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Harmonizing Science: Crafting Innovative Audio Tutorials for Lower Secondary Education

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Abstract
This study explores the development and impact of audio tutorials for 6th-grade science concepts, emphasizing the significance of education for individual growth and societal advancement. It aims to establish a robust audio tutorial system and assess its effects on content knowledge, observation skills, learning progress, and problem-solving confidence among 6th-grade students, considering demographic factors like school type, locality, gender, and parental education. The study's objectives focus on measuring the impact of audio tutorials on content knowledge and their correlation with concentration and observation skill enhancement in this student cohort. The research methodology involves identifying relevant science concepts, creating audio tutorials, and collecting student feedback, with a detailed analysis considering various variables using statistical techniques. The study's findings reveal the crucial influence of school type and parental education on audio tutorial development, stressing the need to tailor resources for private school students and those with graduate parents while extending accessibility to urban areas. Gender, on the other hand, does not significantly impact audio tutorial development, suggesting their universal benefit. In terms of content knowledge and concentration/observation skills development, demographic factors exert minimal influence, highlighting a consistent learning experience. However, parental education emerges as a critical determinant of learning progress and problem-solving confidence, favoring students with graduate parents.

Keywords: Audio tutorials, innovative learning, educational technology, interactive lessons.

1. Introduction

Education forms the bedrock of personal success and societal advancement, equipping individuals with essential skills and molding them into productive members of civilized society (Idris *et al*., 2012). Quality education elevates our intellectual prowess, enhances our capabilities, and enriches our knowledge, thereby fostering positive societal change. Rooted in the Tri-Polar-Modern View, education entails educators purposefully crafting learning experiences attuned to the social context, thriving when students actively engage in social settings and interact with their surroundings (Olugbenga & Olusegun, 2010).

This study is dedicated to the exploration of tutorials designed for lower secondary (middle school) students. Tutorials represent a powerful medium for knowledge transmission within the learning journey, distinguished by their interactivity, focus, and emphasis on experiential learning. Recent technological advances have unlocked a vast array of educational possibilities, enabling the creation of inspiring and engaging learning environments that captivate students. Educators aspire to meticulously design and logically sequence these learning experiences, recognizing that the quality of teaching is paramount to educational effectiveness (Loveless, 2021).

Audio-based instruction breaks free from temporal and geographical constraints, granting students access to educational materials irrespective of location or time. The versatile nature of audio facilitates information delivery in diverse formats, accommodating various learning styles. Audio recordings enhance educational resources by

illustrating real-world scenarios, conveying intricate concepts, fostering group discussions, and sparking conversations (Coman *et al*., 2020) [2]. This study embarks on the mission to develop a robust audio tutorial system, aiming to validate its broader utility. It examines the impact of audio tutorials on content knowledge acquisition, observation skill enhancement, and the cultivation of problem-solving confidence. Furthermore, the research explores potential variations in tutorial effectiveness based on demographic variables such as school type, locality, student gender, and parental educational background.

2. Review of Literature and Research GAP

The existing literature offers valuable insights into the field of education, with a particular focus on innovative teaching methods and the integration of technology. Billinger-Finke *et al*. (2020) [1] highlight the importance of user satisfaction with audio processors, emphasizing the need for reliable measurement tools. Saripalli *et al*. (2018) [6] stress the significance of audio-visual aids in the teaching and learning process, shedding light on their effectiveness, particularly at the university level. Rezaeinejad *et al*. (2015) [5] delve into the realm of learning styles among high school students and their relationship with educational achievement, recognizing the impact of individualized learning approaches. Sinnerton *et al*. (2014) [7] underline the importance of educators' awareness of learning style preferences, noting the positive impact it has on teaching and learning in allied health programs. Patil (2013) [3] introduces the concept of the audio tutorial system as an independent learning method that caters to various learners' needs and abilities. Furthermore, Haleem *et al*. (2022) [8] emphasize the transformative role of digital technologies in education, particularly in the context of achieving quality education and the United Nations' sustainable development goals. They highlight the significance of technology in facilitating inclusive and equitable education, especially in the wake of the COVID-19 pandemic.

However, despite these valuable contributions, there is a noticeable research gap when it comes to understanding the effectiveness of audio tutorials in the context of lower secondary (middle school) education, specifically focusing on 6th-grade students. The literature review did not directly address the objectives of our study, which aim to investigate the impact of audio tutorials on content knowledge acquisition, observation skill enhancement, learning development, and problem-solving confidence in relation to demographic factors like school type, locality, student gender, and parental educational background in this specific educational context. This research seeks to bridge this gap by exploring the unique dynamics of audio tutorials in the context of 6th-grade science education and their intersection with demographic variables.

2.2 Objectives of the Study

1. To assess the impact of audio tutorials on the development of content knowledge in science concepts for 6th standard students.
2. To examine the relationship between the use of audio tutorials and the development of concentration and observation skills among 6th standard students.

3. Research Methodology

The research methodology encompasses various aspects, including tool selection, framework, pilot study, and its implications for the final study. This study's primary objective is to develop audio tutorials for 6th-grade school students on science concepts. Initially, the author identified relevant science concepts from the 6th-grade curriculum and designed an audio device for tutorial purposes. Subsequently, a script was prepared and recorded to create the audio tutorial. The tutorial was then implemented for student tutoring, and feedback was collected using a questionnaire-based feedback system. The research variables used in this study are categorized into four major divisions: Development of Content Knowledge, Development of Concentration & Observation Skills, Development of Learning, and Development of Confidence in problem solving. These divisions are further subdivided based on variables like the type of school, locality of students, gender, and parental educational status. Research tools employed include a personal data sheet and a questionnaire for gathering feedback on the tutorials. These tools were validated by subject matter experts, and after three drafts, a final set of 20 questions was established. Data analysis involved the use of percentage analysis, mean, standard deviation, and significance testing (t-test) to draw conclusions from the collected data.

4. Analysis and Interpretation

Table 1: Development of Audio Tutorial on Science Concepts for 6th Standard Students with respect to Demographic Factors

Development of audio tutorial on science concepts					
Factor	**Variable**	**N**	**Mean**	**S.D(σ)**	**t-value**
Type of school	Government	50	79.9000	7.0306	17.9569**
	Private	50	70.5600	6.4963	
Locality	Urban	60	75.4333	6.1480	7.2669**
	Rural	40	80.025	11.8711	
Gender	Boys	28	80.4285	11.2910	1.5245
	Girls	72	79.4166	7.964	
Education qualification of parent	Non-Graduate	71	80.0281	7.3706	15.3262**
	Graduate	29	72.2413	4.4753	

Source: Primary data

Interpretation

The analysis of the data presented in Table 1 reveals significant patterns. Regarding the type of school, government school students exhibit notably higher development of audio tutorials for science concepts compared to their private school counterparts. Additionally, the locality of the school plays a significant role, with rural students showing greater development than urban students. When considering gender, there is no substantial difference in audio tutorial development between boys and girls. However, parental education qualifications have a significant impact, with students whose parents are non-graduates displaying higher

development compared to those with graduate parents. These findings underscore the influence of demographic factors on the development of audio tutorials for science concepts among 6th-grade students, emphasizing the role of school type and parental education in this context.

Table 2: Relationship between developments of content knowledge on science concepts through audio tutorial with respect to Demographic Factors

Development of Content Knowledge					
Factor	**Variable**	**N**	**Mean**	**S.D(σ)**	**t-value**
Type of school	Government	50	23.0200	1.5710	0.7511
	Private	50	24.2000	1.5853	
Locality	Urban	60	24.3500	0.7059	0.5929
	Rural	40	24.225	1.3070	
Gender	Boys	28	24.0357	1.6653	1.0791
	Girls	72	23.7361	1.2674	
Education qualification of parent	Non-Graduate	71	24.47887	0.5388	1.2288
	Graduate	29	24.6551	0.3768	

Source: Primary data

Interpretation

The analysis of the data presented in Table 2 suggests that there are no significant differences in the development of content knowledge on science concepts through audio tutorials concerning demographic factors. Regardless of the type of school, locality, gender, or parental education qualification, the mean scores for content knowledge development remain relatively consistent. The t-values indicate that the differences observed are not statistically significant. Therefore, it can be inferred that the demographic factors examined in this study do not significantly impact the development of content knowledge in 6th-grade students using audio tutorials for science concepts. This suggests that audio tutorials may offer a consistent and equitable learning experience across various demographic backgrounds in this context.

Table 3: Development of concentration & observation skills through audio tutorial in relation to Demographic Factors

Development of Concentration & Observation Skills					
Factor	**Variable**	**N**	**Mean**	**S.D(σ)**	**t-value**
Type of school	Government	50	23.3400	1.1677	0.6570
	Private	50	23.2000	1.1020	
Locality	Urban	60	22.1000	2.0576	0.7694
	Rural	40	21.8500	2.8487	
Gender	Boys	28	23.6428	0.9788	1.8763
	Girls	72	23.222	1.3020	
Education qualification of parent	Non-Graduate	71	22.3802	1.7533	0.3078
	Graduate	29	22.3793	2.1724	

Source: Primary data

Interpretation

The analysis of the data presented in Table 3 indicates that there are no significant differences in the development of concentration and observation skills through audio tutorials concerning demographic factors. Whether considering the type of school, locality, gender, or parental education qualification, the mean scores for the development of concentration and observation skills exhibit relatively consistent levels. The t-values demonstrate that these observed differences are not statistically significant. Therefore, it can be concluded that demographic factors do not play a significant role in influencing the development of concentration and observation skills among 6th-grade students using audio tutorials. This suggests that audio tutorials have the potential to offer a consistent and equitable enhancement of these skills across diverse demographic backgrounds in this educational context.

Table 4: Relationship between developments of learning through audio tutorial with respect to Demographic factors

Development of Learning					
Factor	**Variable**	**N**	**Mean**	**S.D(σ)**	**t-value**
Type of school	Government	50	20.7800	2.7057	0.2416
	Private	50	20.8600	2.7759	
Locality	Urban	60	20.9333	1.9954	1.2281
	Rural	40	21.325	2.7378	
Gender	Boys	28	21.000	4.9629	0.5064
	Girls	72	21.2361	2.8871	
Education qualification of parent	Non-Graduate	71	20.3662	3.4354	3.2272**
	Graduate	29	21.3103	1.0788	

Source: Primary data

Interpretation

The analysis of the data presented in Table 4 reveals a significant difference in the development of learning through audio tutorials concerning the education qualification of parents. Specifically, students with non-graduate parents have a lower mean score (20.3662) compared to those with graduate parents (21.3103), and this difference is statistically significant (t-value = 3.2272, $p < 0.05$). However, when considering other demographic factors such as the type of school, locality, and gender, there are no statistically significant differences in the development of learning through audio tutorials. This suggests that parental education plays a significant role in influencing the effectiveness of audio tutorials in enhancing learning among 6th-grade students, with students whose parents have graduate-level education benefiting more. Other demographic factors do not exhibit a notable impact on the development of learning through audio tutorials in this context.

Table 5: Development of confidence in problem solving through audio tutorial in relation to demographic factors

Development of Confidence in Problem Solving					
Factor	**Variable**	**N**	**Mean**	**S.D(σ)**	**t-value**
Type of school	Government	50	20.3200	3.4057	0.4377
	Private	50	20.4800	3.2751	
Locality	Urban	60	21.6500	2.5364	0.8679
	Rural	40	21.325	3.9173	
Gender	Boys	28	21.2851	4.2857	1.4927
	Girls	72	21.9861	4.8307	
Education qualification of parent	Non-Graduate	71	20.3662	3.4354	3.2272**
	Graduate	29	21.3103	1.0788	

Source: Primary data

Interpretation

The analysis of data presented in Table 5 indicates a statistically significant difference in the development of confidence in problem-solving through audio tutorials concerning the education qualification of parents. Specifically, students with non-graduate parents exhibit a lower mean score (20.3662) compared to those with graduate parents (21.3103), and this difference is statistically significant (t-value = 3.2272, $p < 0.05$). However, when considering other demographic factors such as the type of school, locality, and gender, there are no statistically significant differences in the development of confidence in problem-solving through audio tutorials. This suggests that parental education level significantly influences the enhancement of problem-solving confidence among 6th-grade students through audio tutorials, with students whose parents have graduate-level education showing greater improvement. On the other hand, other demographic variables do not appear to have a substantial impact on the development of problem-solving confidence through audio tutorials in this context.

Conclusion

The type of school and parental education have a significant influence on the development of audio tutorials for 6th-grade science concepts. To ensure fair access, educational institutions should customize resources for private school students and those with graduate parents. Moreover, extending audio tutorials to urban areas is vital, as rural students demonstrate more progress. Gender does not seem to affect audio tutorial development, suggesting their universal benefit. Regarding content knowledge development through audio tutorials, demographic factors like school type, locality, gender, and parental education play minor roles. This indicates a consistent and equitable learning experience for diverse 6th-grade student backgrounds. Likewise, the development of concentration and observation skills through audio tutorials remains consistent irrespective of demographics. Educators can confidently integrate audio tutorials into their teaching methods, knowing that demographic disparities in skill development are minimal. However, when considering learning development through audio tutorials, parental education significantly matters, with graduate parents' children benefiting more. Therefore, additional support is crucial for students with non-graduate parents. Other demographic factors, such as school type, locality, and gender, have limited impact on learning development. Lastly, parental education notably affects problem-solving confidence through audio tutorials, favoring students with graduate parents. To enhance confidence, interventions should prioritize students with non-graduate parents by providing necessary support and resources.

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