



Multimedia Learning Sources for Experienced Teachers to Support Their Teaching and Learning Processes in the Secondary Education

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ABSTRACT

Purpose: Students and educators benefit tremendously from using ICT in educational systems. Education, like all other areas of human endeavor, has been affected by the accelerated development of technology. Every day, an increasing number of technological applications are utilized in education. Multimedia technology is one of these technologies. This study aimed to determine which teaching strategies teachers and pupils in Indonesia would find most beneficial. **Objective:** The primary objective was identifying numerous "Multimedia Learning Sources" that could help secondary school teachers improve their learning and instructing techniques. **Methodology:** The research was conducted using a quantitative method approach. There was a cross-sectional survey conducted. The research population consisted of 100 teachers from Indonesia selected at random. The survey was distributed offline as opposed to online.

Findings: The findings indicate that the efficacy of multimedia sources has a substantial and positive impact on teacher and student learning. However, training accessibility does not moderate the relationship between student and instructor learning and multimedia effectiveness. **Implications for Research and Practice:** This study demonstrates that economies like Indonesia must develop new strategies to encourage innovation-related active learning.

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1. Introduction

Technology has become an integral component of our daily existence. In the twenty-first century, it has stimulated innovations in all fields of research, including biomedical, healthcare, education, etc. (Septiani & Rejkiningsih, 2020). This development has altered and enriched our lives in numerous ways. It has introduced several novel approaches to learning and teaching. Efforts to foster interactive technologies have resulted in "educational innovations," also called "creative innovations." They include cognitive tutoring systems, computer-based instruction, computer-mediated and assisted assessment, and computer-based instruction (Septiani & Rejkiningsih, 2020). In this digital age, these innovations, developments, and ideas ensure that new high levels of learning processes and interactions have been introduced to motivate and promote meaningful communication and surmount insufficient and meaningless learning processes (Henukh, Rosdianto, & Oikawa, 2020). Therefore, it is difficult for students to adapt to this complex, content-rich learning environment (Sintawati & Abdurrahman, 2020). It has been observed that students have difficulty assimilating the vast quantity of database content. Additionally, technology has altered students' expectations in that they anticipate similar standards to be incorporated into their coursework. It raises several questions, including how teachers will train students using technology and how technology can benefit teachers (Kumala et al., 2021).

Regarding learning resources, print textbooks have traditionally been regarded as the standard reference for students. These textbooks are well-organized and exhaustive because they cover numerous topics (Laksana, Dasna, & Degeng, 2019). Moreover, static textbooks are difficult to personalize. In addition, they fail to demonstrate the overlaps between disciplines. However, the information supplied by textbooks is limited and does not cover scientific advancements (Lai, Chen, & Lee, 2019). In addition, innovations and developments are not typically covered in textbooks. Informatics addresses those requirements that cannot be met through textbooks.

Informatics provides students with current information. This information is disseminated through online services (Alobaid, 2020). With time, however, a new vocabulary emerged. E-learning, E-education, E-libraries, E-books, and E-laboratories received considerable attention. This initial is commonly associated with digital electronic technology.

Regarding ICT, it has been observed that Indonesia has a lengthy history in this area. Educational radio and television are government-sponsored initiatives designed to disseminate information to all educational institutions (Maria, Rusilowati, & Hardyanto, 2019). This is done primarily to optimize the use of technology in education for the learning processes. In addition, the lack of immediate feedback is regarded as the primary flaw of television and radio broadcasts.

In terms of information transmission, a medium of Information and Communication is utilized. Information and Communication Technology levels are used to teach and facilitate education (Ndiokubwayo, Uwamahoro, & Ndayambaje, 2020). Information and Communication Technology is regarded as cutting-edge technology due to its evolution in size, shape, capacity, speed, etc. Several educational institutions have developed numerous information and communication technology processes to support the learning processes in

the current era of technological advancement (Lai et al., 2019). In this case, one of the most prominent examples is macro flash animation media. This innovation has increased students' motivation (Laksana et al., 2019). This study is relevant, however, due to the continuous development and advancement of global trends and automated design systems in the digital transformation of production at all levels (Mulyadi, Atmazaki, & Syahrul, 2019). Integration, one of the fundamental principles of education, is a crucial element in ensuring development quality. Such techniques are typically mastered by students pursuing technical specializations.

This study indicates that nations like Indonesia must develop new techniques and strategies to promote innovation-related learning processes. Information and communication technology is highly regarded as a means to optimize, foster, enhance, and support knowledge acquisition in Indonesia (Sartono, Ambarsari, & Herwin, 2022). Consequently, the primary objective of this article is to identify "Multimedia Learning Sources" that can support instructors' learning and teaching processes in secondary education. In addition, this study aims to examine the beneficial learning processes for Indonesian students and instructors.

2. Literature Review

2.1. Effectiveness of Multimedia Sources and Teacher Learning

The multimedia learning approach is a new method for motivating students to comprehend teachings through images, audio, and animation (Lai et al., 2019). Text comprehension and vocabulary knowledge comprise the two components of the reading comprehension process (Alobaid, 2020). Multimedia learning can help students learn new vocabulary and apply prior knowledge to comprehend the text (Werdiningsih, Triyono, & Majid, 2019). Furthermore, this approach to learning can increase motivation and help develop a more sophisticated learning process. The term multimedia learning is typically associated with technology (So, Chen, & Wan, 2019). Multimedia is, however, very effective in education. It provides educational convenience and accessibility.

Additionally, it facilitates students in acquiring new information of all types (Makransky & Mayer, 2022). Moreover, as a result of the fact that ICT learning processes enable learning practices with this benefit, facilitators and students add one place. Educators frequently employ conventional teaching methods. Typically, textbooks consist of textual and written material that includes descriptions. Numerous studies have elucidated multimedia technologies' significance in spreading knowledge about multimedia tools (Rahimi & Allahyari, 2019). The ability to stimulate students' interest in learning processes, the capacity to present all types of information in a constrained amount of time, and the capacity to transform abstract into concrete content are among the most significant advantages of multimedia applications for learning and teaching practices (Oladejo, Akinola, & Nwaboku, 2021). These learning initiatives are intended to facilitate the adoption of simulations, virtual reality, and laboratory learning. In light of this, it is possible to assert that multimedia sources are highly effective for teacher education.

Hence, it can be concluded:

H1: *The effectiveness of multimedia sources has a positive impact on teacher learning*

2.2. Effectiveness of Multimedia Sources and Student Learning

Multimedia resources facilitate and facilitate education. This innovation has increased students' motivation (Laksana et al., 2019). This study is relevant, however, due to the continuous development and advancement of global trends and automated design systems in the digital transformation of production at all levels (Mulyadi et al., 2019). Integration, one of the fundamental principles of education, is a crucial element in ensuring development quality (Shunkov et al., 2022). Students of technical specializations typically master these techniques as they begin to study them. Multimedia affords students the opportunity and aids them in working independently.

Additionally, it allows students to focus on any subject they desire (Maraza-Quispe et al., 2022). In addition, multimedia enhances the quality and authenticity of instruction and learning. Multimedia conveys messages to recipients in multiple forms and provides students with a rich learning environment. Students are provided with information through various mediums or options, including visuals, audio, video, and animation (Kao & Luo, 2020). It has a positive outcome because it provides authentic results and assists students in achieving success (Makransky & Mayer, 2022). Multimedia creates a realistic and economic environment in education.

Additionally, multimedia contributes to education by assisting students to achieve tremendous academic success (Chen, 2020). Multimedia effects positively impact the quality of academic careers and education if properly designed and distinct from traditional instructions and methods (Alpizar, Adesope, & Wong, 2020). The relationship between the efficacy of multimedia sources and student learning is positive.

Hence, it can be concluded:

H2: *The effectiveness of multimedia sources has a positive impact on student learning*

2.3. Effectiveness of Multimedia Sources, Access to Training, and Teacher Learning

Employees' perceptions regarding their participation in organizational training and the likelihood of this happening are called "Access to training." The perceptions of employees are based on anxiety and objective selection criteria. It involves multiple hypotheses, including whether or not to participate in organizational training programs. Different types of training programs are determined by simple philosophical principles (Tangirov, Jomurodov, & Murodkasimova, 2021). Employees are typically assigned to training programs if they perform adequately. Typically, department managers evaluate the performance of employees before assigning them duties. Training processes typically do not serve the purpose of organizational training, but they are appealing because they are inexpensive and time-efficient (Roemintoyo et al., 2022). However, access to training is crucial because it affects teacher education. Numerous empirical and theoretical studies have supported this view, which asserts that teachers' access to training is the most critical factor in promoting teaching and the learning process of teachers (Lawson & Mayer, 2021). Learning and teaching practices that involve the ability to stimulate students' interest in learning processes, the ability to present all types of information in a limited amount of time, and the ability to transform abstract content into concrete content are very advantageous in terms of multimedia application (Gallagher, 2019).

Therefore, multimedia materials can be regarded as highly effective for teacher education. Moreover, instructors can only be successful if they have access to training. This implies that multimedia resources can only be effective if instructors have access to training.

Hence, it can be concluded:

H3: *Access to Training acts as a moderator between the Effectiveness of Multimedia Sources and Teacher Learning*

2.4. Effectiveness of Multimedia Sources, Access to Training and Student Learning

Multimedia is designed for learning processes to construct mental representations from images and words in multiple contexts (Becker et al., 2020). They are intended to facilitate student learning with instruments applicable to classroom, presentation, and laboratory settings. Typically, the cognitive theory of multimedia learning is used to comprehend multimedia processes that posit various assumptions to define the learning methods (Subaidi bin Abdul Samat & Aziz, 2020). Perceptions of access to instruction refer to probabilities. It is a significant factor that positively influences commitment (Bereczki & Kárpáti, 2021), enabling access to various training opportunities and activities. Since multimedia allows students to work independently, it facilitates their learning. It also permits students to concentrate on any subject they choose (Fissore, Marchisio, & Rabellino, 2020). In addition, multimedia enhances the authenticity and quality of instruction and learning. Multimedia conveys messages to recipients in diverse ways and provides students with a diverse learning environment (Abdulrahaman et al., 2020). However, multimedia sources are not utilized if students do not have access to instruction (Lauc, Jagodić, & Bistrović, 2020). Access to training can be interpreted as a moderator between the efficacy of multimedia sources and student learning.

Hence, it can be concluded:

H4: *Access to Training acts as a moderator between the Effectiveness of Multimedia Sources and Student Learning*

2.5. Theoretical Framework

The cognitive theory of multimedia discusses the process of comprehension via multiple media. This theory proposes that learners make meaningful connections between photographs and words by employing a cognitive theory-based psychological characteristic (Almasseri & AlHojailan, 2019). It has also been observed that the primary objective of multimedia instruction is to assist students in constructing reasonable and logical mental representations of the information provided. The learner must ensure that new information is present (de Muñoz & Letouze, 2022). It has also been suggested that the multimedia learning concept relates to the dual coding theory because both theories help instructors and students improve their cognitive processes to comprehend things (Chau et al., 2019). Despite this, this paradigm was created using this theoretical evidence. The model described below assures that a positive relationship exists between these variables.

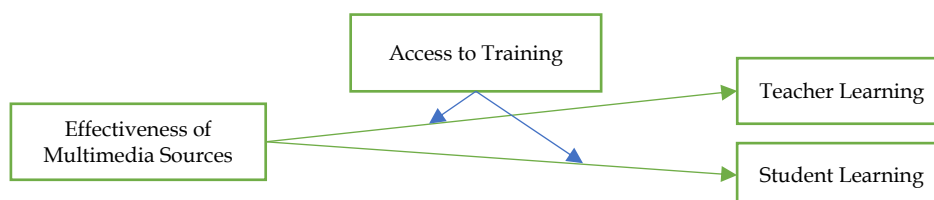


Figure 1 - Theoretical Framework

3. Methodology

A quantitative method approach was utilized (McFadden, 2021). Before disseminating the questionnaire to the intended audience, the researchers created a questionnaire. To address the research objectives, an appropriate questionnaire was developed. It was intended to evaluate the perceptions of secondary school teachers using various ICT tools (Bloomfield & Fisher, 2019). The development of a cross-sectional survey is documented. The questionnaire was constructed using a 5-point Likert scale from 1 to 5. Strongly disagree to concur vehemently. 100 teacher from Indonesia was chosen randomly as a representative sample for the research. The sample responded to the queries based on their perspectives. In addition, the survey was distributed manually rather than online.

The questionnaire was divided into two sections: demographic questions and study variables. The scales for the effectiveness of multimedia sources, access to training, Teacher learning, and Student learning were adapted from previous studies. The procedure by which the researcher collects data is known as data collection. The research query was distributed to 130 educators. The participants were given one week to complete the questionnaire, and they volunteered for this study. However, only a minority of respondents completed them, and several questionnaires were missing data. Only 100 responses were obtained for data analysis in the end. SPSS version 22 was designed to capture data for further study analysis. Both descriptive and inferential analyses were conducted in this regard. The researchers employed descriptive analysis to determine the proportion and frequency of the population to its demographic background.

Additionally, analyzing the frequency, standard deviation, mean, and the percentage was helpful (Alam, 2021). In addition, for the research findings, inferential statistics were employed. This paper examines the impact of e-learning on students' expectations and perceptions of e-learning. In addition, the significance of training in practical skills has been demonstrated by employing teachers' professional expertise. Individual factors influencing the learning process are analyzed. The effectiveness of multimedia sources on student and teacher learning has been evaluated by retaining moderator training. It is required to ensure that the research has been extracted ethically from journals and relevant studies (Suri, 2020). Due to society's expectation that research be conducted with great care, the study needed to be conducted ethically. Not only that but the research's credibility is also maintained with greater care (Wu, Gong, & Luo, 2021). However, ethical principles and guidelines were adhered to and maintained throughout the research. The research complied with all ethical considerations (Sloman et al., 2019). The respondents' privacy was also considered and treated with respect; no personal information was compromised (Fiesler, 2019). Everything was kept in strict confidence. Therefore, this research assures the privacy and confidentiality of literature and peer-reviewed research articles.

4. Results

4.1 Demographic background

Tabulated in Table 1 are the demographic characteristics of the respondents, broken down by gender, age, and years of experience. The total sample size was 312 responses, with 52.5% male respondents and 47.8% female. The respondents' age was also considered as a demographic factor. 24.0% of the participants were under 25, followed by the group "36 to 30 years" with 29.2% and the group "31 to 35 years" with 31.1%. Finally, 15.7% of the sample consisted of respondents older than 35. In addition to demographic information, participant experiences are included in the demographic data. 11.9% of the individuals had less than two years of experience. The plurality of respondents, or 43.6%, had experienced between two and five years. 33.3 % of all years were between 5 and 8 years. In addition, 11.2% of the participants had more than eight years of experience.

Table 1

Demographic data

		Frequency	Percent	Cumulative Percent
Gender	Male	163	52.2	52.2
	Female	149	47.8	100.0
	Total	312	100.0	
Age	Less than 25Y	75	24.0	24.0
	26 to 30Y	91	29.2	53.2
	31 to 35Y	97	31.1	84.3
	More than 35Y	49	15.7	100.0
	Total	312	100.0	
Experience	Less than 2 Years	37	11.9	11.9
	2 to 5 years	136	43.6	55.4
	5 to 8 years	104	33.3	88.8
	More Than 8 years	35	11.2	100.0
	Total	312	100.0	

4.2 Descriptive Summary

Table 2 depicts a descriptive summary of the study's methodology. The descriptive analysis provides summary statistics for the variables that can be used to assess response orientation, normality, outlier detection, and missing values. Responses were tabulated on a 5-point Likert scale, where 1 was the lowest response and 5 was the highest, so the dataset was devoid of any outliers.

Table 2

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
ACT	312	1.00	5.00	3.5203	1.08793	-.632	.138
MME	312	1.13	5.00	3.4916	.95164	-.661	.138
SL	312	1.29	5.00	3.4364	.90322	-.474	.138
TL	312	1.00	5.00	3.3141	1.05513	-.375	.138
Valid N (listwise)	312						

4.3 Factor Loadings

Below is a rotated component matrix displaying the factor loadings for each survey item, utilisation of Kaiser normalization, and the computer varimax rotation method (Acal, Aguilera, & Escabias, 2020). On the advice of previous researchers, a factor loading greater than 0.5 is preferable. ACT, Mme, SL, and TL have respective mean values of 3.5203, 3.4916, 3.4364, and 3.3141. In addition, there must be no cross-loading. As shown in Table 3, Bartlett's test was statistically significant ($p=0.000$), demonstrating no relationship between the items among the various included components that would lead to constructing an identity matrix.

Table 3

KMO & Bartlett test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.923
	Approx. Chi-Square	5758.594
Bartlett's Test of Sphericity	df	300
	Sig.	.000

Table 4

Component Matrix

Rotated Component Matrix^a

	Component			
	1	2	3	4
ACT1	.692			
ACT2	.718			
ACT3	.725			
MME1				.665
MME2				.741
MME3				.749
MME4				.716
MME5				.719
MME6				.743
MME7				.739
MME8				.731
SL1		.772		
SL2		.817		
SL3		.809		
SL4		.764		
SL5		.757		
SL6		.775		
SL7		.817		
TL1			.797	
TL2			.539	
TL3			.601	
TL4			.637	
TL5			.650	
TL6			.631	
TL7			.667	

4.4 Validity Analysis

Convergent validity, evaluated using average variance and composite reliability, is utilized to determine the uniformity of the internal scale. Each variable's CR value exceeds 0.7, indicating the data's precision and consistency.

Table 5

Reliability & Validity Test

	CR	AVE	MSV	MaxR(H)	ACTR	STDLR	TCLR	MULME
ACTR	0.876	0.701	0.827	0.882	0.838			
STDLR	0.800	0.382	0.665	0.856	0.657***	0.618		
TCLR	0.911	0.596	0.697	0.915	0.739***	0.816***	0.772	
MULME	0.879	0.486	0.827	0.901	0.909***	0.744***	0.835***	0.697

4.5 Confirmatory factor analysis

CFA was used to ascertain the goodness of fit. The variables in Table 6 were utilized to evaluate the model's viability. The ranges matched the criterion range, demonstrating the accuracy of the measurement model depicted in Figure 1.

Table 6

Model fitness

Model fitness indices	Threshold Range	Observed Value
CMIN/df	Less than 5	3.568
GFI	Equal to or more than 0.8	.814
IFI	Equal to or more than 0.9	.885
CFI	Equal to or more than 0.9	.884
RMSEA	Less than 0.08	.09

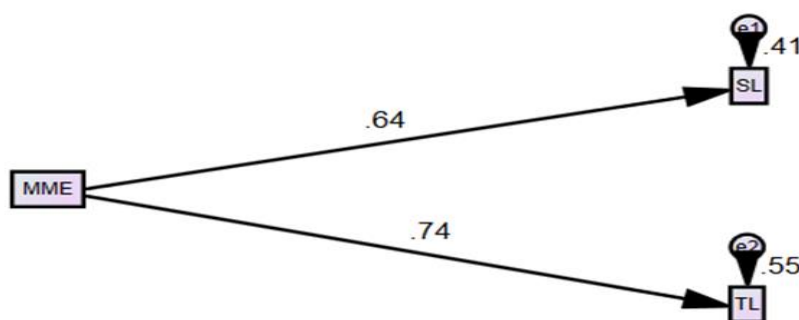


Figure 1: CFA

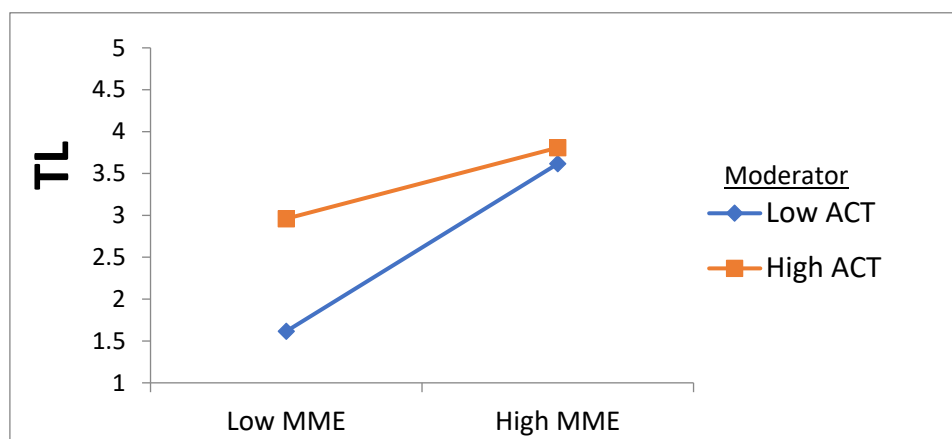
4.6 Structural Equation modeling

Evaluation of the hypothesis was conducted using structural equation modeling. With a p-value of 0.007, the influence of MME on SL is significant. With a p-value of 0.013, the association between MME and TL is also significant. ACT between MME and TL and ACT between MME and SL have non-significant associations with p-values of 0.32 and 0.65, respectively.

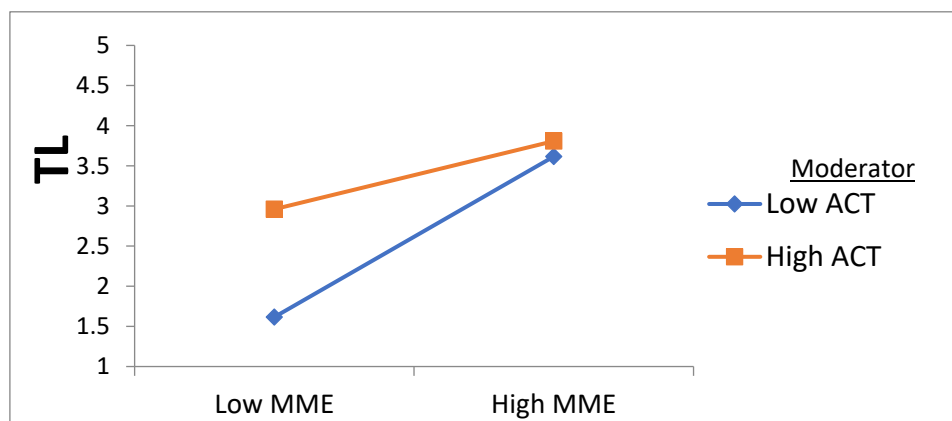
Table 7

Standardized Regression Weights

	Parameter	Estimate	Lower	Upper	P
SL	<--- MME	.638	.584	.704	.007
TL	<--- MME	.742	.683	.788	.013
ZTL	<--- ZMMEXACT	-.288	-.751	.203	.323
ZSL	<--- ZMMEXACT	.215	-.386	.617	.659



ACT strengthens the positive relationship between MME and SL.



ACT dampens the positive relationship between MME and TL.

5. Discussion and Conclusion

This research also analyzed the most beneficial teaching strategies for Indonesian students and teachers. According to the findings, the impact of multimedia sources on teacher and student learning is substantial and positive. While access to training does not moderate the relationship between multimedia efficacy and teacher learning, it does moderate the relationship between multimedia effectiveness and student learning.

Multimedia innovation, which focuses on how information can be electronically transmitted and displayed through various mediums, including written, audible, and visual, is a crucial aspect of ICT (Guan, Song, & Li, 2018). According to Abdulrahman et al. (2020), incorporating diverse media elements in multimedia or virtual classroom resources allows students to develop effective cognitive structures that support data management. Digital educational resources provide content consisting of information and often learning exercises using a combination of text, images, videos, and audio. The structure and complexity of multimedia apps used in a lecture or for curriculum and instruction should be flexible enough to combine multiple cognitive skills to achieve the best instructor replication. On the contrary, Aljazzaf (2020) asserts that multimedia technology unquestionably enhances teaching and learning, but there are a few limitations on how this innovation can be implemented in the classroom. These constraints include undesirable code or user interactions, a lack of resources, necessary skills and expertise, time constraints, and costly service fees. Eye-tracking was utilized by Molina et al. (2018) to determine how proficient elementary school students utilized multimedia. To comprehend the thought patterns of pupils during learning and how they interpret the learning material, some researchers have combined verbal statistics and eye-tracking data (Stark, Brünken, & Park, 2018). As education continues to advance, Subaidi bin Abdul Samat and Aziz (2020) found that using technology in the classroom is a wonderful way to engage students, particularly in reading. This strategy can be viewed as an evolutionary method for supporting the fourth industrialization and the learning process. According to research indicating that incorporating technology into the classroom helps students learn languages more effectively, their demand is on the rise.

In addition, the variety of components used in multimedia instruction can accelerate comprehension and increase student motivation. Multimedia learning is frequently associated with technology use in educational contexts, and as technology advances, multimedia integration must become more straightforward and all-encompassing. Ilhan and Oruc (2016) noted that multimedia is fruitful for learning. Multimedia in education provides convenience and facilities. Students could retain new information due to the use of multimedia in the classroom.

In comparison to traditional learning, the use of multimedia in the classroom improves students' academic performance. When properly implemented, the use of multimedia in the classroom has a positive effect on academic achievement compared to traditional learning. Interactive multimedia is a credible alternative to traditional classroom settings, according to Rachmadtullah, Ms, and Sumantri (2018), who note that learning methodologies created and developed to support and increase student enthusiasm for learning make interactive multimedia a credible replacement learning medium. Comparing learning through interactive multimedia to traditional teaching methods that may lack such involvement, interactive multimedia offers effective instructor-student dialogue. De Sousa, Richter, and Nel (2017) asserted that when students have access to multimedia learning resources, either individually or in groups, they can take charge of their education and promote learning at a pace and in a manner that suits their needs and preferences. Teachers in higher education are under pressure to create more effective learning environments and academic experiences for their students. Teachers have been focusing on adopting appropriate learning environments to enhance student learning. The prevalence of multimedia lectures in classrooms is increasing.

According to the findings, there was no association between access to training and outcomes. According to Assadi, Murad, and Khalil (2019), instructors' commitment to excellent practices is strengthened when they serve as trainers for undergraduates and receive the appropriate faculty support. According to Zhaparova et al. (2016), the development and availability of new training technologies are urgently required to digitize learning to consolidate students' activities into a singular learning environment while simultaneously improving educational standards. One type of such product is multimedia training aids. Due to the lack of future teachers who have access to the multimedia learning programs necessary for the effective realization of the educational, developmental, and pedagogical goals of the student's academic method, there is a social demand for teachers who can effectively carry out their respective tasks within the informatization of learning.

The primary objective was to identify several "Multimedia Learning Sources" that may assist secondary school instructors in enhancing their learning and teaching practices. This research also examined the most beneficial teaching techniques for Indonesian students and teachers. The findings demonstrated that the effectiveness of multimedia sources has a significant and positive influence on both teacher and student learning. At the same time, the moderating effect was not statistically significant.

Implications

The primary advantages of this study are, on the one hand, the novel approach used to investigate the recommendations provided by aspiring instructors. This topic has received little prior research. It will facilitate the approval of prospective teachers' suggestions for enhancing educational research, training, and technology used by higher education's accountable regulators and educational practitioners.

Limitations and Future Recommendations

Despite the presence of notable authors and works, the extant body of literature on the topic still requires additional study and evaluation. Selecting and developing curriculum content that takes advantage of modern technologies is crucial. The technical foundation of schools should be bolstered, and schools should be designed to accommodate multimedia use. Teachers could engage their students more in the learning process by allowing them to create multimedia materials.

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