homogenity test used the Levene homogenity test on SPSS with a significant level of 0.05. Levene's approach is powerful and robust to nonnormality and is becoming a top-rated tool for examining variance's homogenity. Levene's is a statistical procedure that allows researchers in many intellectual disciplines to check the validity of the important assumptions underlying the analysis of data obtained from studies using the anova design. (Gastwirth et al., 2009).

The homogenity test of learning achievement scores with the low and high category students' initial knowledge between the control and experimental groups was used to determine whether the variance of the two groups was the same or not. In this study, to test the variance used Levene's can be seen in Table 4.

Table 4. The results of the homogenity test of learning achievement scores and initial knowledge in the control and experimental classes on the competence of foodborne disease.

F	df1	df2	Sig.
0.381	3	60	0.767

Based on the data from the results of the test score homogenity in Table 4 above, the value of the Levene's test F count on the learning achievement variables and the initial knowledge of the control and experimental classes on the competence of foodborne disease shows a significance level of 0.767 which means greater than 0.05, so that the null hypothesis is accepted or in other words. The variance between groups of learning achievement score variables with low and high category initial knowledge between the control and experimental groups on foodborne disease competence was the same or homogeneous.

2. Test the research hypothesis

The next step, which is carried out after the test requirements for analysis are met, analyzes the data by testing the hypothesis. The data analysis technique used in this study was the two-way covariance analysis test. Because the learning achievement variable fulfilled the normality assumption, a two-way covariance analysis test was used. The results of statistical hypothesis testing are shown in Table 5.

Table 5. Statistical hypothesis test two way anova learning achievement of foodborne disease competencies

Tests of Between-Subjects Effects

Dependent Variable: Student Achievement

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	660.838[a]	3	220.279	7.204	0,000
Intercept	404771.952	1	404771.952	13237.492	0,000
Model	316.765	1	316.765	10.359	0,002
Initial Knowledge	141.143	1	141.143	4.616	0,036
Model * Initial Knowledge	174.347	1	174.347	5.702	0,020
Error	1834.662	60	30.578		
Total	409061.140	64			
Corrected Total	2495.499	63			

Based on Table 5, the results of the first hypothesis can be seen that the significance value of the learning model is 0.002. The significance value is less than 0.05 (0.002 <0.05), it is concluded that H1 is accepted. This means that there is a significant difference in learning achievement between students learning to use DVL and students learning to use DI. In line with the research results, Ames (2016) revealed that the key to the success of the learning model, which refers to discovery, is the process of finding out itself. This, of course, makes students more ready to solve problems, considering that students are directly involved in the learning process (Ames, 2016). Besides, through DVL, students are directed to be able to develop higher-order thinking skills (Soeryanto et al., 2020), develop self-confidence (B. A. Brown, 2016), to be able to collaborate with other people in solving the problems at hand (Ariyanto et al., 2019). Meanwhile, Bamiro (2015) explained that if the teacher can implement discovery learning optimally, it will positively impact students' cognitive skills, which basically also improves problem-solving skills (Bamiro, 2015).

The results of the second hypothesis test showed that the significance value of initial knowledge was 0.036. The significance value is less than 0.036 (0.000 <0.05), it is concluded that H1 is accepted. This means a significant difference in learning achievement between students with high initial knowledge and low initial knowledge students. Initial knowledge is an important part that must be possessed by students before the learning process takes place. This means that initial knowledge is a measure that can be used by the teacher to analyze the increase in student knowledge before and after carrying out the learning process. Purwaningrum

& Sumardi (2016) explain that students with good initial knowledge generally get better learning outcomes than students with low initial knowledge. (Purwaningrum & Sumardi, 2016). On the other hand, Hidayatullah et al. (2020), through their research also shows that students with high initial skills find it easier to analyze ideas when they are converted into a problem solution (Hidayatullah et al., 2020). Meanwhile, Elmiwati et al. (2020) that during the problem-solving process stage, students who are equipped with good initial skills find it easier to build knowledge and develop skills in solving (Elmiwati et al., 2020).

The third hypothesis test results, namely the interaction between learning models and initial knowledge of learning achievement, in this case the significance value obtained is 0.020. The significance value shows less than 0.020 (0.000 <0.05), it is concluded that H1 is accepted. This means a significant interaction between the learning model and the initial knowledge of learning achievement in the Foodborne Disease Competency, as shown in Figure 1.

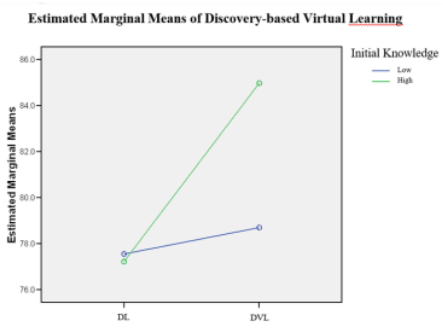

Figure 1. The interaction between learning models and initial knowledge on learning achievement.

Discussion

This study's results are in line with the statement that twenty-first-century knowledge is focused on creativity, ingenuity, critical thinking, and the like. The Discovery learning model is proven to improve student achievement (Clements & Joswick, 2018). Therefore, cognitive science is in principle and practice. Science enhances our understanding of the brain, mind, and learning, and the education profession can benefit from embracing rather than neglecting cognitive science. Consequently, educators must actively contribute to the future cognitive science research agenda (Talkhabi & Nouri, 2012). Cognitive education positions learners to be knowledge-centered. It shows awareness and accommodation of cultural, social, cognitive, and personal factors that influence learning, learning potential, and learning motivation. It also shows that the domain or teaching area's structure is clearly understood and reflected in educational goals and instructional strategies. Cognitive education is discovery-based and constructivist, facilitating the development of cognitive and metacognitive processes that guide further learning and deepening contextual knowledge that facilitates memory and application of acquired knowledge (Hessels & Berk, 2003).

CONCLUSIONS AND SUGGESTIONS

From the results of data analysis and discussion in the previous section, it can be concluded that students learning with DVL are significantly higher than DI. The next result is that students who have high initial knowledge get high learning achievement scores as well. Meanwhile, this study's results also showed a significant interaction between the learning model and the prior knowledge of student achievement in the competency of foodborne illness. In conditions of the Covid-19 pandemic like this, teachers need to pay attention to selecting learning models that focus on students and the initial knowledge that students have.

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