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Authors: Nur Rohmah

Status: Fast Track Review

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A Vocational School Cutting-Edge Learning Strategy: Examining Gamification Towards Student Engagement and Student Achievement

ANONYMOUS

Abstract: The digital era facilitates vocational-based school learning by using innovative and digital methods. Learning media using gamification tends to be better and more relevant for students because it follows their age. This study aims to analyze the effect of gamification and student engagement on student achievement moderated by motivation. The study was conducted on vocational-based secondary school students in Central Java, involving 174 samples. The results showed that gamification and student engagement affected student achievement. Gamification affects student engagement, and motivation strengthens the effect of gamification and student engagement on student achievement. This study confirms that the gamification process in the learning process enhances the interaction between students. Research indicates that relevant gamification is implemented in vocational-based schools. Research demonstrates that motivational gamification has a critical role in increasing student achievement. Schools can adopt gamification methods to improve student learning abilities and achievement so that vocational schools acquire skilled students.

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Introduction

The learning process in vocational schools requires a particular skill to transfer skills to students. The learning method used does not only focus on lectures that require explanations from the teacher to be conveyed to students. Another innovative learning method can combine learning tools with digital techniques. The digital method learning process in the current era is known as gamification (Wang et al., 2017). The learning process adapted to the age of students who are still teenagers requires a more in-depth elaboration to analyze relevant learning strategies in vocational-based schools. Vocational-based schools focus on students' skills to do a job. The output in vocational-based schools is the ability of students to skillfully do a job so that it does not only focus on knowledge. The teacher's ability to explain the lecture method is relevant to students' understanding. Still, for student skills, it is necessary to have a learning method that does not only focus on the teacher as a learning resource.

Gamification is one method that is currently relevant to use because it has a digital visualization that can be used in the learning process. Learning activities that use gamification will be fun for students because they are relevant to their age. In addition, gamification has various advantages, namely, the material delivered does not meet the curriculum rules and can be adapted to digital developments or examples. Submission of material using gamification will tend to be more fun so that it creates an interaction.

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Interactions that occur in bringing up student engagement. Gamification is vital in creating student engagement which will affect student achievement (Hidayat et al., 2020).

Student engagement is an interaction that occurs using digital media, meaning that students are encouraged to carry out an activity using tools in the form of technology that contains a material. Gamification is a game modification that can be done in a learning process. A game is identical to a game, but when gamification is carried out, the learning process requires game principles to be applied to learning activities. Gamification is one method that is very popular in today's era because many various application service providers use gamification as a tool to create interaction between users and service providers. Adopting this strategy in the learning method is one of the ideal steps to increasing students' abilities and skills in vocational-based schools (Vrcelj et al., 2021). When students learn comprehensively through the available gamification, it will bring up success that is measured in the assessment process. Gamification is a tool that is currently popular for creating engagement and innovation to generate higher learning desires. Learning activities on gamification are relevant in vocational-based schools because they emphasize knowledge and skills that can be learned visually through gamification. Gamification requires a learning process that emphasizes student interaction with tools. The teacher as a facilitator provides learning activities oriented to students' skills and abilities. The presence of student motivation strengthens the role of gamification and student engagement. Students who have motivation will have a strong desire to obtain achievement. Measurements made on student achievement are based on the results of the assessment of the tests that students have carried out. The test results will be an indicator of learning achievement. The assessment results are an accurate description of their knowledge and skills. Motivation to get the achievement is one aspect that can strengthen gamification and student engagement, influencing student achievement (Bakar, 2018; Sumarni et al., 2016).

Gamification is a method or strategy implemented to make a learning process interesting. The learning process has experienced several challenges, one of which is the boredom felt by students when following a learning material. Gamification is one of the breakthroughs used to make the present material interesting. Delivering material delivered face-to-face or using the lecture method often has the challenge of boredom. The process of delivering material through communication is by making a game or game that is often used in the digital world. The gamification process requires a method that utilizes creativity that can be done with various tools. One of the gamification processes is to evaluate the material or a light quiz that is used to evaluate the results of the material delivery process so that teachers can measure the level of students' abilities in the material that has been taught. Gamification is an effort to form student engagement when following a material. The learning process that is carried out face-to-face using the lecture method will tend to create a sense of boredom so that to reduce this tendency, an effort is needed to form student engagement; engagement can be done in various ways, one of which is gamification (Yaşar et al., 2020).

The gamification process requires a tool to engage students on the tool containing a material. Establishing engagement is carried out by delivering material that will be evaluated using gamification. Gamification does not only contain an evaluation but a process to create an interesting learning process by adjusting to the subject's interest. Students who like gamification will tend to focus on the evaluation process. Gamification is a tendency favored by teenagers so that the gamification process will have a high level of engagement. This study confirms that gamification has a positive effect on student engagement. Gamification is a process to increase student interest in the evaluation process using tools. The evaluation



process carried out with this tool will support activities to analyze the ability of the material that has been delivered so that it can measure students' abilities. Measurement through gamification is a learning process to analyze the level of students' ability to understand the material. Gamification increases student engagement so the learning process can be optimized. Student engagement is an important indicator to ensure that the learning process can be optimized (Nayir, 2017).

H1: The application of gamification to vocational school students has a positive and significant effect on student engagement

Gamification is a fun learning activity that can be done through a process to increase interaction between students and tools. The tool in question is an interesting learning media according to students' interest in digitizing a tool used in the learning process. Gamification is an innovative activity carried out in the learning process to support fun and creative activities. The conventional learning process is to emphasize understanding to students through various methods. One method that is often used is to use lectures. The lecture method is a method that involves teachers and students so that the focus or attention used is to listen to the teacher's explanation. The learning process is a conventional learning activity so that it often creates a sense of boredom. One alternative is to use gamification where the tool as a learning medium raises creativity in the delivery of material. The material presented does not only focus on the teacher by explaining but gamification allows an independent learning process. This means that students are directed to use a digital learning media to improve their abilities. Gamification is a relevant learning process for vocational schools (Wang et al., 2017). Vocational schools require an emphasis on learning activities on psychomotor aspects so that not only the material delivered by the teacher is needed but a learning process is needed by analyzing activities or aspects related to expertise and skills. The learning process that supports these activities is carried out by gamifying the material. Gamification activities are not only listening but students are actively involved so that it will bring up students' abilities to obtain material optimally. When gamification is carried out, the learning process will form student achievement. The indicators used to measure student achievement are learning success in terms of the results of an objective assessment (Bal, 2019).

Assessment is one of the important indicators of student achievement to analyze the level of ability in acquiring skills and expertise in the field of vocational. Gamification raises an ability to learn more deeply using digital media. Gamification is an innovative method in the learning process to improve students' knowledge and skills. Gamification supports student success in the learning process which is marked by the successful achievement of the expected value standards. The gamification process supports expertise because it is listening to the teacher and digitally obtaining and visualizing to improve his skills and understanding. Previous research has shown that the gamification process allows students to learn more with fun digital methods while providing a comprehensive overview of the material being taught. Relevant gamification is applied to vocational-based schools to support learning achievement so that skills that cannot be learned by the lecture method can use the gamification method to improve the skills of vocational school students (Vrcelj et al., 2021)

H2: The application of gamification to vocational school students has a positive and significant effect on student achievement

Student interaction in the learning process can be done with various media. One of the media used is the digitization of materials and an evaluation method known as gamification. Gamification creates a process of interaction between students and their learning media. Gamification raises a learning process that is both fun and appropriate for the age of the

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students. This study analyzes the implications of gamification, namely student engagement that affects student achievement. Interaction in the learning process is an aspect that is a follow-up to the internalized understanding. Interaction describes the relationship between students and learning media that can create a reciprocal relationship (Shahroom & Hussin, 2018; Sharma, 2019). Interaction requires an input that will produce output on the learning media. The learning process will lead to student engagement between students with the material being studied and the learning media. When students have done a lot of interactions, it will bring up learning success which is called student achievement. Learning achievement is measured using the assessment method, which means that when students have carried out the learning process using media interaction, there is a measurement to analyze the level of understanding of the material being studied. Student achievement is one way that can accurately measure the level of students' understanding of the material being taught and their expertise. Students with a vocational school base need an understanding, expertise, and skills. Vocational schools are not only concerned with understanding theory but require a practice that requires a larger percentage (Purnamasari & Santoso, 2019; Purwandani & Syamsiah, 2020). Student achievement can be achieved when the material being taught is not only using the lecture method but requires an interaction on digitalized tools to facilitate the learning process. Learning activities that use interaction will encourage students' abilities not only to focus on the material but how to practice using the available tools. The learning process using interaction will support student achievement. There is an indicator of achievement indicators that are measured through a series of assessments so that they can analyze student achievement. The learning process that is carried out on an ongoing basis by optimizing student engagement will support student achievement (Istiqomah et al., 2019).

Learning achievement can be achieved when students focus on the material being studied so that the assessment measurement can be carried out optimally. The measurement is to analyze the level of achievement of indicators, both general competence and specific competence. The competencies learned in vocational-based schools show that the expected output is that students have skills. The measurement is to analyze the level of achievement of indicators, both general competence and specific competence. The competencies learned in vocational-based schools show that the expected output is that students have skills. The measurement analyzes the level of achievement of indicators, both general competence and specific competence. The competencies learned in vocational-based schools show that the expected output is that students have skills (Ilaltdinova et al., 2020).

H3: student engagement in vocational-based schools has a positive and significant effect on student achievement

Gamification creates a learning process that is more enjoyable when compared to the lecture method. Gamification raises an interaction that supports interactive learning activities. Learning activities on gamification support the visualization and digitization of learning activities. Gamification affects student achievement to form an objective and optimal assessment result. The learning process with gamification does not only focus on creating an understanding for vocational school students but also creates a skill based on the visualization available in the gamification of vocational-based student learning activities, which emphasizes how to learn that focuses on skills. Learning activities held in vocational-based schools are very relevant to gamification (Yaşar et al., 2020), so learning activities emphasize aspects of student skills to obtain student achievement. Motivation plays a big role in encouraging students to achieve optimal learning activities. Motivation will strengthen the gamification process to achieve student achievement. Learning activities that emphasize

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digitization and visualization require motivational encouragement from students so that student achievement will emerge. When students are not motivated to obtain an achievement, it will reduce student achievement. Conversely, when students have a strong motivation to obtain an achievement that describes student achievement, it will strengthen the gamification that the teacher has provided as a facilitator (Songkram & Chootongchai, 2020).

Student engagement is one indicator that determines an interaction between students and the tools used in the learning process. Student engagement arises from learning media that can create interactive relationships between students and the material presented. The learning process requires an interaction to improve students' understanding and skills by using gamification. This study elaborates in depth the interactions that students can do with the tool, namely by focusing on improving a skill by looking at the visualization that will be practiced on existing material in the laboratory. When students see visually, it will increase understanding not obtained using the lecture method. The lecture method has a weakness: students only listen and the teacher is the center of learning. Learning activities that focus on lecture activities will be relevant to focus on knowledge. Learning motivation is one aspect that can strengthen the effect of student engagement on student achievement. Motivation is a desire to achieve certain achievements so that with the motivation, student achievement will be easier to achieve. Previous research elaborates on motivation that motivation can strengthen a desire to achieve achievement. Student engagement is an interaction that occurs when students carry out the learning process learning activities that are driven by motivation will form a student achievement that will produce an optimal value. Student achievement is a student's ability to acquire knowledge and skills that a certain rating scale can measure. Motivation has an important role in determining student success in student achievement for both gamification and student engagement. Motivation has a strong influence to increase student achievement (Senaratne & Samarasinghe, 2019).

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H4: motivation strengthens the positive influence of vocational-based school gamification on student achievement

H5: motivation strengthens the positive influence of vocational-based school student engagement on student achievement

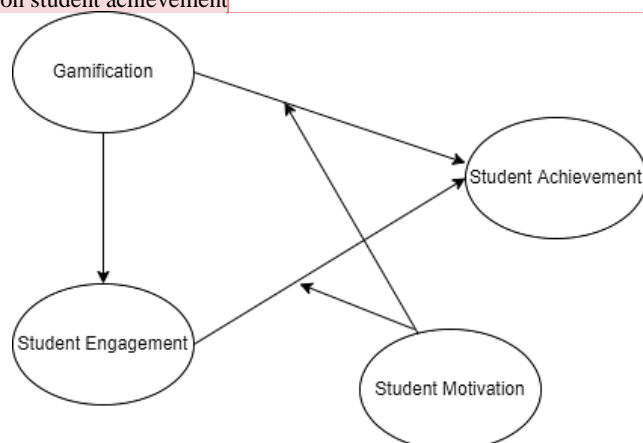


Figure 1. Research Framework

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Research Method

This study aims to analyze the effect of gamification and student engagement on student achievement moderated by motivation. The study used a purposive random sample to obtain the research sample. This research was conducted in vocational-based secondary schools to obtain data. This study involved 174 students who used gamification in their school activities. The criteria chosen in this study were students who had used gamification in learning activities in their schools. The research data that has been obtained is then processed using SEM-PLS. The data tested is by using validity, reliability, and hypothesis testing to prove the research hypothesis (Hair et al., 2014).

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the focus of this section describes; **The research method used, population/sample, research instrument, and analysis technique/hypothesis testing!**

Result and Discussion

Figure 1 shows the research framework and the results of the outer loading on each indicator. The results of this study, both in Figure 1 and Table 1, indicate that all indicators in the study have met the rules of having an outer loading ≥ 0.7 (Hair et al., 2014).

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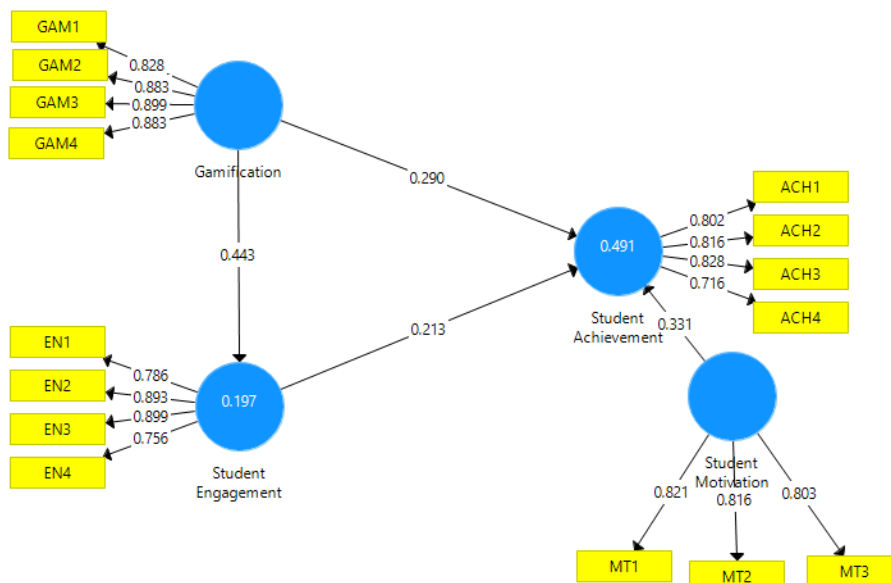


Figure 2. Outer Loading Result
Table 1. Outer Loading Result

Indicator	Gamification	Student Achievement	Student Engagement	Student Motivation
ACH1		0.802		
ACH2		0.816		
ACH3		0.828		
ACH4		0.716		
EN1			0.786	
EN2			0.893	
EN3			0.899	

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EN4			0.756	
GAM1	0.828			
GAM2	0.883			
GAM3	0.899			
GAM4	0.883			
MT1				0.821
MT2				0.816
MT3				0.803

Note: *ACH: Student Achievement; EN: Student Engagement; GAM: Gamification; MT: Motivation

Testing through the Fornell-Larcker criterion aims to analyze the validity of variables with correlations to other variables. Fornell-Larcker testing is based on variance compared to other variables. The study results show that all variables have met the validity rules indicated by a value greater than the other variables as represented in Table 2.

Table 2. Fornell-Larcker Result

Variable	Gamification	Student Achievement	Student Engagement	Student Motivation
Gamification	0.874			
Student Achievement	0.555	0.792		
Student Engagement	0.443	0.572	0.836	
Student Motivation	0.516	0.629	0.697	0.814

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The results in Table 3 showed that Cronbach Alpha and composite reliability had a value ≥ 0.7 , this indicates that the reliability rules have been met, which indicates that all variables in the study are reliable.

Table 3. Reliability Test Result

Variable	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Gamification	0.897	0.902	0.928	0.764
Student Achievement	0.801	0.808	0.87	0.627
Student Engagement	0.855	0.869	0.902	0.699
Student Motivation	0.746	0.751	0.854	0.662

The results of the study in table 4 show that the adjusted R-square value has a value of 0.19 which indicates that the effect of gamification on student engagement has a fairly good value. While the results of the study indicate that the effect of gamification and student engagement on student achievement has a value of 0.478 which indicates that the two variables has a big influence on student achievement.

Table 4. R-Square Result

Variable	R Square	R Square
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		Adjusted
Student Achievement	0.491	0.478
Student Engagement	0.197	0.190

Table 5. Hypothesis Test Result

Variable	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
Gamification -> Student Achievement	0.255	0.272	0.093	2.742	0.006
Gamification -> Student Engagement	0.443	0.453	0.086	5.163	0.000
Student Engagement -> Student Achievement	0.243	0.231	0.097	2.511	0.012
Student Motivation -> Student Achievement	0.301	0.312	0.096	3.124	0.002
Moderating Effect 1 -> Student Achievement	0.312	0.322	0.097	3.254	0.003
Moderating Effect 2 -> Student Achievement	0.561	0.545	0.095	5.647	0.000

Moderating Effect 1: Gamification moderated by student motivation

Moderating Effect 2: Student Engagement moderated by student motivation

The results of the study indicate that the test results support all hypotheses. In addition, this study confirms that moderation, namely student motivation, has a role in strengthening the effect of gamification and student engagement on student achievement.

DISCUSSION

The results showed that gamification had a positive effect on student engagement. Gamification is a learning process that uses a tool to create interaction through visualization and digitization of material so that there is an interaction between students and learning media. The results of this study confirm that a learning process that uses digital media will facilitate the learning process and delivery of material and will support a learning process that will create skills (Vrcelj et al., 2021). Learning activities that use gamification support a learning process or media that can provide a comprehensive picture to students. The learning method used conventionally is lectures or listening to explain to students. This learning method has a weakness, namely it cannot describe the material comprehensively presented. Visualization delivered with gamification and games in the learning process will encourage more intensive interaction. Learning activities use gamification to support an interaction that will create student engagement (Naem, 2011). This study confirms that student engagement can be influenced by the learning process that uses games and visualization. Gamification is a learning process that adapts to the age of students who are still teenagers so that games using gamification In the learning process will support student engagement.

One of the important indicators in learning activities is creating student engagement that can be implemented in learning activities. Student engagement is a process that occurs



when students have an attachment to the material presented and learning media that can encourage an interactive process in learning activities. Interaction is one of the efforts to create the internalization of knowledge and skills. When student engagement can be implemented, it has the potential to bring up more optimal skills and knowledge. Gamification is a fun activity, it is a modification of learning activities that have been done conventionally. Modification is a process of creating a novelty through innovation that students need in learning activities. Gamification is an activity that supports the learning process by creating a game in activities related to the material presented (Qureshi et al., 2021). The material that supports gamification is related to digital so that it can be transformed into a game that will support student engagement. This study reinforces that gamification is an innovative learning activity that affects student engagement.

Gamification is a learning process that uses digitalization visualization and games that are available when students get learning. Learning activities through gamification is a fun and innovative learning process. So far, gamification has been widely adopted by application service providers to provide a playing process to its users. The playing process will support an activity that creates an interaction so that there is an engagement for students. This study confirms that gamification has a positive effect on student achievement. This research proves that the learning process that uses digital interaction and visualization has an important role in shaping student achievement and success. When students learn using conventional methods, the learning process tends to be boring. Learning activities that use innovation will tend to be favored, especially by paying attention to the age of still teenagers, so gamification is an alternative that is very relevant for students who are studying. These learning activities provide a novelty and fun method to bring up a learning process that has implications for achieving effective learning. This study proves that gamification has an effect on student achievement which indicates that playing activities combined with learning tend to be more fun when compared to focusing on material that tends to be boring (Nortvig et al., 2018). Vocational-based schools require a gamification-based learning process to support the achievement of learning activities that can focus on skills. The teacher's explanation as a learning resource in the classroom will tend to increase students' knowledge. However, gamification is a relevant alternative to be implemented if the desired focus is on skills and expertise. This study confirms that gamification in the form of visualization and digitization as well as games tend to be favored and provide positive benefits for student achievement. This study confirms that gamification is a fun learning process that can provide benefits to student achievement, which means that student achievement is also determined by the preferred learning method. The preferred and relevant learning method is an important aspect to determine the success of student learning so that gamification is one of the activities that can provide positive benefits. This study confirms that gamification has a positive effect on student achievement in vocational-based schools.

The results showed that student engagement had a positive effect on student achievement. This study confirms that an interaction created by a tool, namely gamification, will create an interaction between students and intensive learning media. The interaction between students and learning media will be important in creating student learning success. Student engagement is an effort to support learning activities that create interactions, meaning that by using these interactions there can be an exchange of knowledge and skills. Fun learning activities for students are an alternative to create successful learning. One of these learning methods is gamification, which can engage students. The learning process that uses interaction will support learning achievement in accordance with the learning objectives.



Learning activities by supporting interaction between learning media and students will create more knowledge. The learning process using interaction requires a material that has been studied in advance so that students get feedback on these materials. Learning activities carried out by students are not only related to material learning but there is a visualization of the material contained in gamification. The learning process that supports gamification activities can be facilitated by the teacher so that in conventional learning methods it also acts as a learning center but in gamification activities the teacher acts as a facilitator (Teuber et al., 2021).

Learning activities that use tools as learning centers and students who are actively involved in learning activities will support the emergence of student achievement. These learning activities will increase students' knowledge and skills through image visualization, ultimately resulting in student achievement. Student learning activities that support student achievement are carried out continuously so that there are continuous learning activities. Learning activities using gamification aim to facilitate the learning process so as to create student engagement. When students are actively involved, an interaction can be carried out so that it creates engagement that affects student achievement. Student skills can be done by providing a visual understanding that will be easy to understand and practice. Learning activities by prioritizing interaction will be easier to do when compared to one-way learning activities. In the conventional learning process, it tends to deliver lectures to students so that the teacher plays an active role in being the center of learning and learning resources when gamification is carried out, the opposite can be implemented (Elffers et al., 2012). Gamification is a learning process that focuses on students. Learning activities that aim to provide an interaction means that students are actively involved in the process of learning activities. The learning process using gamification encourages active participation to create student engagement. When an interaction occurs in student engagement, there is activity and the student's motor system is actively implemented to play an important role in increasing memory and repetition of the material presented. The influence of temperature and engagement has an important role to create student achievement (Othman et al., 2014).

Gamification is a fun learning process for students. Gamification is a learning alternative that provides comfort and fun for students to be actively involved in learning activities. Application service providers currently widely adopted gamification and can be implemented in student learning activities. Students who have a relatively young age. Young students have a close relationship with learning activities that are applied by combining games in gamification (Rahman et al., 2018). The visualization contained in gamification plays an important role in supporting the achievement of student achievement. Motivation to learn is one of the important aspects that will strengthen gamification effect on student achievement. Motivation arises from gamification implemented by learning activities in the classroom. So that in the learning process there is a desire to increase the development of knowledge and skills.

Motivation is an important aspect supported by age-appropriate gamification relevant to adolescents. When students learn a lot about the material delivered with gamification, the learning processes and activities will increase their knowledge and skills in vocational schools that focus on skills so that they require a visualization that can describe the material being taught (Baghurst et al., 2015). Fun learning activities are one of the stimulations that play an important role in generating motivation. Student engagement is one of the important aspects to raise motivation when students learn with fun materials and methods, it will encourage the desire to learn and achieve the expected achievements. A pleasant learning



process is an important aspect to determine the level of success of learning following the learning objectives. An important aspect in motivation is the desire to achieve achievement so that fun learning activities to achieve the expected achievements are indispensable in learning activities in the classroom, the learning process which is moderated by motivation is proven to have a positive and significant effect on student achievement (Istiqomah et al., 2019). A fun learning process is an important aspect of gamification and student engagement to form student achievement. This research proves that achievement cannot be done without a strong motivation. This means that activities carried out in a fun way will lead to optimal learning achievement. Through motivation. A fun learning process will lead to intensive engagement and interaction with the learning media used and is an important aspect in learning activities because it is an indicator or expected output in vocational-based schools. The expected student achievement is an objective assessment result so that the assessment results will describe student achievement and achievement. Student learning activities that are strengthened by motivation have an important role in determining the success or achievement of student learning (Bakar, 2018). A pleasant learning process is one factor that supports the emergence of learning motivation. When students have succeeded in carrying out learning activities by understanding the material presented and practicing their learning outcomes through image visualization, it will encourage the desire to achieve higher achievements. This study has proven that motivation plays an essential role in motivating and strengthening student achievement. Motivation is a factor that can encourage to create student achievement. This means that motivation strengthens student achievement in achieving student achievement.

Conclusion

This study aims to elaborate on the effect of gamification implemented in schools and student engagement on student achievement which is moderated by motivation. Gamification is one way to deliver innovative learning materials. Gamification in the current era has been widely adopted by application service providers to create engagement for its users. Learning activities carried out with innovative and eggplant to reduce boredom when compared to conventional learning methods. [.....] This study has proven that gamification has a positive effect on student engagement and student achievement. This study confirms that gamification has an important role to create interaction and student learning success. This study also proves that student engagement has an effect on student achievement. This study illustrates that an interaction that occurs in the classroom will determine the success of student learning. Research also proves that motivation strengthens the effect of gamification and student engagement on student achievement. Motivation is an essential aspect in learning activities so that students who have high motivation will have a better level of achievement.

Recommendation

Schools are expected to implement gamification as an alternative effective learning strategy for vocational-based schools. Gamification provides an opportunity for students to learn using methods that are appropriate for their age. Gamification is interesting and has positive implications for skills

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Acknowledgment

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[JK] Editor Decision (Accepted)

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1 September 2022 pukul 12.39

On the behalf of the JK Editorial Team, we are pleased to inform that your paper with entitled: **“A Vocational School Cutting-Edge Learning Strategy: Examining Gamification Towards Student Engagement and Achievement”**, written by **Nur Rohmah** (Department of Shipping and Port Management, Merchant Marine Polytechnic of Semarang) has been *Accepted* and will be proceed to be published in Jurnal Kependidikan (Sinta 2), Vol. 8 No. 3 – (issue) September 2022 (E-ISSN: 2442 – 7667) and will be available online on <https://e-journal.undikma.ac.id/index.php/jurnalkependidikan>.

We congratulate for your achievement. The technical issues about the publication will be informed later. Thank you!

Kindest Regards,
Executive Editor,



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LETTER OF ACCEPTANCE

Number: 75/PB/L1/UNDIKMA/2022

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1 September 2022 pukul 13.14

Dear Author(s),

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A Vocational School Cutting-Edge Learning Strategy: Examining Gamification Towards Student Engagement and Achievement

ANONYMOUS

Abstract: The study aims to analyze the effect of gamification and student engagement on student achievement moderated by motivation. The research using quantitative approach to obtain data. The research instrument using likert scale questionnaire which distributed to student who already employ gamification. The study was conducted on vocational-based secondary school students in Central Java, involving 174 samples. The results showed that gamification and student engagement affected student achievement. Gamification affects student engagement, and motivation strengthens the effect of gamification and student engagement on student achievement. This study confirms that the gamification process in the learning process enhances the interaction between students. Research indicates that relevant gamification is implemented in vocational-based schools. Research demonstrates that motivational gamification has a critical role in increasing student achievement. Schools can adopt gamification methods to improve student learning abilities and achievement so that vocational schools acquire skilled students.

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Introduction

The learning process in vocational schools requires a particular skill to transfer skills to students. The learning method used does not only focus on lectures that require explanations from the teacher to be conveyed to students. Another innovative learning method can combine learning tools with digital techniques. The digital method learning process in the current era is known as gamification (Wang et al., 2017b). The learning process adapted to the age of students who are still teenagers requires a more in-depth elaboration to analyze relevant learning strategies in vocational-based schools. Vocational-based schools focus on students' skills to do a job. The output in vocational-based schools is the ability of students to skillfully do a job so that it does not only focus on knowledge. The teacher's ability to explain the lecture method is relevant to students' understanding. Still, for student skills, it is necessary to have a learning method that does not only focus on the teacher as a learning resource.

Gamification is one method that is currently relevant to use because it has a digital visualization that can be used in the learning process (Rahman et al., 2018; Wang et al., 2017a). Learning activities that use gamification will be fun for students because they are relevant to their age. In addition, gamification has various advantages, namely, the material delivered does not meet the curriculum rules and can be adapted to digital developments or examples (Yaşar et al., 2020). Submission of material using gamification will tend to be more fun so that it creates an interaction. Interactions that occur in bringing up student engagement. Gamification is vital in creating student engagement which will affect student achievement (Hidayat et al., 2020).

Student engagement is an interaction that occurs using digital media, meaning that students are encouraged to carry out an activity using tools in the form of technology that contains a material. Gamification is a game modification that can be done in a learning process. A game is identical to a game, but when gamification is carried out, the learning process requires game principles to be applied to learning activities. Gamification is one method that is very popular in today's era because many various application service providers use gamification as a tool to create interaction between users and service providers. Adopting this strategy in the learning method is one of the ideal steps to increasing students' abilities

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and skills in vocational-based schools (Vrcelj et al., 2021). When students learn comprehensively through the available gamification, it will bring up success that is measured in the assessment process. Gamification is a tool that is currently popular for creating engagement and innovation to generate higher learning desires. Learning activities on gamification are relevant in vocational-based schools because they emphasize knowledge and skills that can be learned visually through gamification. Gamification requires a learning process that emphasizes student interaction with tools. The teacher as a facilitator provides learning activities oriented to students' skills and abilities. The presence of student motivation strengthens the role of gamification and student engagement. Students who have motivation will have a strong desire to obtain achievement. Measurements made on student achievement are based on the results of the assessment of the tests that students have carried out. The test results will be an indicator of learning achievement. The assessment results are an accurate description of their knowledge and skills. Motivation to get the achievement is one aspect that can strengthen gamification and student engagement, influencing student achievement (Bakar, 2018; Sumarni et al., 2016).

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Gamification is a method or strategy implemented to make a learning process interesting. The learning process has experienced several challenges, one of which is the boredom felt by students when following a learning material. Gamification is one of the breakthroughs used to make the present material interesting. Delivering material delivered face-to-face or using the lecture method often has the challenge of boredom. The process of delivering material through communication is by making a game or game that is often used in the digital world. The gamification process requires a method that utilizes creativity that can be done with various tools (Alshammari, 2020). One of the gamification processes is to evaluate the material or a light quiz that is used to evaluate the results of the material delivery process so that teachers can measure the level of students' abilities in the material that has been taught. Gamification is an effort to form student engagement when following a material. The learning process that is carried out face-to-face using the lecture method will tend to create a sense of boredom so that to reduce this tendency, an effort is needed to form student engagement; engagement can be done in various ways, one of which is gamification (Yaşar et al., 2020).

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The gamification process requires a tool to engage students on the tool containing a material. Establishing engagement is carried out by delivering material that will be evaluated using gamification. Gamification does not only contain an evaluation but a process to create an interesting learning process by adjusting to the subject's interest. Students who like gamification will tend to focus on the evaluation process. Gamification is a tendency favored by teenagers so that the gamification process will have a high level of engagement. This study confirms that gamification has a positive effect on student engagement. Gamification is a process to increase student interest in the evaluation process using tools. The evaluation process carried out with this tool will support activities to analyze the ability of the material that has been delivered so that it can measure students' abilities. Measurement through gamification is a learning process to analyze the level of students' ability to understand the material. Gamification increases student engagement so the learning process can be optimized. Student engagement is an important indicator to ensure that the learning process can be optimized (Nayir, 2017).

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Gamification is a fun learning activity that can be done through a process to increase interaction between students and tools. The tool in question is an interesting learning media according to students' interest in digitizing a tool used in the learning process. Gamification is an innovative activity carried out in the learning process to support fun and creative activities (Henderson et al., 2015). The conventional learning process is to emphasize understanding to students through various methods. One method that is often used is to use lectures. The lecture method is a method that involves teachers and students so that the focus or attention

used is to listen to the teacher's explanation. The learning process is a conventional learning activity so that it often creates a sense of boredom. One alternative is to use gamification where the tool as a learning medium raises creativity in the delivery of material. The material presented does not only focus on the teacher by explaining but gamification allows an independent learning process. This means that students are directed to use a digital learning media to improve their abilities. Gamification is a relevant learning process for vocational schools (Wang et al., 2017b). Vocational schools require an emphasis on learning activities on psychomotor aspects so that not only the material delivered by the teacher is needed but a learning process is needed by analyzing activities or aspects related to expertise and skills. The learning process that supports these activities is carried out by gamifying the material (Sadaf & Johnson, 2017). Gamification activities are not only listening but students are actively involved so that it will bring up students' abilities to obtain material optimally. When gamification is carried out, the learning process will form student achievement. The indicators used to measure student achievement are learning success in terms of the results of an objective assessment (Bal, 2019).

Assessment is one of the important indicators of student achievement to analyze the level of ability in acquiring skills and expertise in the field of vocational. Gamification raises an ability to learn more deeply using digital media. Gamification is an innovative method in the learning process to improve students' knowledge and skills. Gamification supports student success in the learning process which is marked by the successful achievement of the expected value standards. The gamification process supports expertise because it is listening to the teacher and digitally obtaining and visualizing to improve his skills and understanding. Previous research has shown that the gamification process allows students to learn more with fun digital methods while providing a comprehensive overview of the material being taught. Relevant gamification is applied to vocational-based schools to support learning achievement so that skills that cannot be learned by the lecture method can use the gamification method to improve the skills of vocational school students (Vrcelj et al., 2021).

Student interaction in the learning process can be done with various media. One of the media used is the digitization of materials and an evaluation method known as gamification. Gamification creates a process of interaction between students and their learning media. Gamification raises a learning process that is both fun and appropriate for the age of the students. This study analyzes the implications of gamification, namely student engagement that affects student achievement. Interaction in the learning process is an aspect that is a follow-up to the internalized understanding (Naeem, 2011). Interaction describes the relationship between students and learning media that can create a reciprocal relationship (Shahroom & Hussin, 2018; Sharma, 2019). Interaction requires an input that will produce output on the learning media. The learning process will lead to student engagement between students with the material being studied and the learning media. When students have done a lot of interactions, it will bring up learning success which is called student achievement. Learning achievement is measured using the assessment method, which means that when students have carried out the learning process using media interaction, there is a measurement to analyze the level of understanding of the material being studied. Student achievement is one way that can accurately measure the level of students' understanding of the material being taught and their expertise. Students with a vocational school base need an understanding, expertise, and skills. Vocational schools are not only concerned with understanding theory but require a practice that requires a larger percentage (Purnamasari & Santoso, 2019; Purwandani & Syamsiah, 2020). Student achievement can be achieved when the material being taught is not only using the lecture method but requires an interaction on digitalized tools to facilitate the learning process. Learning activities that use interaction will encourage students' abilities not only to focus on the material but how to practice using the available tools. The learning process using interaction will support student achievement.

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There is an indicator of achievement indicators that are measured through a series of assessments so that they can analyze student achievement. The learning process that is carried out on an ongoing basis by optimizing student engagement will support student achievement (Istiqomah et al., 2019).

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Learning achievement can be achieved when students focus on the material being studied so that the assessment measurement can be carried out optimally. The measurement is to analyze the level of achievement of indicators, both general competence and specific competence. The competencies learned in vocational-based schools show that the expected output is that students have skills. The measurement is to analyze the level of achievement of indicators, both general competence and specific competence. The competencies learned in vocational-based schools show that the expected output is that students have skills. The measurement analyzes the level of achievement of indicators, both general competence and specific competence. The competencies learned in vocational-based schools show that the expected output is that students have skills (Ilaltdinova et al., 2020).

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Gamification creates a learning process that is more enjoyable when compared to the lecture method. Gamification raises an interaction that supports interactive learning activities. Learning activities on gamification support the visualization and digitization of learning activities. Gamification affects student achievement to form an objective and optimal assessment result. The learning process with gamification does not only focus on creating an understanding for vocational school students but also creates a skill based on the visualization available in the gamification of vocational-based student learning activities, which emphasizes how to learn that focuses on skills. Learning activities held in vocational-based schools are very relevant to gamification (Yaşar et al., 2020), so learning activities emphasize aspects of student skills to obtain student achievement. Motivation plays a big role in encouraging students to achieve optimal learning activities. Motivation will strengthen the gamification process to achieve student achievement. Learning activities that emphasize digitization and visualization require motivational encouragement from students so that student achievement will emerge. When students are not motivated to obtain an achievement, it will reduce student achievement. Conversely, when students have a strong motivation to obtain an achievement that describes student achievement, it will strengthen the gamification that the teacher has provided as a facilitator (Songkram & Chootongchai, 2020).

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Student engagement is one indicator that determines an interaction between students and the tools used in the learning process. Student engagement arises from learning media that can create interactive relationships between students and the material presented. The learning process requires an interaction to improve students' understanding and skills by using gamification. This study elaborates in depth the interactions that students can do with the tool, namely by focusing on improving a skill by looking at the visualization that will be practiced on existing material in the laboratory. When students see visually, it will increase understanding not obtained using the lecture method. The lecture method has a weakness; students only listen and the teacher is the center of learning. Learning activities that focus on lecture activities will be relevant to focus on knowledge. Learning motivation is one aspect that can strengthen the effect of student engagement on student achievement. Motivation is a desire to achieve certain achievements so that with the motivation, student achievement will be easier to achieve. Previous research elaborates on motivation that motivation can strengthen a desire to achieve achievement. Student engagement is an interaction that occurs when students carry out the learning process learning activities that are driven by motivation will form a student achievement that will produce an optimal value. Student achievement is a student's ability to acquire knowledge and skills that a certain rating scale can measure. Motivation has an important role in determining student success in student achievement for both gamification and student engagement. Motivation has a strong influence to increase student achievement (Senaratne & Samarasinghe, 2019).

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Research Method

The study used a purposive random sample to obtain the research sample. The research instrument used a questionnaire to obtain data. Questionnaires were distributed to students who had received material using the gamification method. This research was conducted in vocational-based secondary schools to obtain data. This study involved 174 students who used gamification in their school activities. The criteria chosen in this study were students who had used gamification in learning activities in their schools. The research data that has been obtained is then processed using SEM-PLS. The data tested is by using validity, reliability, and hypothesis testing to prove the research hypothesis (Hair et al., 2014).

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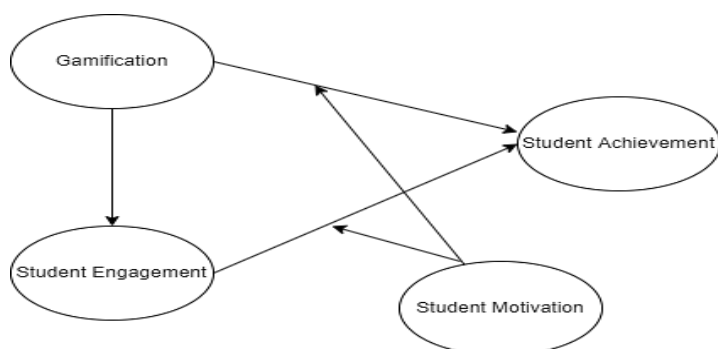


Figure 1. Research Framework

Result and Discussion

Figure 1 shows the research framework and the results of the outer loading on each indicator. The results of this study, both in Figure 1 and Table 1, indicate that all indicators in the study have met the rules of having an outer loading ≥ 0.7 (Hair et al., 2014).

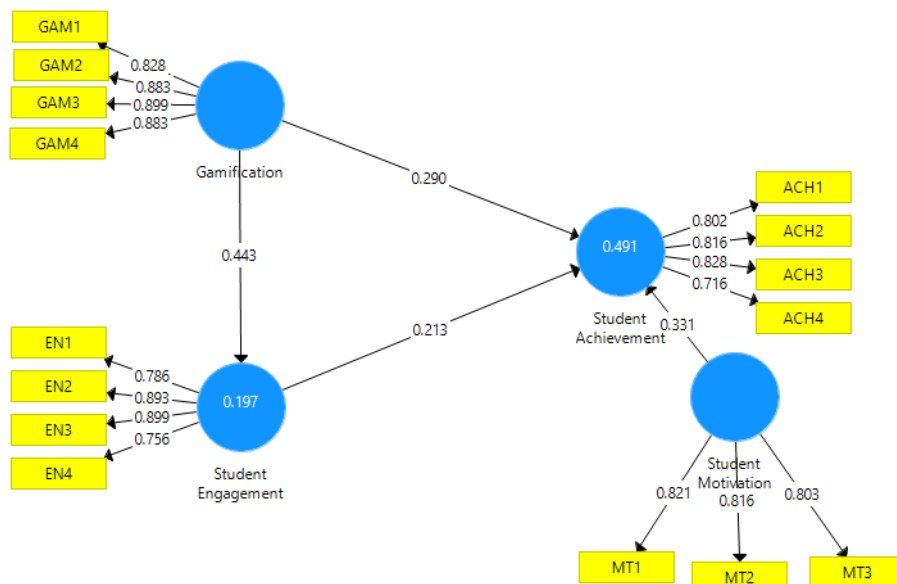


Figure 2. Outer Loading Result

Table 1. Outer Loading Result

Indicator	Gamification	Student Achievement	Student Engagement	Student Motivation
ACH1		0.802		
ACH2		0.816		
ACH3		0.828		
ACH4		0.716		
EN1			0.786	
EN2			0.893	
EN3			0.899	
EN4			0.756	
GAM1	0.828			
GAM2	0.883			
GAM3	0.899			
GAM4	0.883			
MT1				0.821
MT2				0.816
MT3				0.803

Note: *ACH: Student Achievement; EN: Student Engagement; GAM: Gamification; MT: Motivation

Testing through the Fornell-Larcker criterion aims to analyze the validity of variables with correlations to other variables. Fornell-Larcker testing is based on variance compared to other variables. The study results show that all variables have met the validity rules indicated by a value greater than the other variables as represented in Table 2.

Table 2. Fornell-Larcker Result

Variable	Gamification	Student Achievement	Student Engagement	Student Motivation
Gamification	0.874			
Student Achievement	0.555	0.792		
Student Engagement	0.443	0.572	0.836	
Student Motivation	0.516	0.629	0.697	0.814

The results in Table 3 showed that Cronbach Alpha and composite reliability had a value ≥ 0.7 , this indicates that the reliability rules have been met, which indicates that all variables in the study are reliable.

Table 3. Reliability Test Result

Variable	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Gamification	0.897	0.902	0.928	0.764
Student Achievement	0.801	0.808	0.87	0.627
Student Engagement	0.855	0.869	0.902	0.699
Student Motivation	0.746	0.751	0.854	0.662

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The results of the study in table 4 show that the adjusted R-square value has a value of 0.19 which indicates that the effect of gamification on student engagement has a fairly good value. While the results of the study indicate that the effect of gamification and student engagement on student achievement has a value of 0.478 which indicates that the two variables has a big influence on student achievement.

Table 4. R-Square Result

Variable	R Square	R Square Adjusted
Student Achievement	0.491	0.478
Student Engagement	0.197	0.190

Table 5. Hypothesis Test Result

Variable	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
Gamification -> Student Achievement	0.255	0.272	0.093	2.742	0.006
Gamification -> Student Engagement	0.443	0.453	0.086	5.163	0.000
Student Engagement -> Student Achievement	0.243	0.231	0.097	2.511	0.012
Student Motivation -> Student Achievement	0.301	0.312	0.096	3.124	0.002
Moderating Effect 1 -> Student Achievement	0.312	0.322	0.097	3.254	0.003
Moderating Effect 2 -> Student Achievement	0.561	0.545	0.095	5.647	0.000

Moderating Effect 1: Gamification moderated by student motivation

Moderating Effect 2: Student Engagement moderated by student motivation

The results of the study indicate that the test results support all hypotheses. In addition, this study confirms that moderation, namely student motivation, has a role in strengthening the effect of gamification and student engagement on student achievement.

Discussion

The results showed that gamification had a positive effect on student engagement. Gamification is a learning process that uses a tool to create interaction through visualization and digitization of material so that there is an interaction between students and learning media. The results of this study confirm that a learning process that uses digital media will facilitate the learning process and delivery of material and will support a learning process that will create skills (Vrcelj et al., 2021). Learning activities that use gamification support a learning process or media that can provide a comprehensive picture to students. The learning method used conventionally is lectures or listening to explain to students. This learning method has a weakness, namely it cannot describe the material comprehensively presented. Visualization delivered with gamification and games in the learning process will encourage more intensive interaction. Learning activities use gamification to support an interaction that will create student engagement (Naem, 2011). This study confirms that student engagement can be influenced by the learning process that uses games and visualization. Gamification is a learning process that adapts to the age of students who are still teenagers so that games using gamification In the learning process will support student engagement.

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One of the important indicators in learning activities is creating student engagement that can be implemented in learning activities. Student engagement is a process that occurs when students have an attachment to the material presented and learning media that can encourage an interactive process in learning activities. Interaction is one of the efforts to create the internalization of knowledge and skills. When student engagement can be implemented, it has the potential to bring up more optimal skills and knowledge. Gamification is a fun activity, it is a modification of learning activities that have been done conventionally. Modification is a process of creating a novelty through innovation that students need in learning activities. Gamification is an activity that supports the learning process by creating a game in activities related to the material presented (Qureshi et al., 2021). The material that supports gamification is related to digital so that it can be transformed into a game that will support student engagement. This study reinforces that gamification is an innovative learning activity that affects student engagement.

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Gamification is a learning process that uses digitalization visualization and games that are available when students get learning. Learning activities through gamification is a fun and innovative learning process. So far, gamification has been widely adopted by application service providers to provide a playing process to its users. The playing process will support an activity that creates an interaction so that there is an engagement for students. This study confirms that gamification has a positive effect on student achievement. This research proves that the learning process that uses digital interaction and visualization has an important role in shaping student achievement and success. When students learn using conventional methods, the learning process tends to be boring. Learning activities that use innovation will tend to be favored, especially by paying attention to the age of still teenagers, so gamification is an alternative that is very relevant for students who are studying. These learning activities provide a novelty and fun method to bring up a learning process that has implications for achieving effective learning. This study proves that gamification has an effect on student achievement which indicates that playing activities combined with learning tend to be more fun when compared to focusing on material that tends to be boring (Nortvig et al., 2018). Vocational-based schools require a gamification-based learning process to support the achievement of learning activities that can focus on skills. The teacher's explanation as a learning resource in the classroom will tend to increase students' knowledge. However, gamification is a relevant alternative to be implemented if the desired focus is on skills and expertise. This study confirms that gamification in the form of visualization and digitization as well as games tend to be favored and provide positive benefits for student achievement. This study confirms that gamification is a fun learning process that can provide benefits to student achievement, which means that student achievement is also determined by the preferred learning method. The preferred and relevant learning method is an important aspect to determine the success of student learning so that gamification is one of the activities that can provide positive benefits. This study confirms that gamification has a positive effect on student achievement in vocational-based schools.

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The results showed that student engagement had a positive effect on student achievement. This study confirms that an interaction created by a tool, namely gamification, will create an interaction between students and intensive learning media. The interaction between students and learning media will be important in creating student learning success. Student engagement is an effort to support learning activities that create interactions, meaning that by using these interactions there can be an exchange of knowledge and skills. Fun learning activities for students are an alternative to create successful learning. One of these learning methods is gamification, which can engage students. The learning process that uses interaction will support learning achievement in accordance with the learning objectives. Learning activities by supporting interaction between learning media and students will create more knowledge. The learning process using interaction requires a material that has been

studied in advance so that students get feedback on these materials. Learning activities carried out by students are not only related to material learning but there is a visualization of the material contained in gamification. The learning process that supports gamification activities can be facilitated by the teacher so that in conventional learning methods it also acts as a learning center but in gamification activities the teacher acts as a facilitator (Teuber et al., 2021).

Learning activities that use tools as learning centers and students who are actively involved in learning activities will support the emergence of student achievement. These learning activities will increase students' knowledge and skills through image visualization, ultimately resulting in student achievement. Student learning activities that support student achievement are carried out continuously so that there are continuous learning activities. Learning activities using gamification aim to facilitate the learning process so as to create student engagement. When students are actively involved, an interaction can be carried out so that it creates engagement that affects student achievement. Student skills can be done by providing a visual understanding that will be easy to understand and practice. Learning activities by prioritizing interaction will be easier to do when compared to one-way learning activities. In the conventional learning process, it tends to deliver lectures to students so that the teacher plays an active role in being the center of learning and learning resources when gamification is carried out, the opposite can be implemented (Elffers et al., 2012). Gamification is a learning process that focuses on students. Learning activities that aim to provide an interaction means that students are actively involved in the process of learning activities. The learning process using gamification encourages active participation to create student engagement. When an interaction occurs in student engagement, there is activity and the student's motor system is actively implemented to play an important role in increasing memory and repetition of the material presented. The influence of temperature and engagement has an important role to create student achievement (Othman et al., 2014).

Gamification is a fun learning process for students. Gamification is a learning alternative that provides comfort and fun for students to be actively involved in learning activities. Application service providers currently widely adopted gamification and can be implemented in student learning activities. Students who have a relatively young age. Young students have a close relationship with learning activities that are applied by combining games in gamification (Rahman et al., 2018). The visualization contained in gamification plays an important role in supporting the achievement of student achievement. Motivation to learn is one of the important aspects that will strengthen gamification effect on student achievement. Motivation arises from gamification implemented by learning activities in the classroom. So that in the learning process there is a desire to increase the development of knowledge and skills.

Motivation is an important aspect supported by age-appropriate gamification relevant to adolescents. When students learn a lot about the material delivered with gamification, the learning processes and activities will increase their knowledge and skills in vocational schools that focus on skills so that they require a visualization that can describe the material being taught (Baghurst et al., 2015). Fun learning activities are one of the stimulations that play an important role in generating motivation. Student engagement is one of the important aspects to raise motivation when students learn with fun materials and methods, it will encourage the desire to learn and achieve the expected achievements. A pleasant learning process is an important aspect to determine the level of success of learning following the learning objectives. An important aspect in motivation is the desire to achieve achievement so that fun learning activities to achieve the expected achievements are indispensable in learning activities in the classroom. the learning process which is moderated by motivation is proven to have a positive and significant effect on student achievement (Istiqomah et al., 2019). A fun learning process is an important aspect of gamification and student engagement to form

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student achievement. This research proves that achievement cannot be done without a strong motivation. This means that activities carried out in a fun way will lead to optimal learning achievement (Androutsos & Brinia, 2019). Through motivation. A fun learning process will lead to intensive engagement and interaction with the learning media used and is an important aspect in learning activities because it is an indicator or expected output in vocational-based schools. The expected student achievement is an objective assessment result so that the assessment results will describe student achievement and achievement. Student learning activities that are strengthened by motivation have an important role in determining the success or achievement of student learning (Bakar, 2018). A pleasant learning process is one factor that supports the emergence of learning motivation. When students have succeeded in carrying out learning activities by understanding the material presented and practicing their learning outcomes through image visualization, it will encourage the desire to achieve higher achievements (Tokan & Imakulata, 2019). This study has proven that motivation plays an essential role in motivating and strengthening student achievement. Motivation is a factor that can encourage to create student achievement. This means that motivation strengthens student achievement in achieving student achievement.

Conclusion

Based on the result of the test and discussion, the conclusion of this research are proven that gamification has a positive effect on student engagement and student achievement. This study confirms that gamification has an important role to create interaction and student learning success. This study also proves that student engagement has an effect on student achievement. This study illustrates that an interaction that occurs in the classroom will determine the success of student learning. Research also proves that motivation strengthens the effect of gamification and student engagement on student achievement. Motivation is an essential aspect in learning activities so that students who have high motivation will have a better level of achievement.

Recommendation

Schools are expected to implement gamification as an alternative effective learning strategy for vocational-based schools. Gamification provides an opportunity for students to learn using methods that are appropriate for their age. Gamification is interesting and has positive implications for skills. Especially for teacher, gamification is a method that adapts technology. Teachers should learn a lot by adapting new technology. Adaptation should conduct by enriching the material and learning new technologies

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Through motivation, a fun learning process will lead to intensive engagement and interaction with the learning media used and is an important aspect of learning activities because it is an indicator of expected output in vocational-based schools.

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Authors Nur Rohmah 
Title A Vocational School Cutting-Edge Learning Strategy: Examining Gamification Towards Student Engagement and Achievement
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Editor Fitri Astutik 

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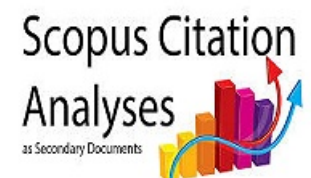
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#5779 Summary

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Submission

Authors	Nur Rohmah
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Original file	5779-19823-1-SM.DOC 2022-08-09
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Title and Abstract

Title	A Vocational School Cutting-Edge Learning Strategy: Examining Gamification Towards Student Engagement and Achievement
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Abstract	<p>The digital era facilitates vocational-based school learning by using innovative and digital methods. Learning media using gamification tends to be better and more relevant for students because it follows their age. This study aims to analyze the effect of gamification and student engagement on student achievement moderated by motivation. The study was conducted on vocational-based secondary school students in Central Java, involving 174 samples. The results showed that gamification and student engagement affected student achievement. Gamification affects student engagement, and motivation strengthens the effect of gamification and student engagement on student achievement. This study confirms that the gamification process in the learning process enhances the interaction between students. Research indicates that relevant gamification is implemented in vocational-based schools. Research demonstrates that motivational gamification has a critical role in increasing student achievement. Schools can adopt gamification methods to improve student learning abilities and achievement so that vocational schools acquire skilled students.</p>
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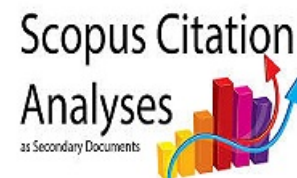
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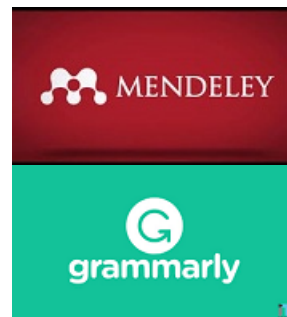
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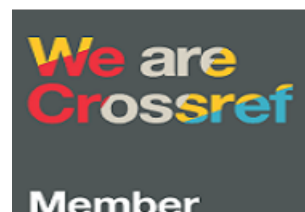
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A Vocational School Cutting-Edge Learning Strategy: Examining Gamification Towards Student Engagement and Achievement

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Abstract: The study aims to analyze the effect of gamification and student engagement on student achievement moderated by motivation. The research using quantitative approach to obtain data. The research instrument using likert scale questionnaire which distributed to student who already employ gamification. The study was conducted on vocational-based secondary school students in Central Java, involving 174 samples. The results showed that gamification and student engagement affected student achievement. Gamification affects student engagement, and motivation strengthens the effect of gamification and student engagement on student achievement. This study confirms that the gamification process in the learning process enhances the interaction between students. Research indicates that relevant gamification is implemented in vocational-based schools. Research demonstrates that motivational gamification has a critical role in increasing student achievement. Schools can adopt gamification methods to improve student learning abilities and achievement so that vocational schools acquire skilled students.

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Introduction

The learning process in vocational schools requires a particular skill to transfer skills to students. The learning method used does not only focus on lectures that require explanations from the teacher to be conveyed to students. Another innovative learning method can combine learning tools with digital techniques. The digital method learning process in the current era is known as gamification (Wang et al., 2017b). The learning process adapted to the age of students who are still teenagers requires a more in-depth elaboration to analyze relevant learning strategies in vocational-based schools. Vocational-based schools focus on students' skills to do a job. The output in vocational-based schools is the ability of students to skillfully do a job so that it does not only focus on knowledge. The teacher's ability to explain the lecture method is relevant to students' understanding. Still, for student skills, it is necessary to have a learning method that does not only focus on the teacher as a learning resource.

Gamification is one method that is currently relevant to use because it has a digital visualization that can be used in the learning process (Rahman et al., 2018; Wang et al., 2017a). Learning activities that use gamification will be fun for students because they are relevant to their age. In addition, gamification has various advantages, namely, the material delivered does not meet the curriculum rules and can be adapted to digital developments or examples (Ya ar et al., 2020). Submission of material using gamification will tend to be more fun so that it creates an interaction. Interactions that occur in bringing up student engagement.



Gamification is vital in creating student engagement, affecting student achievement (Hidayat et al., 2020).

Student engagement is an interaction that occurs using digital media, meaning that students are encouraged to carry out an activity using tools in the form of technology that contains material. Gamification is a game modification that can be done in a learning process. A game is identical to a game, but when gamification is carried out, the learning process requires game principles to be applied to learning activities. Gamification is one method that is very popular in today's era because many various application service providers use gamification as a tool to create interaction between users and service providers. Adopting this strategy in the learning method is one of the ideal steps to increasing students' abilities and skills in vocational-based schools (Vrcelj et al., 2021). When students learn comprehensively through the available gamification, it will bring up success that is measured in the assessment process. Gamification is a tool that is currently popular for creating engagement and innovation to generate higher learning desires. Learning activities on gamification are relevant in vocational-based schools because they emphasize knowledge and skills that can be learned visually through gamification. Gamification requires a learning process that emphasizes student interaction with tools. The teacher as a facilitator provides learning activities oriented to students' skills and abilities. The presence of student motivation strengthens the role of gamification and student engagement. Students who have motivation will have a strong desire to achieve. Measurements made on student achievement are based on the results of the assessment of the tests that students have carried out. The test results will be an indicator of learning achievement. The assessment results are an accurate description of their knowledge and skills. Motivation to get the achievement is one aspect that can strengthen gamification and student engagement, influencing student achievement (Bakar, 2018; Sumarni et al., 2016).

Gamification is a method or strategy implemented to make a learning process interesting. The learning process has experienced several challenges, one of which is the boredom felt by students when following a learning material. Gamification is one of the breakthroughs used to make the present material interesting. Delivering material delivered face-to-face or using the lecture method often has the challenge of boredom. The process of delivering material through communication is by making a game or game that is often used in the digital world. The gamification process requires a method that utilizes creativity that can be done with various tools (Alshammari, 2020). One of the gamification processes is to evaluate the material or a light quiz that is used to evaluate the results of the material delivery process so that teachers can measure the level of students' abilities in the material that has been taught. Gamification is an effort to form student engagement when following a material. The learning process that is carried out face-to-face using the lecture method will tend to create a sense of boredom so to reduce this tendency; an effort is needed to form student engagement; engagement can be done in various ways, one of which is gamification (Ya ar et al., 2020).

The gamification process requires a tool to engage students on the tool containing a material. Establishing engagement is carried out by delivering material that will be evaluated using gamification. Gamification does not only contain an evaluation but a process to create an interesting learning process by adjusting to the subject's interest. Students who like gamification will tend to focus on the evaluation process. Gamification is a tendency favored by teenagers so that the gamification process will have a high level of engagement. This study confirms that gamification has a positive effect on student engagement. Gamification is a process to increase student interest in the evaluation process using tools. The evaluation



process carried out with this tool will support activities to analyze the ability of the material that has been delivered so that it can measure students' abilities. Measurement through gamification is a learning process to analyze students' ability to understand the material. Gamification increases student engagement so the learning process can be optimized. Student engagement is an important indicator to optimize the learning process (Nayir, 2017).

Gamification is a fun learning activity that can be done through a process to increase interaction between students and tools. The tool in question is an interesting learning media according to students' interest in digitizing a tool used in the learning process. Gamification is an innovative activity carried out in the learning process to support fun and creative activities (Henderson et al., 2015). The conventional learning process is to emphasize understanding to students through various methods. One method that is often used is to use lectures. The lecture method is a method that involves teachers and students so that the focus or attention used is to listen to the teacher's explanation. The learning process is a conventional learning activity that often creates a sense of boredom. One alternative is to use gamification where the tool as a learning medium raises creativity in delivering material. The material presented does not only focus on the teacher by explaining but gamification allows an independent learning process. This means that students are directed to use digital learning media to improve their abilities. Gamification is a relevant learning process for vocational schools (Wang et al., 2017b). Vocational schools require an emphasis on learning activities on psychomotor aspects so that not only the material delivered by the teacher is needed but a learning process is needed by analyzing activities or aspects related to expertise and skills. The learning process supports these activities by gamifying the material (Sadaf & Johnson, 2017). Gamification activities are not only listening but students are actively involved so that it will bring up students' abilities to obtain material optimally. When gamification is carried out, the learning process will form student achievement. The indicators used to measure student achievement are learning success in terms of the results of an objective assessment (Bal, 2019).

Assessment is one of the important indicators of student achievement to analyze the level of ability in acquiring skills and expertise in the field of vocational. Gamification raises an ability to learn more deeply using digital media. Gamification is an innovative method in the learning process to improve students' knowledge and skills. Gamification supports student success in learning, which is marked by achieving the expected value standards. The gamification process supports expertise because it is listening to the teacher and digitally obtaining and visualizing to improve his skills and understanding. Previous research has shown that gamification allows students to learn more with fun digital methods while providing a comprehensive overview of the material. Relevant gamification is applied to vocational-based schools to support learning achievement so that skills that cannot be learned by the lecture method can use the gamification method to improve the skills of vocational school students (Vrcelj et al., 2021).

Student interaction in the learning process can be done with various media. One of the media used is the digitization of materials and an evaluation method known as gamification. Gamification creates a process of interaction between students and their learning media. Gamification raises a learning process that is both fun and appropriate for the age of the students. This study analyzes the implications of gamification, namely student engagement that affects student achievement. Interaction in the learning process is an aspect that is a follow-up to the internalized understanding (Naeem, 2011). Interaction describes the relationship between students and learning media that can create a reciprocal relationship (Shahroom & Hussin, 2018; Sharma, 2019). Interaction requires an input that will produce



output on the learning media. The learning process will lead to student engagement between students with the material being studied and the learning media. When students have done many interactions, it will bring up learning success which is called student achievement. Learning achievement is measured using the assessment method, which means that when students have carried out the learning process using media interaction, there is a measurement to analyze the level of understanding of the material being studied. Student achievement is one way that can accurately measure the level of students' understanding of the material being taught and their expertise. Students with a vocational school base need an understanding, expertise, and skills. Vocational schools are not only concerned with understanding theory but require a practice that requires a larger percentage (Purnamasari & Santoso, 2019; Purwandani & Syamsiah, 2020). Student achievement can be achieved when the material being taught is not only using the lecture method but requires interaction on digitalized tools to facilitate the learning process. Learning activities that use interaction will encourage students' abilities not only to focus on the material but how to practice using the available tools. The learning process using interaction will support student achievement. There is an indicator of achievement indicators that is measured through a series of assessments so that they can analyze student achievement. The learning process that is carried out on an ongoing basis by optimizing student engagement will support student achievement (Istiqomah et al., 2019).

Learning achievement can be achieved when students focus on the material being studied so that the assessment measurement can be carried out optimally. The measurement analyzes the level of achievement of indicators, both general competence and specific competence. The competencies learned in vocational-based schools show that the expected output is that students have skills. The measurement is to analyze the level of achievement of indicators, both general competence and specific competence. The competencies learned in vocational-based schools show that the expected output is that students have skills. The measurement analyzes the level of achievement of indicators, both general competence and specific competence. The competencies learned in vocational-based schools show that the expected output is that students have skills (Ilaltdinova et al., 2020).

Gamification creates a learning process that is more enjoyable when compared to the lecture method. Gamification raises an interaction that supports interactive learning activities. Learning activities on gamification support the visualization and digitization of learning activities. Gamification affects student achievement to form an objective and optimal assessment result. The learning process with gamification does not only focus on creating an understanding for vocational school students but also creates a skill based on the visualization available in the gamification of vocational-based student learning activities, which emphasizes how to learn and focuses on skills. Learning activities held in vocational-based schools are very relevant to gamification (Ya ar et al., 2020), so learning activities emphasize aspects of student skills to obtain student achievement. Motivation plays a big role in encouraging students to achieve optimal learning activities. Motivation will strengthen the gamification process to achieve student achievement. Learning activities that emphasize digitization and visualization require motivational encouragement from students so that student achievement will emerge. When students are not motivated to obtain achievement, it will reduce student achievement. Conversely, when students have a strong motivation to obtain an achievement that describes student achievement, it will strengthen the gamification that the teacher has provided as a facilitator (Songkram & Chootongchai, 2020).

Student engagement is one indicator that determines an interaction between students and the tools used in the learning process. Student engagement arises from learning media

that can create interactive relationships between students and the material presented. The learning process requires interaction to improve students' understanding and skills using gamification. This study elaborates in depth the interactions that students can do with the tool, namely by focusing on improving a skill by looking at the visualization that will be practiced on existing material in the laboratory. When students see visually, it will increase understanding not obtained using the lecture method. The lecture method is weak: students only listen and the teacher is the center of learning. Learning activities that focus on lecture activities will be relevant to focus on knowledge. Learning motivation is one aspect that can strengthen the effect of student engagement on student achievement. Motivation is a desire to achieve certain achievements so that with motivation, student achievement will be easier to achieve. Previous research elaborates on motivation that motivation can strengthen a desire to achieve achievement. Student engagement is an interaction that occurs when students carry out the learning process learning activities driven by motivation will form a student achievement that will produce an optimal value. Student achievement is a student's ability to acquire knowledge and skills that a certain rating scale can measure. Motivation has an important role in determining student success in student achievement for both gamification and student engagement. Motivation has a strong influence on increasing student achievement (Senaratne & Samarasinghe, 2019).

Research Method

The study used a purposive random sample to obtain the research sample. The research instrument used a questionnaire to obtain data. Questionnaires were distributed to students who had received material using the gamification method. This research was conducted in vocational-based secondary schools to obtain data. This study involved 174 students who used gamification in their school activities. The criteria chosen in this study were students who had used gamification in learning activities in their schools. The research data that had been obtained was then processed using SEM-PLS. The data tested is by using validity, reliability, and hypothesis testing to prove the research hypothesis (Hair et al., 2014).

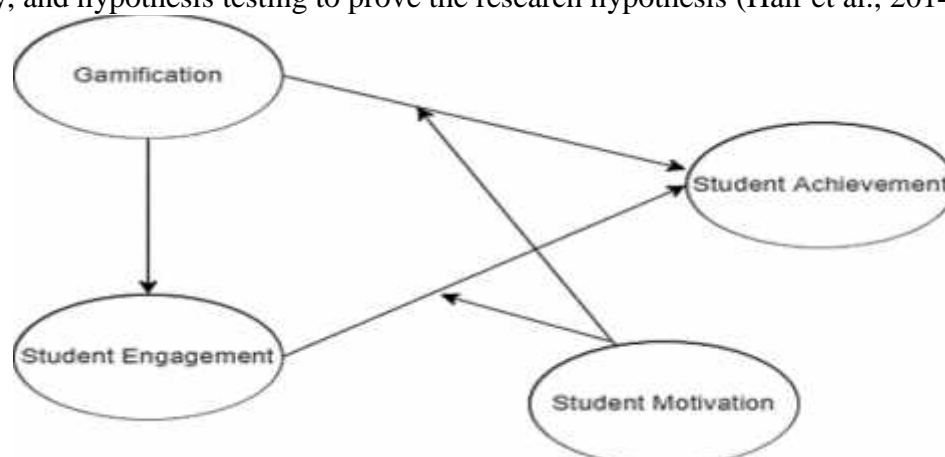


Figure 1. Research Framework

Results and Discussion

Figure 1 shows the research framework and the results of the outer loading on each indicator. The results of this study, both in Figure 1 and Table 1, indicate that all indicators in the study have met the rules of having an outer loading ≥ 0.7 (Hair et al., 2014).

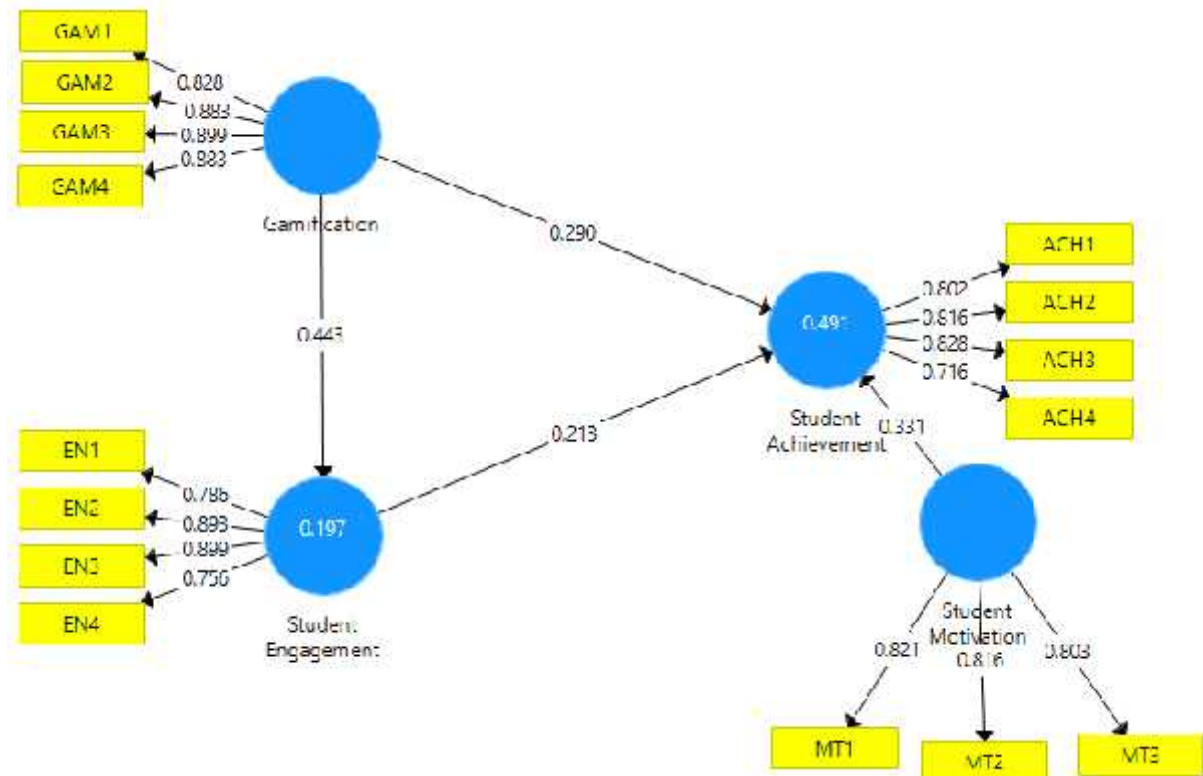


Figure 2. Outer Loading Result

Table 1. Outer Loading Result

Indicator	Gamification	Student Achievement	Student Engagement	Student Motivation
ACH1		0.802		
ACH2		0.816		
ACH3		0.828		
ACH4		0.716		
EN1			0.786	
EN2			0.893	
EN3			0.899	
EN4			0.756	
GAM1	0.828			
GAM2	0.883			
GAM3	0.899			
GAM4	0.883			
MT1				0.821
MT2				0.816
MT3				0.803

Note: *ACH: Student Achievement; EN: Student Engagement; GAM: Gamification; MT: Motivation

Testing through the Fornell-Larcker criterion aims to analyze the validity of variables with correlations to other variables. Fornell-Larcker testing is based on variance compared to other variables. The study results showed that all variables had met the validity rules indicated by a value greater than the other variables as represented in Table 2.

Table 2. Fornell-Larcker Result

Variable	Gamification	Student Achievement	Student Engagement	Student Motivation
Gamification	0.874			
Student Achievement	0.555	0.792		
Student Engagement	0.443	0.572	0.836	
Student Motivation	0.516	0.629	0.697	0.814

The results in Table 3 showed that Cronbach Alpha and composite reliability had a value ≥ 0.7 , this indicates that the reliability rules have been met, which indicates that all variables in the study are reliable.

Table 3. Reliability Test Result

Variable	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Gamification	0.897	0.902	0.928	0.764
Student Achievement	0.801	0.808	0.87	0.627
Student Engagement	0.855	0.869	0.902	0.699
Student Motivation	0.746	0.751	0.854	0.662

The results of the study in table 4 showed that the adjusted R-square value had a value of 0.19 which indicated that the effect of gamification on student engagement had a fairly good value. While the results of the study indicated that the effect of gamification and student engagement on student achievement had a value of 0.478 which indicated that the two variables have big influence on student achievement.

Table 4. R-Square Result

Variable	R Square	R Square Adjusted
Student Achievement	0.491	0.478
Student Engagement	0.197	0.190

Table 5. Hypothesis Test Result

Variable	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
Gamification -> Student Achievement	0.255	0.272	0.093	2.742	0.006
Gamification -> Student Engagement	0.443	0.453	0.086	5.163	0.000
Student Engagement -> Student Achievement	0.243	0.231	0.097	2.511	0.012
Student Motivation -> Student Achievement	0.301	0.312	0.096	3.124	0.002
Moderating Effect 1 -> Student Achievement	0.312	0.322	0.097	3.254	0.003
Moderating Effect 2 -> Student Achievement	0.561	0.545	0.095	5.647	0.000



Moderating Effect 1: Gamification moderated by student motivation

Moderating Effect 2: Student Engagement moderated by student motivation

The results of the study indicated that the test results supported all hypotheses. In addition, this study confirms that moderation, namely student motivation, has a role in strengthening the effect of gamification and student engagement on student achievement.

Discussion

The results showed that gamification had a positive effect on student engagement. Gamification is a learning process that uses a tool to create interaction through visualization and digitization of material so that there is an interaction between students and learning media. The results of this study confirm that a learning process that uses digital media will facilitate the learning process and delivery of material and will support a learning process that will create skills (Vrcelj et al., 2021). Learning activities that use gamification support a learning process or media that can provide a comprehensive picture to students. The learning method used conventionally is lecturing or listening to explain to students. This learning method has a weakness, namely it cannot describe the material comprehensively presented. Visualization delivered with gamification and games in the learning process will encourage more intensive interaction. Learning activities use gamification to support an interaction that will create student engagement (Naeem, 2011). This study confirms that student engagement can be influenced by the learning process that uses games and visualization. Gamification is a learning process that adapts to the age of students who are still teenagers so that games using gamification In the learning process will support student engagement.

One of the important indicators in learning activities is creating student engagement that can be implemented in learning activities. Student engagement is a process that occurs when students have an attachment to the material presented and learning media that can encourage an interactive process in learning activities. Interaction is one of the efforts to create the internalization of knowledge and skills. When student engagement can be implemented, it has the potential to bring up more optimal skills and knowledge. Gamification is a fun activity, it is a modification of learning activities that have been done conventionally. Modification is creating a novelty through innovation that students need in learning activities. Gamification is an activity that supports the learning process by creating a game in activities related to the material presented (Qureshi et al., 2021). The material that supports gamification is related to digital so that it can be transformed into a game that will support student engagement. This study reinforces that gamification is an innovative learning activity that affects student engagement.

Gamification is a learning process that uses digitalization visualization and games that are available when students get learning. Learning activities through gamification is a fun and innovative learning process. So far, gamification has been widely adopted by application service providers to provide a playing process to its users. The playing process will support an activity that creates an interaction so that there is an engagement for students. This study confirms that gamification has a positive effect on student achievement. This research proves that the learning process that uses digital interaction and visualization has an important role in shaping student achievement and success. When students learn using conventional methods, the learning process tends to be boring. Learning activities that use innovation will be favored, especially by paying attention to the age of still teenagers, so gamification is an alternative that is very relevant for students who are studying. These learning activities provide a novelty and fun method to bring up a learning process that has implications for achieving effective learning. This study proves that gamification affects student achievement



which indicates that playing activities combined with learning tend to be more fun when compared to focusing on material that tends to be boring (Nortvig et al., 2018). Vocational-based schools require a gamification-based learning process to support the achievement of learning activities that can focus on skills. The teacher's explanation as a learning resource in the classroom will tend to increase students' knowledge. However, gamification is a relevant alternative if the desired focus is on skills and expertise. This study confirms that gamification in the form of visualization and digitization as well as games tend to be favored and provide positive benefits for student achievement. This study confirms that gamification is a fun learning process that can provide benefits to student achievement, which means that student achievement is also determined by the preferred learning method. The preferred and relevant learning method is an important aspect to determine the success of student learning so that gamification is one of the activities that can provide positive benefits. This study confirms that gamification positively affects student achievement in vocational-based schools.

The results showed that student engagement had a positive effect on student achievement. This study confirms that an interaction created by a tool, namely gamification, will create an interaction between students and intensive learning media. The interaction between students and learning media will be important in creating student learning success. Student engagement is an effort to support learning activities that create interactions, meaning that by using these interactions there can be an exchange of knowledge and skills. Fun learning activities for students are an alternative to create successful learning. One of these learning methods is gamification, which can engage students. The learning process that uses interaction will support learning achievement in accordance with the learning objectives. Learning activities by supporting interaction between learning media and students will create more knowledge. The learning process using interaction requires a material that has been studied in advance so that students get feedback on these materials. Learning activities carried out by students are not only related to material learning but there is a visualization of the material contained in gamification. The learning process that supports gamification activities can be facilitated by the teacher so that in conventional learning methods it also acts as a learning center but in gamification activities the teacher acts as a facilitator (Teuber et al., 2021).

Learning activities that use tools as learning centers and students who are actively involved in learning activities will support the emergence of student achievement. These learning activities will increase students' knowledge and skills through image visualization, ultimately resulting in student achievement. Student learning activities that support student achievement are carried out continuously so that there are continuous learning activities. Learning activities using gamification aim to facilitate the learning process to create student engagement. When students are actively involved, an interaction can be carried out so that it creates engagement that affects student achievement. Student skills can be done by providing a visual understanding that will be easy to understand and practice. Learning activities by prioritizing interaction will be easier compared to one-way learning activities. In the conventional learning process, it tends to deliver lectures to students so that the teacher plays an active role in being the center of learning and learning resources when gamification is carried out, the opposite can be implemented (Elffers et al., 2012). Gamification is a learning process that focuses on students. Learning activities that aim to provide an interaction means that students are actively involved in the process of learning activities. The learning process using gamification encourages active participation to create student engagement. When an interaction occurs in student engagement, there is activity, and the student's motor system is



actively implemented to play an important role in increasing memory and repetition of the material presented. The influence of temperature and engagement is important in creating student achievement (Othman et al., 2014).

Gamification is a fun learning process for students. Gamification is a learning alternative that provides comfort and fun for students to be actively involved in learning activities. Application service providers currently widely adopt gamification and can be implemented in student learning activities. Students who have a relatively young age. Young students have a close relationship with learning activities that are applied by combining games in gamification (Rahman et al., 2018). The visualization contained in gamification plays an important role in supporting the achievement of student achievement. Motivation to learn is one of the important aspects that will strengthen gamification effect on student achievement. Motivation arises from gamification implemented by learning activities in the classroom. So in the learning process, there is a desire to increase the development of knowledge and skills.

Motivation is an important aspect supported by age-appropriate gamification relevant to adolescents. When students learn a lot about the material delivered with gamification, the learning processes and activities will increase their knowledge and skills in vocational schools that focus on skills so that they require a visualization that can describe the material being taught (Baghurst et al., 2015). Fun learning activities are one of the stimulations that play an important role in generating motivation. Student engagement is one of the important aspects to raise motivation when students learn with fun materials and methods, it will encourage the desire to learn and achieve the expected achievements. A pleasant learning process is an important aspect of determining the level of success of learning following the learning objectives. An important aspect of motivation is the desire to achieve achievement so that fun learning activities to achieve the expected achievements are indispensable in learning activities in the classroom; the learning process which is moderated by motivation is proven to have a positive and significant effect on student achievement (Istiqomah et al., 2019). A fun learning process is an important aspect of gamification and student engagement to form student achievement.

This research proves that achievement cannot be done without strong motivation. This means that activities carried out in a fun way will lead to optimal learning achievement (Androutsos & Brinia, 2019). Through motivation, a fun learning process will lead to intensive engagement and interaction with the learning media used and is an important aspect of learning activities because it is an indicator of expected output in vocational-based schools. The expected student achievement is an objective assessment result so that the assessment results will describe student achievement and achievement. Student learning activities that are strengthened by motivation have an important role of determining the success or achievement of student learning (Bakar, 2018). A pleasant learning process is one factor that supports the emergence of learning motivation. When students have succeeded in learning activities by understanding the material presented and practicing their learning outcomes through image visualization, it will encourage the desire to achieve higher achievements (Tokan & Imakulata, 2019). This study has proven that motivation plays is essential in motivating and strengthening student achievement. Motivation is a factor that can encourage to create student achievement. This means that motivation strengthens student achievement in achieving student achievement.

Conclusion

Based on the test result and discussion, this research's conclusion is proven that gamification has a positive effect on student engagement and student achievement. This study confirms that gamification is important in creating interaction and student learning success. This study also proves that student engagement affects on student achievement. This study illustrates that an interaction in the classroom will determine the success of student learning. Research also proves that motivation strengthens the effect of gamification and student engagement on student achievement. Motivation is an essential aspect of learning activities so that students with high motivation will have a better level of achievement.

Recommendation

Schools are expected to implement gamification as an alternative effective learning strategy for vocational-based schools. Gamification allows students to learn using appropriate methods for their age. Gamification is interesting and has positive implications for skills. Especially for teachers, gamification is a method that adapts technology. Teachers should learn a lot by adapting new technology. Adaptation should conduct by enriching the material and learning new technologies.

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