Application Research of the Theory of Sustainable Education Scientific Development in the Teaching of High School Art Education

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Abstract

Education is a process that is directly related to a country's development. Through the processes of teaching and learning. When making decisions in their classes, experienced teachers are more likely to like to be in control than starting teachers. The purpose of this research is to evaluate the influence that the efficacy of education has on the viability of education. In addition, the study investigated the function that sustainable technology adoption plays as a mediator, as well as the moderating role that teacher support and qualification play. A questionnaire that was adapted from previous studies was used. The collection of data was carried out utilizing a method of straightforward random sampling. A 5-point Likert scale was used to measure the items associated with each characteristic. The data was examined by utilizing the software packages SPSS and smart-PLS. The results of the study show that there is a significant relationship between educational effectiveness and sustainable education. The conclusions of the data demonstrated that educational efficiency has a major effect on education that can be maintained over time. In addition, there is a strong and positive mediation effect of the adoption of sustainable technology on the relationship between educational efficacy and sustainable education.

Keywords: Sustainable Education; Sustainable Technology Adoption; Educational Effectiveness; Teacher Support; Teacher Qualification

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Introduction

The pursuit of one's education should be a priority in their life. It is essential if we wish to achieve success in the future and take advantage of various possibilities throughout our lives. People stand to gain a great deal from receiving an education. For example, it enlightens a person's mind and the way they are thinking. Students are better able to plan for career or higher education by the time they graduate from college because of this (Tsang, So, Chong, Lam, & Chu, 2021). Education in a subject helps individuals think, feel, and behave in a manner that contributes to their success and enhances not only their own personal satisfaction but also the community as a whole. Education in a subject helps people think, feel, and conduct themselves in a way that contributes to their success. In addition, education fosters the growth of a person's personality, as well as their thoughts and social abilities. Additionally, it gets people ready for the experiences of life. It gives individuals a distinctive status in their own society as well as in any other society in which they reside (Salvioni, Franzoni, & Cassano, 2017).

The goal of education for sustainable development, also known as ESD, is to foster the development of integrated thinking, improve decision-making, enhance living, and alleviate action correlations for interlinked environmental, cultural, social, and economic systems in order to encourage living for both the current generation and future generations. Education plays a pivotal role due to the fact that its influence may be found at the core of all of these interdependent systems: the environment, culture, society, and economy (Caeiro, Hamón, Martins, & Aldaz, 2020). The Sustainable Development Goals (SDGs) can be addressed by ESD in the following ways: (1) incorporating them into the curriculum; (2) ensuring that all educational institutions and stakeholders share the principles and values that support sustainable living and actions; (3) encouraging problem-solving, critical thinking, and action that can accurately address the sustainability challenges; (4) incorporating diversity in education methods; (5) involving learners in decision making; and (6) raising awareness in addressing both local and global challenges (Nevin 2008). Sustainable development is a complex idea. In addition to this, it undergoes consistent change, which makes it challenging to characterize.

The purpose of this research is to contribute new information to the existing body of knowledge concerning the connection between educational effectiveness and sustainable education with the mediating role of sustainable technology adoption and moderating role of teacher qualification and support. As a result, the new question that is posed by this research is as follows: "Do teacher qualification and teacher support impact the link between educational effectiveness and sustainable education in association with the art education system in China?" This study would not only validate the anticipated results of sustainable education.

Literature Review

Sustainable Education

In the existing body of research, one can find a variety of definitions of "sustainable education". As a result of this, it is impossible to put up a single definition that is shared by everybody. When it comes to the topic of sustainable education, however, previous research has shown two primary schools of thought about the fundamental ideas that form the basis of sustainable education. The research investigates a number of topics, one of which is the long-term viability of the educational system. In these works, education is conceptualized as a process that demands uninterrupted progression from one stage to the next (Salvioni et al., 2017). The primary objective of this body of study is to identify the critical factors that influence the results of education. It places an emphasis on the continued viability of education during the process of changing educational approaches. For instance, as a result of COVID-19, many educational institutions have been compelled to fully implement online instruction rather than the more traditional face-to-face instruction (Moore, 2005). During the process, a great number of institutions were harmed, and a significant amount of research has been done to investigate the challenges that online education faced during the shift (Tsang et al., 2021). Another line of inquiry has looked into how the field of education might make a contribution to the United Nations' specified objectives for the advancement of sustainable development. Education is one of the

primary communication vehicles that is used to inform the notions of sustainability, and it has the potential to assist students in developing the skills necessary to be eligible future citizens (Faulks et al., 2022). Students can also be equipped with the necessary knowledge and talents to make a contribution to sustainable development through education. Students can, for instance, improve their skills in system thinking through education, which places an emphasis on thinking comprehensively within a system.

Education Effectiveness

Education has the potential to play a significant part in both the achievement of Sustainable Development Goals (SDGs) and the transition to a more sustainable lifestyle. This is reflected in SDG 4, and more specifically in target 4.7, which explicitly suggests that "by 2030 ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including among other things through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship, and appreciation of cultural diversity and of culture's contribution to sustainable development." This is reflected in SDG 4, and more specifically in target 4.7, which explicitly suggests that "by 2030 ensure (Al-Maroof & Al-Emran, 2018) educational institutions have a responsibility to play a part in the transition that must occur in order for sustainability to develop. This responsibility entails providing graduates with the skills that are necessary to become citizens of a sustainable future (Kyriakides, 2005). The preparation of future professionals with the knowledge and skills, also known as the competencies, that are needed to address urgent challenges such as climate change, violent conflict, and the health emergencies that society is facing today is one of the most important roles that higher education institutions play. Therefore, one of the most significant goals that higher education should strive to achieve is the incorporation of ideas of sustainability into educational curricula (Cheong, 2000).

Education has a significant part to play in addressing the problem of deteriorating environmental conditions; despite this, some have questioned its potential to produce favorable results (Lederman, 1990). "It is the highly educated people who are causing the environmental destruction" is a statement that is frequently used to capture how unsuccessful education efforts have been so far in challenging the status quo, the values and perspectives that permeate the unsustainability of our times. This statement is often used to capture how education efforts have been so far in challenging the status quo, the values and perspectives that permeate the unsustainable nature of our times. The other two major orientations of education are the vocational/neo-classical, which focuses on career goals and skills that are important for the labor market, and the liberal/progressive, which focuses on personal development through experiential learning and integral. Education for Sustainable Development (ESD) fits within the socially critical orientation of education, which assumes that it can challenge existing power structures and enable the democratic and equal participation of all in society (Blewitt, 2012).

H1: Sustainable Effectiveness leads toward sustainable education.

Sustainable Technology Adoption

An increase in students' active participation in class is one of the most significant positive effects that technology has had on the educational system. In addition, the use of technology has improved students' general comprehension, as well as their ability to learn in a more practical setting, their ability to better manage their time, and their ability to study combination methodologies (Läpple et al., 2017). Teachers and trainers can increase their productivity with the help of technology, which also allows them to add useful digital tools that broaden the educational opportunities available to their pupils and encourage greater student support and participation. Technology gives educators the ability to refine their instructional practices and personalize students' educational experiences. Schools can save money by using technology since it reduces the expense of purchasing physical teaching materials, boosts the effectiveness of educational programs, and frees up more of the teachers' time. Access to an unfathomably large quantity of up-to-date data and information drawn from a variety of sources (Haseeb et al., 2019).

H2: Technology Adoption leads toward Sustainable Education.

Technology Adoption as a Mediator

Because of the increased availability of resources brought about by the incorporation of technology in educational settings, tuition fees have been lowered, the demand for books as well as the price of books has decreased, and there is less of a requirement for students to have school supplies. The introduction of e-books has made life easier for families living on a limited budget, and it has given students the opportunity to approach education on an equal footing with their peers, free from the pressure that comes from having parents who have made significant financial investments in their children's education (Chen & Sintov, 2016). The use of electronic books in educational settings has the additional advantage of having a beneficial knock-on effect of indirectly assisting in the reduction of deforestation. By removing obstacles that are common in the outside world, classroom technology fosters teamwork and encourages students to work together. Online venues make it possible for collaboration to happen more naturally, so people don't have to rely on the limited social connection that can occur in person (Straub, 2009). Children benefit from it by developing their creativity, originality, and adaptability. Utilizing technology in education is an efficient method because there are many programs available that could assist you in acquiring the knowledge and abilities that will be important in the future. The next generation will need to be able to use many forms of technology. Every application features a set of benefits, some of which may be a good fit for the way you study or the things you value most in life (Choudrie & Practice, 2005).

H3: Technology Adoption mediates the relationship between educational effectiveness and sustainable education.

Teacher Qualification as a Moderator

In the field of educational research, a great number of studies that cover a wide variety of topics have explored pupils' understandings of sustainability concepts, as well as how these understandings participate in ongoing learning, and in environmental ethics (Boyd et al., 2007). These studies are related in some way to effect-oriented correlational and experimental studies on so-called process-product research. In this line of inquiry, the process refers to the activities that were carried out in the classroom by both the teachers and the students, while the product refers to the information that was gleaned from those activities. Since the 1990s, there has been a considerable increase in the number of research-designed lessons and the methodologies of so-called lesson and learning studies in the field of educational science (Jacob Kola & Sunday, 2015). There are already an increasing number of studies focusing on the relationships between educators and sustainable education. The research that has been done in this area has helped teachers have a better knowledge of the ideas that are associated with sustainable development (Yurchenko et al., 2021). The influence of teacher education programs on the values, attitudes, and norms that teachers have about sustainable development has received less attention than they deserve. The methodologies that have been employed have been qualitative for the most part, and the goal has been to establish typologies of the many ways in which teachers conceptualize and approach sustainable development in their teaching (Manning, Wong, Fleming, & Garvis, 2019). The question of what exactly causes this conceptualizing has not, however, been the primary focus of inquiry. Research on teachers' perspectives of learning, teaching, and the content being taught is being conducted concurrently with this research, even if it may not necessarily be oriented toward educational sustainable development. In this piece of research, it is thought that the beliefs that instructors have about teaching, as well as the content that teachers teach, are ultimately responsible for influencing teaching practice. It has been hypothesized that the perspective that teachers have on certain subjects, such as mathematics, is significant since it has a tendency to influence the manner in which students will teach mathematics (Yurchenko et al., 2021). It is possible for a teacher's interpretation of the significance of enlightening students about the issues at hand to be influenced by the degree to which the instructor is personally invested in the subject matter. There is, of course, a vast body of research in the field of higher education concerning the effects of teaching methods on students' topic understanding, engagement, and attendance. The study was conducted by Carl Wieman and his colleagues. Even though research has been done on how students understand sustainable development and how teachers understand the concepts of environmental, social, and economic development (ESD), very little is known about how higher education affects teacher education students' perceptions of sustainable development-friendly beliefs and norms. This comes as a surprise when one considers that educators may play a pivotal role in the development of educational programs geared toward fostering sustainable development

among individuals (Guo et al., 2012).

H4: Teacher Qualification moderated the relationship between educational effectiveness and sustainable education.

Teacher Support as a Moderator

When looking into sustainable education, obtaining an understanding of the perspectives of educators can be both useful and valuable in terms of the research that can be conducted. Teachers are the driving forces in education; therefore, their knowledge and opinions on sustainable development, their practice in designing and delivering relevant learning materials, as well as their insights into challenges and required support can be critical determinants in the process of developing a successful sustainable education strategy. In general, the findings that teachers are aware of environmental problems and have a high level of disposition toward sustainable teaching have been documented consistently throughout the body of academic research (Li & Bai, 2018). The perspectives of educators towards sustainable education typically center on the importance of system thinking and citizen participation. When it comes to the ways in which educators can make a contribution to sustainable development, the reference lists several essential factors that should be considered (Tennant et al., 2015). These factors include the participation of the teaching staff, personal motivation, effective leadership, and support from the school. (Qin & Bowen, 2019) demonstrated, among other things, that a key factor in sustainable education is the consistency of the employees as well as their identification with the project. A positive outlook on the topic, as well as experiential activities and activities that take place outside of the classroom, might be crucial factors in the success of the program. This finding is another significant discovery. In terms of the perspectives of various groups of teachers, reference discovered that male teachers have a tendency to have a more favorable attitude toward sustainable education than female teachers. Although there are some disparities between these two groups of instructors in terms of educational achievement and competency, there is no evidence to suggest that there are any differences regarding the ability to recognize challenges. From another angle, some other studies have examined the difference between pre-service teachers (i.e., current students who will be future teachers) as well as incumbent teachers (Lei, Cui, & Chiu, 2018). It has been found that pre-service teachers may have more theoretical knowledge of sustainable education than incumbent teachers, while the latter can have more practical knowledge.

H5: Teacher Support moderated the relationship between educational effectiveness and sustainable education.

On the basis of all the above discussion and literature review, the developed conceptual framework is shown in Figure 1.
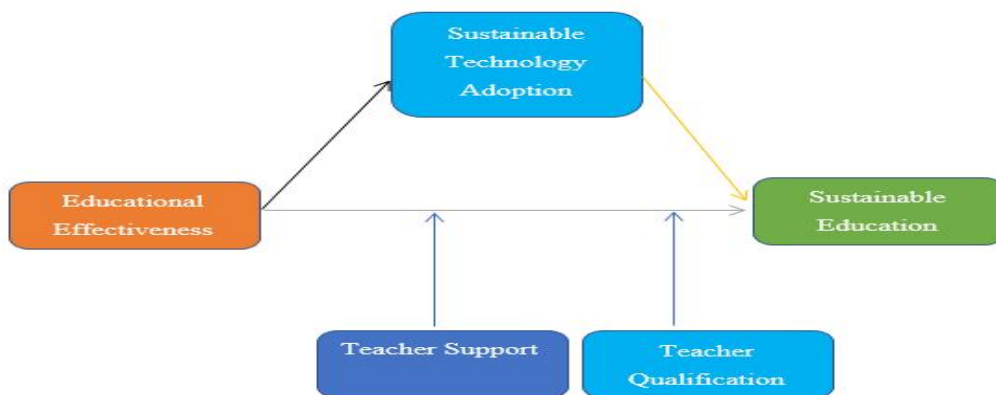

Figure 1. Conceptual Framework

Methodology

An approach to research known as cross-sectional surveying was used for the study because it was appropriate for the kind of research topic that had been discussed before. Studies that are carried out in a universe that is composed of a range of components and in which either the entire universe or a specific sample that has been taken from it is utilized in order to create an overall view regarding the universe are examples of these types of studies. Studies that use a cross-sectional methodology are ones in which the progression of development is observed in separate groups that are thought to represent the various stages of development all at once, at a single point in time. This type of research can be done in a variety of settings, including medical research, social science research, and anthropological research (Fraenkel, Wallen, & Hyun, 2012). The population of the study consisted of art students from each of China's universities, and they participated in the study. To be more explicit, all of the people who participated in the study were students who were actively enrolled in art programs at the time of the research. On the other hand, the segment of the population that could be reached comprised art students who possessed an internet connection. A total of (500) questionnaires were sent randomly to students enrolled in the art program. Only (312) of the original (500) questionnaires were considered to be complete enough to warrant further investigation. The questionnaire was divided into two sections. Section 1 contains the demographic information of the respondents such as gender, age, education, use of the internet for education purposes, and time spend on the internet. Whereas section 2 contains statements related to the variables of the study. For the analysis of demographic variables, SPSS was used whereas to check the hypothesis Smart-PLS was used in Table 1.

Table 1. Demographic Profile of the Respondents

Demographic Item		Frequency
Gender	Male	145
	Female	176
Age	19-21 years	79
	22- 25 years	53
	26-29 years	155
	More than 30 years	34
Education	College	161
	University	160
Time Spent on Social Media	2-3 hours	89
	4-8 hours	96
	More than 8 hours	136
Use the Internet for Educational Purposes	Always	205
	Rarely	45
	Frequently	71

Measure

Previous research was used to develop the questionnaires for all of the variables (educational effectiveness, sustainable education, teacher support, teacher qualification, and sustainable technology adoption). To measure educational effectiveness, a scale developed by (Scheerens, 2016) was adopted. The scales used to measure sustainable education were taken from (Ferguson, Roofe, & Cook, 2021). Items used to measure teacher support were taken from a scale developed by (Liu et al., 2021), while the scale used to measure teacher qualification was taken from (Guo et al., 2012), and the scales used to measure sustainable technology adoption were taken from (Läpple et al., 2017). In addition, this investigation made use of the Likert scale, which consists of five levels and spans from 1 (which denotes "not at all") to 5 (which denotes "very much") to evaluate sustainable education, educational effectiveness, sustainable technology adoption,

teacher qualification, and teacher support.

Results

This study validated the model by using the partial least square structural equation modeling (PLS-SEM) method that is contained in Smart-PLS 3.0. This method was used to examine the data. PLS-SEM is better suited for exploratory studies than covariance-based structural equation modelling, which is one of the reasons it was chosen rather than covariance-based structural equation modelling. Another reason is that PLS-SEM is easier to interpret than covariance-based structural equation modelling. The initial point to make is that this study incorporates an exploratory analysis. Second, the PLS technique is suitable for the analysis of data derived from relatively small samples as a result of the flexibility it possesses.

Measurement Model

In the context of measurement models, both the dependability of the model and its validity are crucial issues to take into account. Cronbach's alpha, roh-A, composite reliability, and average variance extract were utilized in this investigation in order to assess the degree to which the model could be relied upon. In addition, convergent and discriminant validity were utilized in an analysis to determine the model's soundness (Hair et al., 2016). Table 2 and Figure 2 exhibit the findings of the models used in this research to analyze the dependent relationships among all of the variables. To begin, Cronbach alpha requires that it have a value that is greater than 0.70 in order for it to be considered satisfactory (Hair et al., 2019). Overall, the values of Cronbach's alpha for the model variables in this research are greater than 0.70. For instance, the values of IV (educational effectiveness), DV (sustainable education), mediator (sustainable technology adoption), and Moderators (teacher support and teacher qualification) are (0.868), (0.897), (0.834), (0.902) and (0.813) respectively. The Cronbach alpha threshold was specified, and these are the values that correspond to it. As a direct consequence of this, all values are recognized. Second, the roh-A values of all the variables have been modified in such a way that they now align with the threshold value. The third stage of the analysis involves looking into the composite reliability (CR) and average variance extract (AVE) of the model variables. Both the average variance extract and the acceptable values of the variables for composite reliability are better than 0.5, and the acceptable values of the variables are bigger than 0.7. The acceptable values for the variables are also higher than 0.5. In addition to this, the outer loadings of each variable were investigated, and the findings are presented in Table 2 below. When it comes to establishing acceptable outside loadings for various objects, a value that is more than 0.6 is considered appropriate (Figure 2). Every single item in the variables has a value that is more than 0.6.
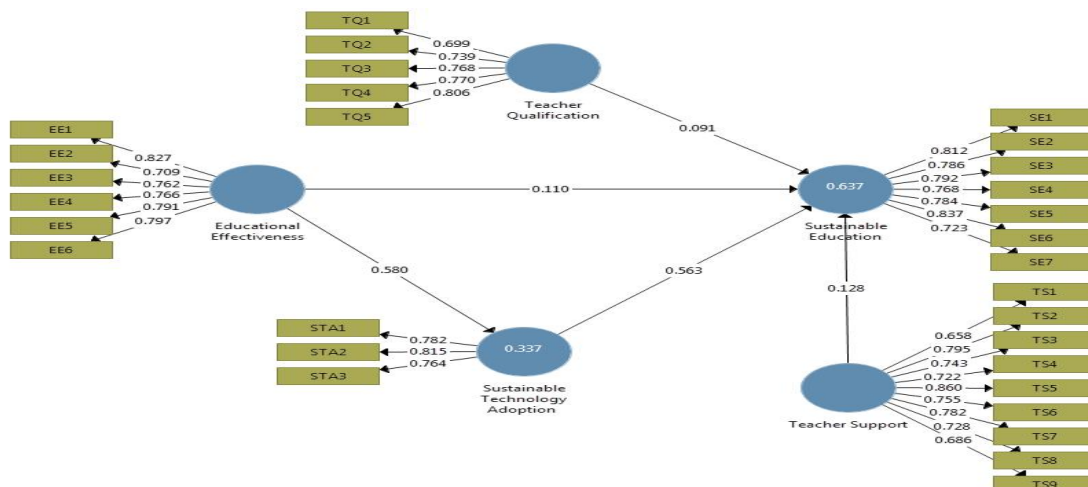

Figure 2. Measurement Model

Furthermore, the collinearity issue was investigated with the use of the variance inflation factor in this work (VIF). Readings of the VIF that are lower than (0.5), as recommended by the researchers, are considered to be satisfactory (Hair et al., 2014). According to Table 2, the VIF values of the research model's key constructs range anywhere from (1.384) to (3.932). This range was determined by taking the average of all of the VIF values. It is evident that the VIF values of all of the components meet the prerequisites set out by the threshold. As a result, the research model that was utilized for this investigation did not exhibit any signs of having an issue with collinearity.

Table 2. Construct Reliability and Validity

	Items	Outer Loading	VIF	Cronbach's Alpha	rho-A	CR	AVE
Educational Effectiveness	EE1	0.827	2.249	0.868	0.876	0.901	0.602
	EE2	0.709	1.549				
	EE3	0.762	1.753				
	EE4	0.766	2.127				
	EE5	0.791	1.825				
	EE6	0.797	1.921				
Sustainable Education	SE1	0.812	2.531	0.897	0.898	0.919	0.619
	SE2	0.786	2.032				
	SE3	0.792	2.411				
	SE4	0.768	1.902				
	SE5	0.784	2.084				
	SE6	0.837	2.602				
	SE7	0.723	1.817				
Sustainable Technology Adoption	STA1	0.782	1.345	0.834	0.692	0.830	0.620
	STA2	0.815	1.498				
	STA3	0.764	1.293				
Teacher Qualification	TQ1	0.699	1.507	0.813	0.813	0.870	0.574
	TQ2	0.739	1.558				
	TQ3	0.768	2.039				
	TQ4	0.770	1.702				
	TQ5	0.806	2.075				
Teacher Support	TS1	0.658	1.619	0.902	0.905	0.920	0.562
	TS2	0.795	2.614				
	TS3	0.743	2.147				
	TS4	0.722	2.272				
	TS5	0.860	3.594				
	TS6	0.755	2.372				
	TS7	0.782	2.567				
	TS8	0.728	2.212				
	TS9	0.686	1.998				

The Fornell-Larcker criterion and the heterotrait-monotrait (HTMT) technique were utilized in order to conduct an analysis of the discriminant validity of this research (Hair et al., 2016). The validity of the discriminant function can be checked using the Fornell-Larcker criterion by taking the square root of the average variance extract values for all model variables (Hair et al., 2016). Table 3 provides a comprehensive analysis of the discriminant validity of each variable, utilizing the Fornell-Larcker criterion as its primary reference point. Because the initial values of all variables within each column show the highest values relative to their subsequent values, this table demonstrates that the model's discriminant validity has been achieved.

Table 3. Discriminant Validity (Fornell-Larcker)

	Educational Effectiveness	Sustainable Education	Sustainable Technology Adoption	Teacher Qualification	Teacher Support
Educational Effectiveness	0.776				
Sustainable Education	0.597	0.787			
Sustainable Technology Adoption	0.580	0.768	0.787		
Teacher Qualification	0.743	0.574	0.543	0.757	
Teacher Support	0.722	0.677	0.715	0.739	0.750

According to the HTMT rationing criterion, in order for any of the variable values to be considered appropriate, they must have a value that is lower than (0.85). Despite this, HTMT values of up to (0.90) are occasionally regarded to be acceptable (Hair et al., 2016). The findings of this investigation are detailed in Table 4, where it is clear that each value lies within the permissible range, which extends from (0.660) to (0.890) and can accommodate all of the given options. The results of this investigation showed that the model that was proposed for the investigation has discriminant validity.

Table 4. Discriminant Validity (HTMT)

	Educational Effectiveness	Sustainable Education	Sustainable Technology Adoption	Teacher Qualification	Teacher Support
Educational Effectiveness					
Sustainable Education	0.660				
Sustainable Technology Adoption	0.725	0.872			
Teacher Qualification	0.876	0.669	0.717		
Teacher Support	0.802	0.740	0.890	0.866	

When the R^2 score is larger than (0.5), it is determined that the strength of the model in the initial data is strong. In this investigation, the level of model strength indicated by rumor

spreading was moderate (R2 = 0.637). (Hair et al., 2016). In addition to this, the values of Q2 for each of the latent constructs in the models are higher than Zero, which is a requirement for inclusion in the models. In addition to that, it functions as an example of significant indications. Table 5 presents the values of R2 and Q2.

Table 5. R-Square Values and Q-Square Values for the Variables

	R²	**Q²**
Sustainable Education	0.637	0.365
Sustainable Technology Adoption	0.337	0.195

Direct Path Analysis

This study uses a bootstrapping method with 5,000 different samples for the goal of performing statistical validation on the model hypotheses (Hair et al., 2016). The t and p values were analyzed in this study to assess whether or not the hypotheses should be accepted or rejected (Hair et al., 2016). The results of the H1 relationship, which anticipated that educational effectiveness has a significant impact on sustainable education, are shown in Table 6 and Figure 3, which can be seen here. Both the value of t and the value of p indicate that this hypothesis should be accepted (t = 1.827, P = 0.034). As a result, H1 is acceptable. According to the second hypothesis, sustainable technology adoption has a significant impact on sustainable education. Both the value of t and the value of p indicate that this hypothesis should be accepted (t = 11.429, P = 0.000). Therefore, H2 is accepted.

Table 6. Direct Effect

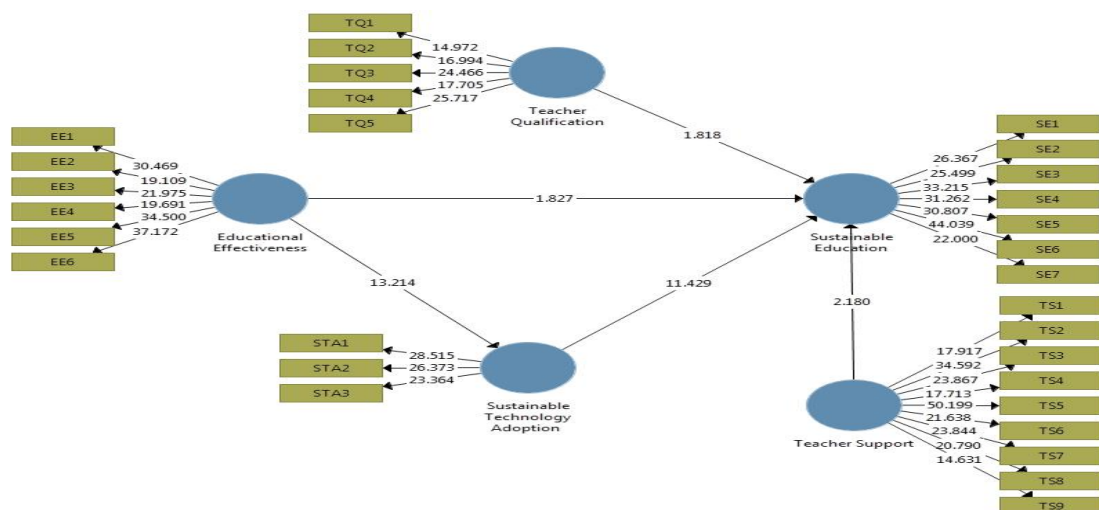| **Hypotheses**	**Relationship**	**Beta**	**SD**	**T Values**	**P Values**	**Decision**
H1	EE -> SE	0.110	0.060	1.827	0.034	Supported
H2	STA -> SE	0.563	0.049	11.429	0.001	Supported

Figure 3. Structural Model

Mediation Analysis

Additionally, the role that sustainable technology adoption could play as a potential mediator in the relationship between educational effectiveness and sustainable education was investigated in this research. According to Hypothesis 3, sustainable technology adoption act as a mediator in a way that is counter-productive for the relationship between educational effectiveness and sustainable education. The data indicate that sustainable technology adoption plays a role as a mediator in the connection between educational effectiveness and sustainable education (p=0.0301). Therefore, H3 is accepted. Table 7 presents the results of the mediation analysis.

Table 7. Indirect Effects

Hypotheses	Structural Paths	Direct Effect	Indirect Effect	Total Effect	Interpretation	Results
H3	EE-> STA -> SE	0.110 (0.034)	0.326 (0.001)	0.473 (0.001)	Partial Mediation	Supported

Moderation Analysis

According to the fourth and fifth hypotheses, both teacher support and teacher qualification exert a significant moderating influence on the connection between educational effectiveness and sustainable education. An interaction term was utilized so that an analysis could be conducted to determine how much of a moderating effect both teacher support and teacher qualification. According to the findings of the research, a connection exists between educational effectiveness and sustainable education, and this connection is moderated by both teacher support and qualification (t=3.746, p=0.000) and (t= 1.893, p=0.025) respectively. As a direct consequence of this, Hypotheses 4 and 5 are accepted. The moderating influence of both teacher support and qualification is depicted in Figure 4 and Figure 5, as well as in Table 8, respectively.

Table 8. Moderation Effect

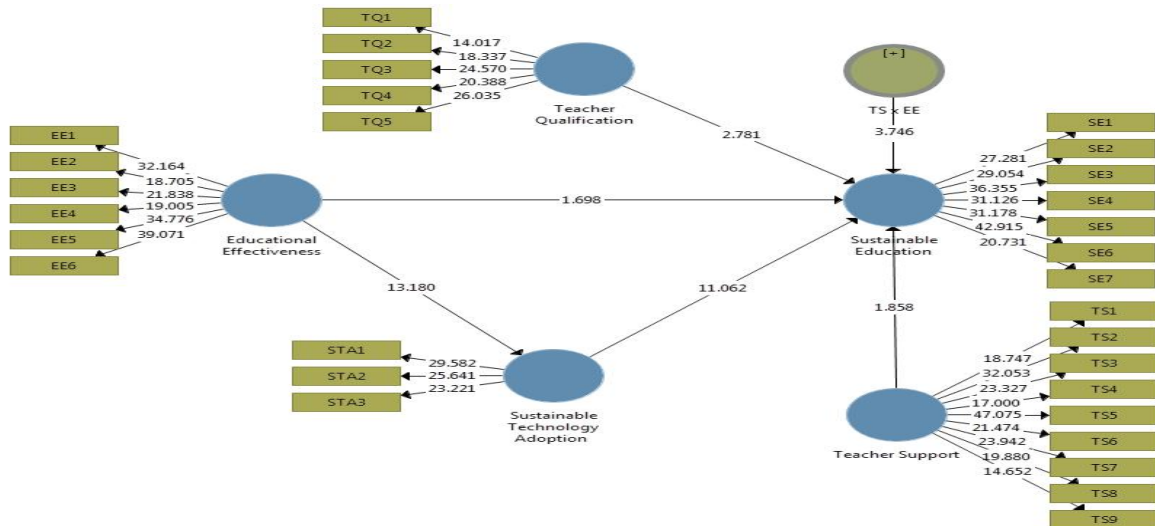| Hypotheses		Original Sample	T Values	P Values
H4	TS x EE -> Sustainable Education	0.135	3.746	0.001
H5	TQ x EE -> Sustainable Education	0.094	1.893	0.025

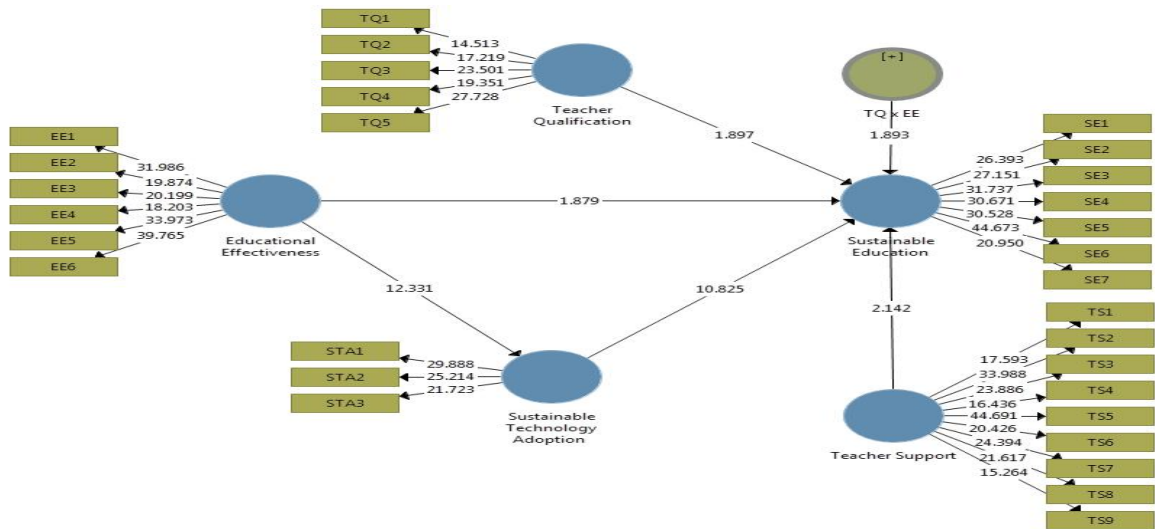Figure 4. Teacher Support as a Moderator

Figure 5. Teacher Qualification as a Moderator

Discussion

The aim of the study was to investigate the relationship between educational effectiveness and sustainable education. The finding of the study shows that there is a significant relationship between educational effectiveness and sustainable education. These findings are aligned with the previous study conducted by (Hussain et al., 2020) and (Myers, 2012) who stated that due to educational effectiveness, sustainability in education increases. The education sector is now taking steps towards sustainability because it is trending. The second objective of the study was to investigate the relationship between sustainable technology adoption and sustainable education. When educational institutes use sustainable technology and upgrade their institute according to technology development they move towards sustainable education (Läpple et al., 2017). The finding of the current study is supported by these studies and therefore, H2 is accepted.

The third objective of the study was to investigate the mediating effect of sustainable technology adoption on the relationship between educational effectiveness and sustainable education. The findings of the study showed that sustainable technology adoption mediated the relationship between the relationship of educational effectiveness and sustainable education. Sustainability in education increases when the education which is provided is effective and the institute use sustainable technology mode (Chen & Sintov, 2016). Learners are provided with the

competencies, information, attitudes, and values necessary to participate in sustainable development as a result of education for sustainable development. the goals of environmental education are to raise awareness of sustainable development, communicate the values associated with sustainability, and encourage sustainable conduct. Education with an emphasis on sustainable development could potentially produce informed people who are able to critically examine sustainable development issues along with the related complexity, uncertainty, and contradictions. These kinds of people may one day be in a position to bring about the required transition in order to create a future that is sustainable by advocating for political, social, and economic change (Handtke et al., 2022). Hence H3 is supported.

The fourth and fifth objectives of the study were to investigate the moderating effect of teacher support and teacher qualification on the relationship between educational effectiveness and sustainable education. Additionally, essential to the successful implementation of sustainability education is the competency of educators. According to the findings of (Buchanan, 2012) pre-service teachers had better-developed views of sustainable development than their supervising instructors did in schools. Gaining insight into the viewpoints of teachers can be both beneficial and valuable when researching sustainable education. Teachers' expertise and attitudes on sustainable development, practice in building and delivering relevant learning materials, and insights into problems and required support can all be significant determinants in developing a successful sustainable education strategy (Ferguson et al., 2021). The findings of the current study also align with previous studies and hence H4 and H5 are also accepted.

Conclusion

The purpose of the research was to determine whether or not there is a correlation between educational efficiency and educational sustainability. In addition, the study investigated the function that sustainable technology adoption played as a mediator, as well as the impact that teacher qualification and support played as moderators. Data were acquired from 321 pupils through the use of a technique known as simple random sampling. According to the findings, there is a meaningful connection between educational efficacy and educational sustainability on the one hand and educational sustainability on the other. The data were acquired through the use of a questionnaire that was adapted from previously conducted research. A 5-point Likert scale was utilized in order to quantitatively analyze the responses. The smart-PLS program was used to perform the analysis of the data. The findings reevaluated the idea that the deployment of environmentally responsible technology-mediated the connection between educational efficacy and environmentally responsible education. The findings also revealed that the level of educational qualification held by teachers and the support they received played a moderating role in the connection between educational efficacy and sustainable education. This study has a number of applications in the real world. With the assistance of this study, educational establishments, decision-makers, educators, and students will be aware of the aspects that play a vital part in obtaining a sustainable education. In a broader sense, there are implications that can be made from these findings for the implementation of responsible education within educational institutions and environments. It is impossible to stress how crucial it is to train educators to be able to promote sustainability in the education sector while taking into consideration the developments that have been made in information and communication technology in the twenty-first century. Students and teachers alike must be equipped with the fundamental technological competencies they need in order to be able to deal with the new improvements brought about by the education system.

The study's reproducibility is a significant weakness in its overall design. In this particular study, only students who had previously completed art-related coursework participated. In subsequent research, it may be possible to take into account the perspectives of additional students in order to widen the findings' scope of applicability. The fact that the study used a survey method to quantify sustainable schooling is yet another drawback of the investigation. In the future, researchers can choose to collect data using either qualitative research or experimental methods. In addition, this research examined the role of sustainable technology adoption as a mediator, as well as teacher support and teacher qualification as moderators. In subsequent

research, other mediating and moderating variables may be taken into consideration. This study made a contribution to the existing body of research by investigating the connection between efficient education and environmentally responsible education. Specifically, the researchers used the adoption of environmentally friendly technology as a mediator, while teacher support and teacher qualification served as moderators. This study will assist educational institutions in determining ways in which they might improve the amount of sustainable education offered inside their own facilities.

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