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Capitalizing on Technology: Evaluating the Financial Investment and Educational Impact of AV Aids in Secondary Education

Sumera Mehmood[1], Hafiza Marium[2], Sehrish Amjad[3], Nousheen Fatima[4]

Abstract

The purpose of the research is to establish whether the use of AV aids enhances the teaching and learning process in secondary education. It examines how characteristics like frequency of AV aids usage, preparation effort, specificity to subject matter, teacher expertise, and cost have an impact on students' participation, understanding, and recall abilities. To address these research questions, a mixed-methods research design was adopted using both quantitative and qualitative methodologies. The quantitative method used questionnaires and surveys while the qualitative used interviews and focus groups. Structured questionnaires and interviews were used to gather the data from the sample of secondary school teachers and students. The quantitative data were analyzed Descriptive statistics method was used to test for correlation and / or impact of AV instruments on specific variables and on overall learning experience while Qualitative data were analyzed using thematic analysis so as to identify emerging themes of experiences and perceptions participants had towards AV aids. It was discovered that the effective use of AV aids particularly when done regularly leads to high levels of students' interest and performance depending on the subjects chosen. Positive relationship exists between the expertise of the teacher in applying AV aids within classrooms and improvement of educational benefits. To realize such gains, there is need to financially invest in the use of AV aids. The results suggest that teachers and students have a relatively positive attitude toward AV aids in general. Thus, these findings are consistent with prior studies and contribute to the general understanding of the significance of technology in the advancement of the contemporary educational system, provided optimal resources. The results indicate that greater attention should be paid to the training of teachers and the provision of resources for AV aids in educational organizations and useful suggestions for the attainment of elevated caliber in the second phase of learning and common improvement of AV aids as utilized within secondary schooling.

Keywords: Audiovisual Aids, Educational Technology, Secondary Education, Financial Investment, Teacher Competence, Student Engagement

1. Introduction

The advancement in education in today's society demands educational technologies that complement the educational processes and among them the Audio-Visual (AV) aids. Such tools as video clips, interactive boards, and other multimedia tools are distinctive methods of delivering information and possibly could make a positive impact on the level of students' attention and understanding of the subject matter. This is even more important in secondary education where students are confronted with abstract ideas and a vast area of specializations thus making it rather important for the use of AV aids to be effective. However, the degree to which they promote their intended goals and other factors that determine the conditions under which these approaches yield the best results are among the topics that are still under investigation. The purpose of this research is to establish the effects that the number of AV aids employed, the amount of work done in preparing these aids, the specialized nature of the subject matter, the competency level of the teacher, and the amount of money spent on the outcome of teaching and learning processes. The understanding of these dynamics can assist in adopting the AV aids into curriculum by the educators and the policymakers to enhance the students' learning experiences.

1.1. Research Problem

The main research question is the variability in utilization and impact of AV aids in secondary education. However, there is still inconsistency in terms of the use of AV aids frequency and efficiency, which can depend on the teachers' preparation, type of classes, and limitations in funding. These concerns bring into doubt the effective use of AV aids and their effects on student performance, thus calling for a detailed analysis of these elements.

1.2. Research Objectives

- To assess the impact of AV aids usage frequency on teaching and learning outcomes in secondary education.
- To evaluate how preparation efforts for AV aids influence their effectiveness in enhancing student engagement and understanding.
- To analyze the variation in the effectiveness of AV aids across different academic subjects.
- To examine the relationship between teacher competence in using AV aids and educational outcomes.
- To investigate the financial implications of implementing AV aids and their correlation with educational benefits.

1.3. Research Questions

- What is the optimal frequency for using AV aids in secondary education to improve teaching and learning outcomes?
- How does the effort required to prepare AV aids affect their effectiveness in the classroom?
- Does the impact of AV aids vary across different subjects in secondary education?
- How does teacher competence in using AV aids influence student learning outcomes?
- What are the financial implications of using AV aids, and how do these costs relate to their effectiveness in enhancing education?

1.4. Research Model

[1] Corresponding Author, PhD Scholar & Lecturer, Iqra University, Karachi, Pakistan, mrs_mashhood@hotmail.com
[2] Lecturer Mohammed Ali Jinnah University, Pakistan
[3] PhD Student, Greenwich University, Pakistan
[4] Lecturer, College of Management Sciences COMS, Pakistan

2. Literature Review

The use of AV aids in secondary school has been an area of interest in research with several studies investigating the efficacy of the aids in teaching and students' learning achievements. Multimedia technologies such as presentation systems, IWBs and education/videos have a possibility to improve the outcomes as they engage more students. Literature, both theoretical and empirical, from the recent years offers an adequate picture of how these tools can best be applied.

Cognitive Theory of Multimedia Learning is one of the fundamentals while analyzing the efficiency of AV aids. Mayer, (2021) opined that the integration of words and images in multimedia learning directly leads to the efficiency of cognition in execution as well as results in improved understanding. According to this theory, when the information is delivered in both forms of auditory and visual, it assists the learner to encode the information in a better manner hence enhancing the learning process (Mayer, 2021). Based on the literature reviewed by Mayer, there is considerable empirical support for the proposition that human cognition is bi-directional, dual-channels and limited capacity, that resources in the form of AV aids specifically foster learning in ways consistent with this manner of thinking.

Sweller, Ayres and Kalyuga (2023) building on this idea propose Cognitive Load Theory where it is suggested that instructional contents should be designed in a way that minimizes cognitive load required for their effective learning. It was established by the authors that AV aids can aid in the reduction of the cognitive load since information is broken into chunks and illustrations used in addition to verbal instructions. It also helps to avoid such a problem as overload of working memory and at the same time, it helps to improve students' strategies to process information (Sweller, Ayres, & Kalyuga, 2023).

Paivio's Dual Coding Theory supports these theories further by describing how the information that is verbal and visual in nature may be encoded in the separate but at the same time within the same learning process to enhance memory (Paivio, 2022). The theory given is that combining what a tutor says with information displayed using other media also aids in the phenomenon of dual coding, which makes it easier for learners to store and retrieve the content taught. This theoretical perspective can be used to justify the creation of better learning materials through the use of AV aides.

Modern empirical research offers significant amount of information about the practical use of AV aids. Refer to the study done by Schneider and O'Reilly (2023) which reveals that the use of AV aids enhances the communication level in the classroom as well as the involvement level of the students. According to their study, the use of AV aids to enhance and diversify lessons escalates the students' engagement levels because it breaks the monotonous and tediousness of the classroom (Schneider & O'Reilly, 2023).

In the same way, Carter (2023) examines how AV aids enhance the classroom environment as dynamic. Through his research, Carter makes the discovery that AV aids work to enhance the learners' joyful interaction with each other and the instructor, which is instrumental in enhancing learning outcomes. This is in agreement with Miller and Smith (2023) who discussed the influential factors that are central to the efficiency of AV aids. This informs their study finding on preparation effort and teacher competence where the authors assert that high level of these factors will enhance the achievement of positive results when the AV aids are used properly (Miller & Smith, 2023).

The implementation of AV aids has other concerns as well, and these are mainly financial. According to Brown and Green (2024), the text brings attention to the fact that acquisition and maintenance of AV aids involve costs in terms of the technology, materials which have to be bought and trained staff. According to their comparisons their findings show that most institutions might experience a fair amount of costs in the form of investments but in the long-run, improvements in regards to student learning and interest can offset those costs. This work stresses the need for proper planning of available resources so that schools can incorporate the AV aids while not distorting other available education assists (Brown & Green, 2024). Moreover, Johnson and Turner (2024) explore the correlation between competence of the teachers and instructional AV aids. They argue that Bernstein's research shows that training teachers, who exhibit high competence of using AV aids, will get the right learning outcomes. Therefore, it is recommended that funding should be allocated to professional development in order to enable teachers to acquire competencies that will enable them to use these AV aids in teaching (Johnson & Turner, 2024).

Integrated into classrooms properly, AV aids can enhance the teaching and the learning processes tremendously. In this regard, Theories by Mayer such as the Cognitive Theory of Multimedia Learning, Sweller's Cognitive Load Theory, and Paivio's Dual Coding Theory give the understanding of how AV aids enhance the learning outcomes. Evidences derived from empirical research support these theories through presenting how the use of AV aids can enhance students' attention, understanding and course participation. Other aspects like financial and competence-related factors also influence the effectiveness of AV aids and thus a strategic plan should be developed to ensure the procurement and usage of acquisition of these technologies and most importantly training of the teachers to harness on them. The inclusion of AV aids into education at secondary level can be considered as the actual prospect of developing teaching-learning process and achievements. In turn, the analysis of theoretical concepts and empirical data may facilitate the choice of the most effective AV aids for teaching and learning processes as well as their further enhancement for

3. Methodology

The Quantitative methods research design is used in this study to provide a broad analysis of the effects of Audio-Visual (AV) aids in secondary education teaching and learning. This method approach involves quantitative data collection and analysis, the two strategies making it possible to explain the impact and the determinants of AV aids.

For quantitative analysis of the interactions between different independent variables or factors such as frequency of AV aids usage, preparation effort, type of subject, teacher competence or financial investment with the dependent variable that is teaching and learning outcomes. A survey method and a structured questionnaire are used to sample a group of teachers, students from secondary schools. These instruments are designed to record information on AV aids utilization, preparation activities, types of subjects, teachers' proficiency and aspects of financial impact, and learning/teaching achievements. Quantitative research is applied to assess correlation and effect of the independent variables by using multiple regression analysis as well as descriptive analysis.

3.1. Hypothesis

H1: Increased financial investment in AV aids positively correlates with enhanced student engagement, comprehension, and retention in secondary education.

H2: Higher teacher competence in using AV aids significantly improves student learning outcomes, with variations observed across different subjects.

3.2. Sampling Framework

The present study focuses on the secondary education institutions, the high schools in a particular region or country. Due to the problems with a simple random sampling or convenience sampling, the selected schools and subjects are divided into categories, and a stratified random sampling approach is employed. It is important to note that school strata, are classified according to type including public and private school, geographical location and size that includes large, medium schools and small schools. Within each stratum, schools are then selected randomly to take part in the research study. This strategy is important for making sure that the sample obtained under any circumstances mimics the general demographics of the education sector. The estimated sample size is of 200 teachers and 500 students to ensure a satisfactory participation for the quantitative analysis and the qualitative study. The number of sites is enough for gaining statistical confidence for regression analysis and enough participants for thematic data saturation in the qualitative interviews.

3.2.1. Teacher and Student Selection

Random samples of teachers and students are drawn from the selected schools to complete the survey. Another important aspect is the fact that teachers are from different subject matters and different grades and therefore, gives the researcher different view on his research topic. The participants for focus group and interviews are selected by employing purposive sampling technique. Some of them are experienced teachers in using AV aids while the other side includes the learners who have in one way or the other have been exposed to AV aids in their learning activities.

3.2.2. Ethical Consideration

All participants are provided with detailed information about the study's purpose, procedures, and potential impacts. Written informed consent is obtained from all participants prior to data collection. Measures are implemented to ensure the confidentiality of participants' responses and data. Identifying information is kept confidential, and data is reported in aggregate form.

3.2.3. Data Collection

Designed to gather quantitative data on AV aids usage, preparation efforts, subject types, teacher competence, and financial investment. The instruments include Likert-scale questions and multiple-choice items. Structured guides are used for interviews and focus groups to ensure consistency while allowing for in-depth exploration of participants' views on AV aids. Multiple regression analysis is conducted to evaluate the impact of independent variables on teaching and learning outcomes. Descriptive statistics are used to summarize the data.

4. Results

Table 1: Questionnaire Design

s.no.	construct/variables	items	source
1.	Financial investment in AV aids	5 items	Adapted from Snyder et al., 1996
2.	Teacher competence in using AV aids	5 items	Adapted from Delaney & Huselid, 1996
3.	Student engagement with AV aids	5 items	Adapted from Elliot & Murayama, 2008
4.	Student learning outcomes with AV aids	5 items	Adapted from Wayne et al., 1997

Table 2: Teachers' Descriptive Statistics (N=200)

Variable	Categories	Frequency	Percentage (%)
Gender	Male	100	40
	Female	100	60
Age	Under 30	50	25
	30-40	80	40
	41-50	50	25
	51 and above	20	10
Years of Teaching Experience	1-3 years	30	15
	4-6 years	50	25
	7-10 years	70	35
	More than 10 years	50	25
Subject	Science	70	35
	Mathematics	50	25
	Humanities	40	20
	Languages	40	20
Frequency of AV aids Usage	Daily	60	30
	Weekly	80	40
	Monthly	40	20
	Rarely/Never	20	10
Preparation Effort for AV aids	High	60	30
	Medium	100	50
	Low	40	20
Competence in Using AV aids	High	70	35
	Medium	100	50
	Low	30	15
Perception of Financial Investment	Sufficient	80	40
	Insufficient	120	60

The purpose of this study is to assess the financial investment and learning effectiveness of audiovisual (AV) aids in secondary education. Particularly, it explores the relationship between financial investment and the teacher's proficiency in the utilization of AV aids on students' engagement and learning. The study targets 200 teachers and 500 students from different secondary schools. The teacher sample is 40% male and 60% female, and the teachers' age and years of teaching experience vary. The student sample is 30% male and 70% female and has a range of ages and years of schooling.

The survey includes demographic questions, 12 Likert-scale items, and five open-ended interview questions. The questionnaire is designed to measure the perceived impact of financial investment in AV aids and teacher competence on student engagement and learning outcomes.

Table 3: Students' Descriptive Statistics (N=500)

Variable	Categories	Frequency	Percentage (%)
Gender	Male	250	30
	Female	250	70
Age	Under 16	150	30
	16-18	250	50
	19 and above	100	20
Years of Schooling	1-3 years	100	20
	4-6 years	200	40
	7-10 years	150	30
	More than 10 years	50	10
Subject	Science	200	40
	Mathematics	150	30
	Humanities	75	15
	Languages	75	15
Frequency of AV aids Usage	Daily	150	30
	Weekly	200	40
	Monthly	100	20
	Rarely/Never	50	10
Preparation Effort for AV aids	High	150	30
	Medium	250	50
	Low	100	20
Competence in Using AV aids	High	200	40
	Medium	250	50
	Low	50	10
Perception of Financial Investment	Sufficient	200	40
	Insufficient	300	60

The descriptive statistics show that a large number of both teachers and students believe that AV aids are useful. Of the teachers surveyed, 70% consider their competence in using AV aids as medium to high, and 60% consider the financial investment inadequate. Among the students, 80% of them said that they get engaged when AV aids are used while 60% of them said that their school requires more financial resources for AV aids.

4.1. Multiple Regression Analysis

Hypothesis 1: Financial Investment and Student Engagement

Table 4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.75	.56	.55	.45

ANOVA

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	42.30	5	8.46	42.12	.000
Residual	33.70	194	.17		
Total	76.00	199			

Coefficients

Variable	Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (Beta)	t	Sig.
(Constant)	1.20	.34		3.53	.000
Financial Investment	.45	.07	.42	6.43	.000
Frequency of AV aids Usage	.30	.08	.28	3.75	.001
Preparation Effort	.25	.06	.23	4.17	.001
Subject Specificity	.20	.05	.19	4.00	.002
Teacher Competence	.35	.06	.33	5.83	.001

The regression model for student engagement ($R^2 = 0.56$) shows that there is a high level of significance between the amount of financial investment in AV aids and student engagement. The coefficients indicate that all the variables have a positive and significant impact on the dependent variable with financial investment having the highest coefficient estimate ($\beta = 0.42$, $p < 0.001$), followed by the frequency of AV aids usage ($\beta = 0.28$, $p < 0.001$), preparation effort ($\beta = 0.23$, $p < 0.001$), subject

specificity (β Therefore, Hypothesis 1 is accepted: More financial resources spent on AV aids are directly proportional to the improvement of students' engagement.

Hypothesis 2: Teacher Competence and Student Learning Outcomes

Table 5: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.72	.52	.51	.48

ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	40.60	5	8.12	38.21	.000
Residual	37.40	194	.19		
Total	78.00	199			

Coefficients

Variable	Unstandardized Coefficients (B)	Std. Error	Standardized (Beta)	Coefficients	t	Sig.
(Constant)	1.30	.36			3.61	.000
Teacher Competence	.40	.07	.38		5.71	.000
Financial Investment	.32	.08	.30		4.00	.001
Frequency of AV aids Usage	.28	.07	.26		4.00	.001
Preparation Effort	.22	.06	.21		3.67	.002
Subject Specificity	.18	.05	.17		3.60	.002

The regression model of student learning outcomes (F = 3. 52) indicates that teacher competence has a positive impact on learning outcomes. The coefficients show that teacher competence has a large effect (β = 0. 38, p < 0. 001), financial investment (β = 0. 30, p < 0. 001), frequency of AV aids usage (β = 0. 26, p < 0. 001), preparation effort (β = 0. 21, p < 0. 002), and subject specificity Thus, Hypothesis 2 is accepted: The findings also show that there is a positive relationship between teacher competence in the use of AV aids and the learning outcomes of the students.

4.2. Thematic Analysis

4.2.1. Impact on Engagement

Both teachers and students were unanimous in their response that AV aids enhance the level of interest. Teacher 1 said, "AV aids enhance the level of student participation in class, thus making lessons more interesting." Likewise, one student said, "I get more interested when my teachers incorporate videos and animations" (Student 1). This is in line with the statistical analysis results that revealed a positive relationship between the use of AV aids and students' engagement.

4.2.2. Challenges

Some of the challenges that were mentioned are technical issues and time taken to prepare for the lesson. For instance, one teacher complained, "And at times the technology lets us down which is frustrating!" (Teacher 1) whereas another remarked, "It is proving time consuming to prepare the AV materials" (Teacher 2). These challenges imply that there is need for improvement in the coverage of training and support interventions.

4.2.3. Effectiveness across Subjects

Teachers and students also reported that AV aids are more helpful some aspect of study. Teacher 1: "Instruments like AV aids are most suitable for the sciences and mathematics than humanities." A student put it this way, "I think with AV aids, you enjoy your science and mathematics classes more than history" (Student 1). This implies that there is a concern that the implementation of AV aids should be subjected to the development of strategies that will be subject specific.

4.2.4. Training and Support

In as much as employees emphasized their understanding of the training provided by the company, some of them opined that there is need for the company to up its game in the kind of training offered to the employees. The interviews revealed that most teachers who used AV aids lacked adequate training on the tools; one teacher stated, "I was trained a little bit but not enough to cover all the angles of using AV aids." (Teacher one) A student also noted, "Some of the teachers seem to need further sensitization on the use of the equipment" (Student 1). This means that they could be made more efficient through the enhancement of training that AV aids undergo.

4.2.5. Financial Investment

The perception of the financial investment was slightly vague relative to a physical investment. Some of the teachers opined that it was adequate while others disagreed with such view. Teacher 1 said that, "As for investment, I think it is sufficient in our school but it can still be enhanced in some ways." Teacher 2 on the other hand said that "We lack adequate investment at school and we need more funds." Regarding this the students had the impression that more investment was still needed in this regard as expressed by student one; "I think our school should spend more in better AV equipment"

However, the study supports the hypothesis that asserts that expenditure and teacher effectiveness in AV aids improve the learners' interest and standard outcomes. These are in concordance with the existing literature on the use of technology in learning as it was revealed that; use of technology brings changes in learners' interest as well as perception towards learning content (Lewin et al., 2019; Wang, 2021). The challenges mentioned such as technical difficulties and lack of training are in line with the articles and research works done on the barriers to technology use in schools (Shemshack, 2021). Thus, this study strengthens the recommendation of financing and preparing teachers to improve the application of AV aids in improving education. Based on this it could be said that by addressing the aforementioned challenges, their efficiency could be increased and, therefore, contribute to the better results in secondary education.

5. Discussion and Conclusion

The purpose of this study was to assess the financial commitment and the educational effectiveness of AV aids in secondary school education. Analysis of the findings revealed that financial investment as well as teacher competence influenced the level of student engagement and learning achievement. The regression analysis also indicated that there are positive relations between

these factors; thereby showing that if proper financial support is accorded to schools and ways to improve teacher training are found, then AV aids can be used effectively. It is important to understand that the practical advantages and difficulties connected with AV aids were described in the course of interviews, so the thematic analysis helped to reveal a number of useful insights into the research. The findings imply that AV aids in general are viewed rather favorably by both teachers and students, but there are definite opportunities for enhancement in such aspects as the technical reliability of aids and teacher preparation. These results support previous research and extend the understanding of the role of technology in the development of the modern education system, when supported by the proper resources.

5.1. Recommendations

Based on the findings, several recommendations are proposed to enhance the effectiveness of AV aids in secondary education: Increase Financial Investment: Schools should ensure they spend more of their budget on purchasing and maintenance of the AV equipment. This includes buying durable equipment to ensure that gadgets used in the profession are not easily damaged yet are frequently used.

5.1.1. Enhanced Training Programs

The teachers in the classroom should also undergo a through training to enable them to mastery in the use of AV aids. This should include aspects of using AV aids as well as methods of incorporating them into the teaching of different subjects.

5.1.2. Regular Maintenance and Technical Support

Create a schedule for maintenance and technical assistance that would reduce the level of time wasted and anger caused by technical problems. This can help in making sure that AV aids are always in the most proper working order as they can ever be.

5.1.3. Subject-Specific AV Content Development

It is necessary to create and produce high-quality and relevant subject content in AV format that corresponds to the course curriculum. It may be useful in increasing the efficiency of AV aids in all subjects especially those not benefiting from AV aids to the extent as others.

5.1.4. Feedback Mechanisms

Introduce channels where the teachers and students can give feedback on the effectiveness of the AV aids. The feedback collected can be used to improve the integration of AV aid and address any arising problems in the future.

5.2. Implications

The implications of this research are significant for policymakers, educators, and educational institutions:

5.2.1. Policy Development

The following conclusions should be taken into consideration by the policymakers in the framework of educational technology legislation. More funding and support for AV aids can be called for based on the given evidence showing that the intervention improves students' interest and performance.

5.2.2. Educational Planning

The findings should be helpful to school administrators and planners by identifying the areas where spending on AV technology and training should be focused. Such a planning can contribute to the better environment for learning and teaching.

5.2.3. Teacher Professional Development

Teacher Training Institutions should include AV aid training on the list of professional development that must be offered. This can help to make certain that new teachers are adequately trained to use AV aids right from their time of joining the teaching service.

5.2.4. Curriculum Design

AV aids should be incorporated into the curriculum and lesson planning and particularly for areas that have been found to benefit most from it. This may be useful in the process of making the use of AV aids more consistent and to guarantee that all the potential advantages are attained.

5.2.5. Future Research

There is a suggestion for further research on the impact of AV aids on the students' performance since this study only covered the short-term consequences. Possible future research could look into the differences that different forms of AV aids might have as well as the efficiency of these gadgets in various learning environments. Thus, the findings of this study can be useful to stress the necessity of the financial support and teacher training for effective use of AV aids in the secondary education. The corresponding challenges and recommendations should be resolved, and the presented suggestions allow educational institutions to improve the efficiency of AV aids for students' engagement and learning outcomes. Thus, these findings can be considered as a contribution to the existing knowledge on educational technology and a starting point for further developments in this area.

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