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Impact of Game-Based Learning Media in Improving Learning Outcomes of High School Students at Sekolah Indonesia Kota Kinabalu

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ABSTRACT

This study focuses on the Information and Communication Technology (ICT) learning outcomes of high school students at Sekolah Indonesia Kota Kinabalu. The researcher employed a one-group pretest-posttest approach. A total of 33 students from class XB participated in the study, selected using a purposive sampling technique. The research instrument consisted of 20 cognitive test items administered before and after the intervention. To evaluate the effectiveness of the change in learning outcomes, the Wilcoxon test and N-gain test were used, given that the data were not normally distributed. The data showed that the students' average score increased from 46.36 on the pretest to 71.06 on the posttest. The Wilcoxon test result of 0.00 (<0.05) provides strong evidence that the use of game-based learning tools can improve student learning outcomes. The high effectiveness of the game-based learning materials was confirmed by an N-gain score of 0.83 (or 83.33%), indicating an improvement in ICT learning outcomes among the high school students at Sekolah Indonesia Kota Kinabalu.

Keywords: Game-Based Learning Media, Learning Outcomes, High School Students, Information And Communication Technology (ICT), Digitization.

ABSTRAK

Penelitian ini berfokus pada hasil belajar Teknologi Informasi dan Komunikasi (TIK) siswa SMA di Sekolah Indonesia Kota Kinabalu. Peneliti menggunakan pendekatan one-group pretest-posttest. Sebanyak 33 siswa dari kelas XB berpartisipasi dalam penelitian ini, yang dipilih menggunakan teknik purposive sampling. Instrumen penelitian terdiri dari 20 butir soal tes kognitif yang diberikan sebelum dan sesudah intervensi. Untuk mengevaluasi efektivitas perubahan hasil belajar, digunakan uji Wilcoxon dan uji N-gain, mengingat data tidak berdistribusi normal. Data menunjukkan bahwa nilai rata-rata siswa meningkat dari 46,36 pada pretest menjadi 71,06 pada posttest. Hasil uji Wilcoxon sebesar 0,00 (<0,05) memberikan bukti kuat bahwa penggunaan perangkat pembelajaran berbasis permainan dapat meningkatkan hasil belajar siswa. Tingginya efektivitas materi pembelajaran berbasis permainan tersebut dikonfirmasi oleh skor N-gain sebesar 0,83 (atau 83,33%), yang menunjukkan adanya peningkatan hasil belajar TIK pada siswa SMA di Sekolah Indonesia Kota Kinabalu.

***Kata Kunci**: Media Pembelajaran Berbasis Permainan, Hasil Belajar, Siswa Sekolah Menengah Atas, Teknologi Informasi dan Komunikasi (TIK), Digitalisasi.*

INTRODUCTION

Current advancements in digital technology are having a profound impact on society, particularly in the fields of education and the study of Information and Communication Technology (ICT). ICT examines both the practical development of technology and the underlying concepts and principles (Kwartolo et al., n.d.). The implementation of digital education, referred to as the knowledge era, was initiated by the advent of scientific and computer technology(Anisa & Hasanah, 2022).

However, ICT learning in schools can usually only be carried out by teachers in a conventional and *theoretical manner*. Monotonous and non-interactive teaching methods can reduce students' desire and motivation to learn, which can lead to a decline in their interest in learning (Nurul Hasanah et al., 2025).

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With the rapid development of technology today, there are more and more interactive learning methods that can be used by teachers, one of which is a learning method based on digital media. Digital media is a learning medium that combines text, images, audio, video, simulations, *AR/VR*, applications, and *e-learning* in its use (Batubara & Ariani, 2015).

Currently, the most popular digital media among students, especially high school students, is *gaming*. Games often have attractive visuals and content, which can make students addicted to playing and lead to high levels of addiction (HAZAR, 2018). Rather than just letting young people become addicted to gaming and reducing their interest in learning and their learning outcomes, we should utilize games to assist in the learning process.

Learning outcomes are a collection of results from learning that have been acquired by a student in the form of skills, knowledge, and mastery. In the national education system, educational objectives are formulated as both curricular and instructional objectives using Bloom's revised classification of learning outcomes (Anderson, 2001: 63-89), which divides learning outcomes into three domains: cognitive, affective, and psychomotor. However, in this study, only the cognitive domain will be discussed.

Good game-based learning media can help students be more active in learning by providing a good user experience and incorporating various elements found in games to attract students' interest in learning(Zhonggen Yu et al., 2020). An interesting storyline encourages creativity and decision-making skills in learners and fosters a strong personal spirit. Rewards, points, and leaderboards help users improve themselves and become more competitive (Senthil Kumaran V et al., 2023).

Initial observations at Sekolah Indonesia Kota Kinabalu High School showed that students had varying ICT learning outcomes, with some having low initial scores. Therefore, this study focused on the use of game-based learning media to improve students' ICT learning outcomes.

RESEARCH METHODOLOGY

In order to ascertain the impact of one item on another in controlled environments, this study used the experimental procedure (Sugiyono, 2008, p. 107).

The study used a one-group pre-test-post-test design and was pre-experimental in nature. The experiment's results on the dependent variable are impacted by more than simply the independent variable since this design incorporates extrinsic variables that affect the formation of the independent variable. This is because the sample was not chosen at random and there were no control factors (Nuryanti, 2019). An experiment that only tests one group and excludes a comparison group is known as a one-group pre-test-post-test. The research participants in this study will be assessed prior to treatment. Following that, they will get therapy and either another test or a final test to gauge the effectiveness of the treatment.

Table 1. Research Design

Pretest	Treatment	Posttest
O1	X	O2

(Nuryanti, 2019)

This study was conducted in the 2025/2026 academic year in the odd semester at the Indonesian School in Kota Kinabalu. In this study, the subjects used were grade XB high school students selected using *purposive sampling(Robinson, 2023)*. The research instrument used consisted of 20 questions and had a total of 33 students as research subjects.

The information gathered during this inquiry will be statistically analyzed. To determine whether using game-based learning materials enhances student learning outcomes, statistical analysis is necessary. The N-gain statistical analysis was performed using the Wilcoxon non-parametric test. The Wilcoxon test was used rather than the T test since the research data did not have a normal distribution. The impact's size was evaluated using the N-gain test (Kishore & Jaswal, 2022; Dexter, 2013). The N-gain values are displayed in Table 2 below.

Table 2. N-gain value categories

N-gain Value	Category
$p > 0.7$	High
$0.3 \leq p \leq 0.7$	Moderate
$p < 0.3$	Low

(Wijaya et al., 2021)

RESULT AND DISCUSSIONS

This study was conducted at Sekolah Indonesia Kota Kinabalu, specifically in class XB during the 2025/2026 academic year. Before learning using game-based media, students were given time to complete a pre-test consisting of 20 questions about computer network material for class X.

After the students completed the pre-test questions, the researcher obtained data in the form of scores from a total of 33 students. The results of the pre-test can be seen as follows.

Table 3. Pre-test Scores

Name	Pre-test (%)
AF	70
AH	0
AL	0
AM	50
AR	60
US	70
AU	60
CA	80
DA	80
DV	80
DE	50
DW	60
DI	20
FE	40
FI	0
GL	80
GO	0
HE	10
IM	40
IZ	80
JO	20
MA	90
NE	50
OV	50
PR	0
SA	30
SE	80
SI	0
SU	40
SY	50
SK	60
SV	60
TA	70

After looking at the pre-test data, we can see that the results vary greatly. We can also see from the pre-test scores that some students have low scores and some even scored 0.

After completing the pre-test, students will begin learning using the prepared game media. According to research conducted by Wang & Zheng (2021), the stages of learning using game-based learning media can be divided into three stages, namely (1) pre-game, (2) game, and (3) post-game. Each stage has its own purpose and objective. The pre-game stage aims to convey the learning objectives, the material to be delivered, explain the rules and how to play, and provide a brief demonstration of *the gameplay*. Meanwhile, the game stage

(implementation) is when students use the game provided and the teacher acts as class manager and technical support. The post-game stage is used for reflection and discussion as well as preparation for the final test (post-test).

After going through the learning treatment phase using game-based learning media, students will be given questions to see how the games they play affect their learning comprehension. The data from the post-test results can be seen as follows.

Table 4. Post-test Scores

Name	Post(%)
AF	75
AH	75
AL	75
AM	70
AR	60
US	70
AU	90
CA	80
DA	90
DV	80
DE	55
DW	75
DI	70
FE	55
FI	60
GL	65
GO	5
HE	85
IM	50
IZ	70
JO	65
MA	90
NE	70
OV	85
PR	65
SA	70
SE	95
SI	65
SU	75
SY	75
SK	85
SV	70
TA	80

After obtaining the pre-test and post-test scores, the next step was for the researcher to calculate and test the data obtained. Because after testing for normality, the results of the data showed a non-normal distribution, the tester used the *Wilcoxon* test to find the N-gain(Kishore & Jaswal, 2022).

Table 5. Statistical Description

	N	Min	Maximum	Mean	Std. Deviation
pre-test	33	0	90	46.36	29.242
posttest	33	5	95	71.06	16.093
Valid N (listwise)	33				

Prior to doing the Wilcoxon tests, the data from the pre- and post-tests may be seen in Table 4 above. Out of 33 students, an average of 46.36 (ranging from 0 to 90) and a standard deviation of 29.242 were recorded on the pre-test; Similarly, 71.06 (ranging from 5 to 95) and 16.093 (standard deviation) were recorded on the post-test.

Table 6. *Wilcoxon* Test

		N	Mean Rank	Sum of Ranks
posttest - pretest	Negative Ranks	2[a]	8.25	16.5
	Positive Ranks	26[b]	14.98	389.50
	Ties	5[c]		
	Total	33		

Based on *the Wilcoxon* test results shown in Table 5, it can be interpreted that there were two respondents who obtained lower post-test scores than their pre-test scores, but the number and contribution were relatively small. It was also found that 26 respondents experienced an increase in their post-test scores, indicating that the majority of respondents experienced a significant increase. There were also five respondents who did not experience any change in their pre-test and post-test scores.

Table 7. Significance values

	posttest - pretest
Z	-4.253[b]
Asymp. Sig. (2-tailed)	.000

A two-tailed significance value of 0.000 was produced using the Wilcoxon test. With a significance level below 0.05, we can accept the alternative hypothesis (Ha) and reject the null hypothesis (Ho). So, it's safe to say that the utilization of game-based learning tools has a significant influence on students' pre- and post-test scores at SMA XB Sekolah Indonesia Kota Kinabalu.

$$\text{N-Gain} = \frac{(\text{Skor Posttest} - \text{Skor Pretest})}{(\text{Skor Maksimum} - \text{Skor Pretest})}$$

After finding an effect between pre- and post-game learning media use using the Wilcoxon test, we will use an N-gain test to quantify the effect. You can see the N-gain value in Table 8 down below.

Table 8. Descriptive Statistics of N-gain Score

	N	Minimum	Maximum	Mean	Std. Deviation
NGainscore	33	-.75	.83	.3528	.36971
NGain percentage	33	-75.00	83.33	35.2796	36.97068
Valid N (listwise)	33				

An N-gain test result of 0.83 was obtained. That puts the N-gain value in the upper echelon. If we express it as a percentage of N-gain, we get 83.33%. According to the data, students' learning outcomes at SMA XB Sekolah Indonesia Kota Kinabalu were enhanced by 83.33% (classified as a "high" effectiveness category) when game-based learning media was utilized (Marcella et al., 2022)(Jamalludin et al., 2023).

CONCLUSION

A significant value (2-tailed) of 0.00 was obtained in the N-gain data hypothesis test using the Wilcoxon test. This value is less than the significance level of 0.05, thus (Ho) may be rejected and (Ha) can be accepted, according to the results of the data analysis. The usage of game-based learning material is significantly affected by the rejection of (Ho). An average N-gain score of 83.33% reveals this difference. This is due to the fact that teaching via gaming media has the potential to improve learning outcomes by making students happier and more invested in the learning process. Consequently, it is reasonable to assume that the use of game-based learning media affects the results of student learning.

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