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Disruptive Technology: The Effectiveness of Implementation Game Based Learning to Learning Performance
(Perception Based Analysis Between Teacher's and Student's Senior High School in East Java)

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ABSTRACT
Rapid technological developments in 21st century have an impact on advances in education. This is evidenced by the existence of a game-based learning model using smartphones. However, if teachers or students don't have technological skills, this can be an obstacle. So it is important for both teachers and students to have knowledge of technology and computer skills. This study aims to analyze learning performance and measure teachers' proficiency in using technology by using variables such as technical knowledge, computer skills, game-based learning implementation, and school areas. The method used in this research is multiple regression analysis. Respondents in this study were high school teachers and students in Blitar, Kediri, and Tulungagung. The number of samples used in this study was 205 teachers and 945 students. The data used in this study are primary data using data collection techniques, namely questionnaires. The results of this study indicate that simultaneously the independent variable has a significant effect on the learning performance as variable dependent.

Keywords: *Technology knowledge, Computer skill, Game-based learning, Learning performance.*

1. INTRODUCTION

Almost all aspects of life are always integrated with digital, this can be reflected in the rapid development of technology, especially in the fields of education and economy. This will certainly be an opportunity and a challenge, especially for the millennial generation. For example, in education, currently learning has been integrated with technology so that this is a form of progress in the field of education.

21st-century education appears marked by the increasing use of technology. The emergence of technology does not only support the needs of daily life but also plays a role in learning activities [1], [2]. Almost all Technology plays a significant role in facilitating the learning process to help students manage their time independently and work together with other classmates [3]. For students, the use of technology in learning can increase their motivation and have impacted their achievements [4]. Furthermore, the use of technology in a comprehensive manner will also improve and develop student skills such as the ability to analyze, solve problems, evaluate, and think creatively [5].

The rapid development of technology in the Industrial Revolution 4.0 has had a significant impact, especially in education [6]. Learning in educational institutions has also undergone lots of changes due to technology [7]. The use of technology is one of the primary sources to support good and quality learning activities [8]. Learning activities in educational institutions require exceptional knowledge of technology [9]. Therefore, the ability to work with technology is needed by academics to support a qualified learning system [10]. Knowledge about technology from time to time must be honed to support the realization of the goals and missions of educational institutions in creating quality learning [11]. Various kinds of technology ranging from computers to smartphones are very useful and beneficial for academic

institutions to support effective and efficient learning activities [12].

The use of appropriate technology can create an effective learning process and enhance students' competence [3]. When the student's ability advances, they will also do better in their assignments and get better evaluations from their teachers. Concerning evaluation from teachers, technology can make it easy for students to assess their learning performance independently because with technology teachers can provide feedback directly after grading. An independent evaluation system in learning is beneficial for students to measure their abilities and improve their competencies [13].

On the other hand, for teachers, the use of technology needs to be balanced with adequate technical knowledge and skills to innovate modern ways of learning. Teachers in the 21st century must have technological literacy skills to avoid technical failures. Technological literacy is defined as the knowledge and skills required to use, manage and evaluate technology-based on objectives [14]. Teacher's technological literacy skills that are integrated with education will increase the effectiveness of learning such as the efficiency of learning time, increased student learning performance, and high student motivation. Another benefit for the teachers is the ease in using technology when learning is adapted to strategies and methods of teaching activities [15], [16].

One of the uses of technology in educational institutions is computers. Computers help ease teachers and students in carrying out learning activities [17]. In the world of education, teachers are required not only to master pedagogical skills but also to have the necessary computer operating skills [18]. This is because if the teachers can familiarize themselves with technology, they will have no problem delivering their lessons. Hence, computer skills can be honed through training as well as direct literacy for teachers.

Computer skills are crucial during the 21st century. In fact, in some countries, being able to work with computers have become part of the high school curriculum [19]. Since 2012, in Turkey, a basic knowledge about software and programming has been included in the subject curriculum for "Information Technology and Software" and has been given since primary school level [20]. Computer skills are needed by students and teachers at every level of education, including at the higher education level, which requires teachers to innovate in technology-based learning. 21st-century learning that has been integrated with technology requires computer skills. Not only useful in the use of technology but also the ability to assess the use of technology. These skills in the 21st century is known as ICT literacy. According to the [5] ICT literacy is defined as using digital technology beside that it must also be balanced with ability to communicating, connecting, organizing, combining, evaluating, and making information to inform the community of advanced knowledge.

Computer facilities in teaching and learning activities are usually used as learning media and learning tools. There are several factors that affect the effectiveness of the use of computers in teaching and learning activities, including basic skills regarding the use of computers, the use of computers as a source of learning information and learning media, and the use of computers as learning support tools for students [21]. The right strategy to use to support this effectiveness is to develop computer skills for both teachers and students. One of the strategies that can be done is to provide technical guidance training for teachers on technology-based learning which of course requires computer skills. Unfortunately, there are yet still teachers who lack technological skills. The main reason why this happens is that teachers are not used to combining technology in their teaching process. Especially in several school areas that do not have adequate technology-based learning facilities. To say the least, technology can be a tool for teachers to create learning innovations that are relevant to the 21st century era.

Currently, students tend to look for things that are easier and more enjoyable during their process of learning. Usually, students prefer to participate in learning activities that involve interactive games because they are inclined to be a lot more enthusiastic about learning. Interactive games in teaching are usually internet-based, thus students have room to enjoy what they are learning and not get easily bored. However, in Indonesia the learning system is still quite traditional. Teachers are used to teaching students in traditional ways; therefore, they are more comfortable with that teaching style. In order to improve, teachers must understand multiple learning intelligences and game-based learning. Multiple learning intelligences are interpersonal intelligence related to a person's ability to work together to communicate effectively with any media, both in social and in the learning process. [22]. Teachers are required to be more creative and master technology, especially for the benefit of fun learning, so that students who are taught can participate in learning activities thoroughly. [23].

Learning by utilizing internet and technology will have a positive impact, because it can be able to easily access relevant learning resources and increasing the effectiveness of learning activities. Various forms of learning utilize technology both in terms of learning media, learning resources, and learning platforms used. One of the uses of technology used in learning is smartphones as a learning media of inquiry in higher education [24]. Based on a study conducted by [24]

smartphones creates integrated learning where students have the opportunity to interact and collaborate in teams with various sources [25]–[28]. Furthermore, the findings of the research conducted [25] with lecturers' respondents in higher education indicating that smartphones can be one of the promising means of improving pedagogical abilities. Therefore, the use of smartphones as learning media will increase the dynamics in the teaching and learning process in the 21st century era.

Smartphones as learning media is one strategy to improve the quality of learning. One of strategy to use a smartphone that is integrated with game-based learning so that it can create fun learning. The game-based learning activities are carried out by utilizes digital games to convey learning material, improve students' cognitive and analytical abilities, provide effective learning feedback, and more transparent learning evaluation. The results of research conducted by [29] show that game-based learning give a better and more enjoyable learning experience than non-game-based learning. Similar research conducted by [30] revealed that game-based learning would provide a better learning experiences when it can be integrated with learning that provides direct instruction or guidance to students. Research conducted by [31] collected student high school respondents which proved that game-based learning has a significant positive effect on learning performance. Learning performance are an indicator to measure the success achieved by a student. According to [32] learning performance is overall student achievement which is an indicator of change in students' competence and behavior. According to [33] the essence of learning performance is a change in individual behavior, including cognitive, affective, and psychomotor domains. Achievement of student learning performance is influenced by two factors, namely internal and external. Internal factors are factors that come from within students such as psychologically and physically. At the same time, external factors come from outside the student, such as the learning environment, learning facilities, and the social environment. This study emphasizes the cognitive learning performance. The cognitive domain is related to the mastery of the material in students. Learning performance were measured based on the results of the test in the form of a posttest after students take part in the game model learning. This can be seen from the increasing completeness of student learning performance in classes using game-based learning models.

Teachers have a crucial role throughout their students' learning process. Today, studying using interactive media allows students to experience something new. It does not take much to learn online. Students and teachers are expected to identify themselves to interact with one another, even if they are parted by distance. Teachers are required to innovate different ways of learning, so that students are willing to study, effectively and efficiently. One example of learning that is fun for students is by playing, to be specific, game-based learning which involves mobile learning [34]. Besides, the practice of mobile learning includes inquiry models and mobile games [35]. Mobile learning can provide a new experience and develop students' cognitive abilities compared to non-game learning [34]. Based on few types of research, and the phenomenon that is on-going in Indonesia, researchers are interested in researching how technology knowledge, computer skills, game-based learning implementation, and school areas can affect student learning performance. Therefore, this study is aimed explicitly at analyzing learning performance and measuring teachers' proficiency in the use of technology using the observation variables of technology knowledge, computer skills, game-based learning implementation, and school areas.

2. METHOD

This research is a descriptive study with a quantitative descriptive approach that describes and analyzes the effect of the independent variable (X) on technology knowledge, computer skills, and game-based learning on the dependent variable (Y) on student learning performance. This study used a saturated sample conducted on all SMA/SMK (High School/Vocational High School), specifically for economics teachers and students in three cities, namely Blitar, Tulungagung, and Kediri with the following numbers:

Table 1 Distribution of High School Student's and Teacher's

No	School Areas	Total Students	Total Teachers
1	Blitar	228	50
2	Tulungagung	306	90
3	Kediri	411	65

There are several data analysis steps used by researchers to evaluate the data in this study, including using classical assumption tests and regression analysis. The classic assumption test is used to determine whether the parameters generated by the regression model are BLUE (*best linear unbiased estimator*). The classic assumption tests used in this study consisted of: normality, multicollinearity, and heteroscedasticity tests. Furthermore, the data analysis used is multiple regression analysis, which aims to determine whether the independent variables (*technology knowledge, computer skills, and game-based learning implementation*) and dummy (school area) on the

dependent variable (learning performance). The equation models used in this study are:

$$Y = \alpha + \beta 1\, X1 + \beta 2\, X2 + \beta 3X3 + \beta 1D1 + \beta 3D + \varepsilon$$

Multiple regression analysis used in this study was conducted using two tests, called the simultaneous test (F test) and partial test (t-test). The F test aims to determine whether all independent variables used in the regression model significantly affect the dependent variable (learning performance), with the hypothesis below,

H_A = Technology Knowledge, computer skills, game-based learning implementation, and school area has a significant influence on learning performance

In comparison, the t-test aims to determine whether each independent variable significantly affects the dependent variable (learning performance).

a) X1 → H_1 = Technology Knowledge has a significant influence on learning performance
b) X2 → H_2 = Computer skills has a significant influence on learning performance
c) X3 → H_3 = Game based learning implementation has a significant influence on learning outcomes
d) Dummy variable → H_4 = School area has a significant influence on learning performance

3. RESULTS AND DISCUSSION

This study uses multiple regression analysis to test the hypothesis. The tolerable error percentage is 5%, so the belief process used in this study is 95%. Therefore, if the significance value is less than 0.5, it can be concluded that the independent variable has a significant effect on the dependent variable. From the results of statistical tests, the multiple regression model equation is obtained as follows:

R2 (Adjusted R Square) value is 0.027. This value indicates that 2.7% of the variation in learning performance can be explained by the four independents, namely technology knowledge, computer skills, game-based learning implementation, and school area. The remaining 97.3% is influenced by other factors that have not been examined. The sig value F = 0.000. This means that simultaneously the four independent variables significantly affect learning performance because the value is below 5%. Also, the value of the constant is 80.329. This shows that if other variables are considered constant, the learning outcome variable is 80.329. Based on table 2, the following results are obtained:

a. Variable X1 (technology knowledge) has a positive and insignificant effect on variable Y (learning performance). Seen from the t-test statistics with |t count| smaller than t table (1,787 <1,962) and the p-value t is more significant than α (0.074> 0.050). This test shows the decision that H1 is rejected. A positive coefficient indicates that an increase in variable X1 (technology knowledge) can increase variable Y (learning performance) but it is not significant.
b. Variable X2 (computer skills) has a positive and significant effect on variable Y (posttest learning performance). Seen from the t-test statistics with |t count| is greater than t table (2,260> 1,962) and the p-value t is smaller than α (0.024 <0.050). This test shows the decision that H2 is rejected. A positive coefficient indicates an increase in the X2 variable (computer skills) can significantly increase the Y variable (learning performance).
c. Variable X3 (game-based learning implementation) has a negative and insignificant effect on variable Y (learning performance). Seen from the t-test statistics with |t count| smaller than t table (0.559 <1,962) and the p-value t is greater than α (0.576> 0.050). This test shows the decision that H3 is rejected. The negative coefficient indicates that an increase in the X3 variable (game-based learning implementation) can reduce the Y variable (learning performance) but it is not significant.
d. Variable D (school area) is split into categories, namely Blitar, Kediri, Tulungagung. Along with that, also Kediri area as a reference, as shown, the effect of changing is categorized as 1 (Blitar), or 3 (Tulungagung). The results are as follows:
    1. Variable D1 (School Area in Blitar) has a positive and significant effect on variable Y (learning performance). Seen from the t-test statistics with |t count| is greater than t table (3,745> 1,962) and the p-value t is smaller than α (0.000 <0.050). This test shows the decision that H4 is accepted. The positive coefficient shows that the variable D1 (School Area in Blitar) can significantly increase the Y variable (learning performance).
    2. Variable D3 (School Area in Tulungagung) has a positive and insignificant effect on variable Y (learning performance). As can be seen from the t-test statistics with |t count| smaller than t table (0.773 <1.962) and the p-value t that is greater than α (0.440> 0.050). This test shows the decision that H5 is rejected. The positive coefficient shows that the variable D3 (School Area in Tulungagung) can increase the Y variable (learning performance) but it is not significant.

Table 2 Summary of the Multiple Linear Regression Test

Variable	B	T_{count}	p-value t	Explanation
Constant	80.329			
X1 (Technological Knowledge)	0.126	1.787	0.074	Insignificant
X2 (Computer skills)	0.119	2.260	0.024	Insignificant
X3 (Game based learning implementation)	-0.026	-0.559	0.576	Insignificant
D1 (School Area in Blitar)	2.182	3.745	0.000	Significant
D3 (School Area in Tulungagung)	0.411	0.773	0.440	Insignificant
A		= 0.050		
Coefficient of Determination (R^2)		= 0.027		
F-count		= 5.225		
F-table ($F_{5,939,0.05}$)		= 2.224		
p-value F		= 0.000		
t-table($t_{939,0.05}$)		= 1.962		

3.1 The Effect of Technological Knowledge on Learning Performance

Testing the first hypothesis (H_1) proves that technical knowledge has a positive and insignificant effect on learning performance with a significance value of 0.074. Thus, the first hypothesis is rejected. The regression coefficient of the technology knowledge variable is 0.126. This shows that technology knowledge does not have a significant impact on student *learning performance* during learning at school. As a result, students lack knowledge when it comes to technology, thus, it does not have a significant impact on student learning performance. Technology knowledge can improve student learning performance even though they cannot improve significantly. The results of this study are consistent with the research of Al-Hariri [3] which states that the use of technology has essential benefits to improve learning performance. Thus, the use of technology must be balanced with technology skills.

3.2 The Effect of Computer Skills on Learning Performance

The second hypothesis testing (H_2) proves that *computer skills* have a positive and insignificant effect on learning performance with a significance value of 0.024. Thus, the second hypothesis is rejected. The regression coefficient of the *computer skills* variable was 0.119. This shows that *computer skills* have a significant impact on student learning performance during learning at school. As a result, students have good computer operation skills, which can have a significant impact on student learning performance. *Computer skills* can significantly improve student learning performance. The results of this study are consistent with the research of Schmid et al.,[34] which shows that the *computer skills* possessed by students will support the learning process, so that they can achieve optimal learning performance.

3.3 The Effect of Game-Based Learning Implementation on Learning Performance

Hypothesis testing in (H_3) proves that *game-based learning implementation* has a negative and insignificant effect on variable Y (learning performance). Seen from the t-test statistics with |t count| smaller than t table (0.559 <1,962) and the p-value t is greater than α (0.576> 0.050). This test shows the decision that H_3 is rejected. The negative coefficient indicates that an increase in the X3 variable (*Game-based learning implementation*) can reduce the Y variable (learning performance) but it is not significant. This shows that the *game-based learning implementation* learning model has not significantly affected student learning performance.

3.4 The Effect of School Areas on Learning Performance

The school area is split into three categories, namely Blitar, Kediri, and Tulungagung. Along with that, there is Kediri area as a reference. It is proven that change is shown in the category to 1 (Blitar) or 3 (Tulungagung). Based on the test results using regression analysis, it shows that the Blitar school area (D1) has a positive and significant effect on the Y variable (learning performance). Based on the statistical test t-test with |t count| is more generous than the t-table (3,745> 1,962) and the p-value t is smaller than α (0.000 <0.050). This test shows the decision that H_4 is accepted. The positive coefficient shows that the variable D1 (Blitar school area) can significantly increase the Y variable (learning performance). Whereas in the school area Tulungagung (D3), it shows that this school area has a positive and insignificant effect on the Y variable (learning performance). Based on the statistical test t-test with |t count| smaller than t table (0.773 <1.962) and the p-value t that is greater than α (0.440> 0.050). This test shows the decision that H_5 is rejected. The positive coefficient shows that the variable D3 (School Area in Tulungagung) can increase the Y variable (learning performance) but it is not significant.

4. CONCLUSION

This study has tested the technical knowledge, computer skills, game-based learning implementation, and school area variables using multiple regression models. The results of this study indicate that simultaneously all independent variables have a significant effect on the dependent variable (learning performance).

Technological knowledge has no significant effect on learning performance. This shows that technological knowledge has contributed to improving student learning performance even though it is not significant.

Computer skills have a significant effect on learning performance. This proves that computer skills do play an essential role in students' ability to use technology, hence the necessary skills of technology help students achieve optimal learning performance.

Game-based learning implementation is not significant in learning performance. This shows that game-based learning implementation has not been successful because other factors have not been examined in this study.

School areas in Blitar have a significant effect on learning performance, but the school area in Tulungagung has no significant effect on learning performance. This proves that the school area also has a vital role in students' success in learning. Besides, the supporting infrastructure for the learning process in each region is different, so this is a factor that may have resulted in contrasting findings.

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