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RESEARCH ARTICLE

Building a Collaborative STEM Culture through Website, Radio, and Journal Creation with High School Students from the 4th High School of Ilion: An Evaluation of a Technology-Enhanced Educational Project

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ABSTRACT

In today's digital age, educators must employ innovative and creative approaches to engage students in collaborative and interdisciplinary STEM education. Integrating technology tools like Photoshop, Audacity, and social media platforms such as Instagram offers students the chance to acquire and apply vital skills in real-world contexts. This study evaluates the effectiveness of a technology-enhanced educational project where high school students collaboratively build a formal school site, radio, and journal, fostering communication, collaboration, and project management skills.

Drawing on research highlighting students' autonomy and technology integration in education, this study examines the project's impact on student learning outcomes. It investigates how the project influences student engagement, collaboration, and creativity. The use of technology in the project is expected to boost student motivation and enable personalized learning, ultimately enhancing the educational experience.

The research questions explore the effects of the technology-enhanced project on student engagement, collaboration, and creativity within the context of building a school site, radio, and journal. Additionally, the study aims to understand students' perceptions of the project, including their satisfaction, motivation, and self-efficacy. The findings will suggest improvements to support STEM education and enhance student learning outcomes.

Keywords: Collaborate learning, community building, learning and creativity, STEM Education.

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1. Introduction

In today's increasingly digital and technology-driven world, it is more important than ever for educators to engage students in innovative and creative ways that promote collaboration and STEM (Science, Technology, Engineering, Arts, and Mathematics) education. The integration of technology tools, such as Photoshop, Audacity, and social media platforms like Instagram, provides an opportunity for students to not only learn these skills but also to apply them to real-world challenges. One way to achieve this is by engaging students in building a formal school site, radio, and school journal which not only promotes creativity, but also enhances communication, collaboration, and project management skills.

Research has shown that collaborative projects in which students have a high degree of autonomy and ownership over their learning have the potential to improve academic outcomes and foster creativity, problem-solving, and critical thinking skills [1]. Additionally, the use of technology in the classroom has been shown to increase student engagement and motivation, facilitate communication and collaboration, and provide opportunities for personalized learning [2].

This study aims to evaluate the effectiveness of a technology-enhanced educational project in which high school students build a formal school site, radio, and school journal while promoting collaboration and STEM education. Specifically, the study will examine the impact of this project on student learning outcomes, including increased engagement, collaboration, and creativity.

2. Theoretical Framework

The theoretical foundation for this study is anchored in the importance of evidence-based practices in education [2], which supports the adoption of innovative approaches such as STEM education [3]. The framework also draws on Vygotsky's sociocultural theory, which emphasizes the role of social interaction and collaboration in learning [1]. Collaborative learning is recognized as an effective approach for promoting critical thinking, problem-solving, and positive attitudes towards learning [4]–[6]. Additionally, the integration of technology in education is explored through the lens of technology-enhanced learning [7] and its potential to enhance creativity [8]. The use of social media as a tool for communication and collaboration among students is considered within the framework, with attention to guidelines and policies [9] and the potential benefits and challenges identified in the literature [10]–[12].

The theoretical framework for this study incorporates the principles of Freinet pedagogy, as highlighted by previous research [13]. This alternative approach to traditional schooling emphasizes student autonomy, collaborative projects, and cooperative learning. By aligning with the focus on evidence-based practices, STEM education, technology-enhanced learning, and the use of social media for communication and collaboration among students, the principles of Freinet pedagogy enhance the comprehensive understanding of the theoretical framework and its implications for educational practices.

Overall, this theoretical framework provides a comprehensive understanding of the interplay between STEM education, technology-enhanced learning, collaborative learning, and the use of social media in facilitating communication and collaboration among students. By drawing on established theories and empirical evidence, this framework guides the exploration of these concepts and their implications for educational practices.

3. Literature Review

3.1. The Importance of STEM Education Today

STEM education integrates Science, Technology, Engineering, Arts, and Mathematics to nurture critical thinking, problem-solving, creativity, and innovation [3]. It equips learners with essential skills for the complexities of the 21st century, including digital literacy, adaptability, collaboration, and an entrepreneurial mindset. STEM education aligns with the evolving job market's demand for cross-disciplinary knowledge and skills. The study's findings reflect the increasing recognition of STEM education as a global trend, addressing the educational needs of a rapidly changing society and empowering individuals for success in various professional fields [3].

In an article on the importance of STEM education, several key findings are revealed [14]. Firstly, the incorporation of computational thinking within STEM education fosters the development of crucial skills such as problem-solving, logical reasoning, and algorithmic approaches. Secondly, the integration of engineering epistemology equips students with design thinking, problem-solving abilities, creativity, and collaborative skills. Lastly, the inclusion of computational science enhances students' understanding of complex scientific phenomena through computer simulations, modeling, and data analysis. These results underscore the significance of STEM education in equipping individuals with the necessary skills and knowledge to thrive in a technology-driven and interconnected society, addressing real-world challenges, and fostering innovation and critical thinking [14].

A recent analysis of STEM education using the Web of Science database revealed a notable increase in research focused on STEM education, specifically in the fields of engineering and technology [15]. The study also observed a growing emphasis on interdisciplinary approaches in STEM education, as evidenced by the frequent use of co-words like "interdisciplinary," "innovation," and "creativity" in the literature [15]. This research underscores the significance of STEM education in equipping students for future careers and addressing global challenges [15].

These articles highlight the importance of STEM education today, equipping individuals with essential skills such as problem-solving, logical reasoning, and algorithmic thinking. Integration of computational thinking nurtures design thinking, creativity, problem-solving, and collaboration skills. Additionally, incorporating computational science enhances understanding of complex scientific phenomena. The research findings underscore the significance of STEM education in preparing individuals for a technology-driven world, addressing real-world challenges, fostering innovation and critical thinking, and aligning with the evolving job market. These articles contribute to the global recognition of STEM education as a vital trend, catering to the needs of a changing society and empowering individuals for success in diverse professional domains.

3.2. The Role of Technology in Enhancing Learning and Creativity

Recent literature has drawn attention to the transformative role of technology in fostering learning and creativity. A comprehensive literature review [7] examined the correlation between technology and creativity in the context of teaching and learning. Their findings indicate that technology holds significant promise in enhancing creativity; however, they also highlight the challenges and complexities associated with its integration into educational settings. The authors emphasize the existence of an "uneasy space of implementation," wherein the potential benefits of technology intersect with the practical realities of its adoption within classrooms.

Likewise, a recent study examined the perspectives and practices of digital technology-integration expert teachers

regarding technology-enhanced creativity [8]. The findings revealed that these expert teachers perceived technology as a valuable tool for fostering and amplifying creativity among students. The study found that the expert teachers viewed technology as a tool to support and enhance creativity and highlighted the importance of providing students with opportunities to explore and experiment with technology. However, the study also revealed challenges such as the need for ongoing professional development and support for teachers in effectively integrating technology in teaching and learning [8].

The significance of technology in promoting cooperation and collaborative learning has been underscored by researchers [16]. It has been emphasized that technology has the potential to facilitate more effective collaboration among learners, enabling them to share ideas, capitalize on each other's strengths, and address individual weaknesses [16].

Overall, the literature suggests that while technology has the potential to enhance learning and creativity, its successful implementation in education requires careful consideration of pedagogical approaches, ongoing professional development, and support for teachers.

3.3. The Benefits of Collaborative Learning and Student Participation in Educational Projects

In today's education, collaborative learning has gained increasing attention to promote student participation and engagement in educational projects.

The benefits of cooperative learning in secondary school science education have been explored by researchers [5]. It has been found that when students engage in collaborative work, they experience more meaningful discussions and develop a deeper comprehension of socio-scientific topics. Additionally, cooperative learning enhances problem-solving and critical thinking abilities, boosts motivation to learn, and cultivates positive attitudes toward science.

Researchers have examined the impact of collaborative learning in the field of architecture, engineering, and construction (AEC) education [6]. Their findings indicate that collaborative learning fosters the development of problem-solving skills and facilitates the cultivation of teamwork, communication, and leadership abilities among students [6].

A model for effective cooperative learning has been proposed, emphasizing individual accountability, positive interdependence, face-to-face interaction, and team-building skills [4]. These elements are believed to facilitate effective communication, enhance problem-solving skills, and foster teamwork among students. Furthermore, the benefits of group work in news and broadcasting classes have been observed, adding perspective, and enhancing critical thinking skills. Group discussions provide opportunities for students to share ideas, analyze news, and engage in meaningful discussions [4].

Overall, the literature suggests that collaborative learning can have many benefits for students, including improved critical thinking skills, motivation to learn, and positive attitudes toward education. Furthermore, technology can play a significant role in facilitating cooperation and collaboration among students.

3.4. The Use of Social Mediain Facilitating Communication and Collaboration Among Students

Social media has been widely adopted by individuals for communication and collaboration purposes, including in education. This literature review explores its use in facilitating communication and collaboration among students. Studies on social media use in higher education highlight its potential to enhance communication, collaboration, and engagement among students [9]. Clear guidelines and policies are emphasized as necessary for regulating its use [9].

Incorporating social media platforms, such as Facebook and Twitter, in a blended learning course enhances student engagement and participation [10].

A literature review on social media use in the classroom identifies advantages like improved communication, collaboration, and student engagement, while also acknowledging potential distractions and the importance of clear goals and guidelines [11].

During the COVID-19 pandemic and distance learning, social media platforms enabled students to maintain social connections, engage in group discussions, and share resources [16]. They provided a virtual space for interaction, idea exchange, and information sharing, overcoming the challenges of remote learning [17].

Social media platforms offer opportunities for students to interact, share ideas, and collaborate on projects, enhancing communication channels and fostering a sense of community [18].

The literature suggests that social media holds several benefits for facilitating communication and collaboration among students, requiring clear guidelines and policies for responsible use in educational settings.

4. Purpose–Objectives–Research Questions

The purpose of this study is to investigate the impact of a technology-enhanced educational project on student engagement, collaboration, and creativity in the context of building a formal school site, school radio, and school journal. The study aims to explore students' perceptions of the project, including their satisfaction, motivation, and self-efficacy. Additionally, the research seeks to identify areas for improvement to better support STEM education and enhance student learning outcomes.

The research questions that guide this study are:

How does the technology-enhanced educational project impact student engagement, collaboration, and creativity in the context of building a formal school site, school radio, and school journal?

What are the students' perceptions of the project, including their satisfaction, motivation, and self-efficacy?

How can the project be improved to better support STEM education and student learning outcomes?

Furthermore, the hypotheses for this study are as follows:

The technology-enhanced educational project will have a positive impact on student engagement, collaboration, and creativity in the context of building a formal school site, radio, and journal.

The students will report high levels of satisfaction, motivation, and self-efficacy in the project.

By addressing these research questions and testing the hypotheses, this study aims to contribute to the understanding of the effectiveness and potential improvements of technology-enhanced educational projects in promoting engagement, collaboration, creativity, and student perceptions in the context of STEM education.

5. Methodological Framework

5.1. Participants and Sampling

The participants in this study were 42 high school students from the 1st, 2nd, and 3rd grades from the 4th high school in Ilion, Greece. The participants were selected through convenience sampling, based on their availability and willingness to participate in the study.

5.2. Procedures and Timeline

Participant Selection: The participants for this study were selected from the 4th high school of Ilion, Greece. Participants were chosen based on their interest in STEM-related topics and their willingness to actively participate in the project.

Project Design: The project was designed to focus on STEM-related topics, with each group being assigned a specific part of the project. The participants were divided into groups of 4–5 students, and each group was given a particular task to work on. The decision-making process was facilitated through classroom convening and voting. The groups were formed for various tasks, including content writing for the website, website design, technical aspects of the website (working on the editor), photo editing, photo shooting, audio editing for the podcast, podcast team, design of the journal, drawing, and writing articles.

Project Timeline:

The project was conducted over a 15-week period during the academic year. The timeline for the project was as follows:

Weeks 1–2: Introduction to the project and team formation

Weeks 3–4: Research and topic selection

Weeks 5–6: Planning and design

Weeks 7–10: Implementation and development

Weeks 11–12: Discussion of results, voting, and refinement

Weeks 13–14: Finalization of the project

Week 15: Presentation.

During the project timeline, participants actively engaged in collaborative work within their assigned groups. They utilized a range of software tools to accomplish tasks related to sound editing, image editing, HTML coding, and text writing. The use of these tools facilitated the creation of engaging and interactive content for the school website, podcast, and journal.

The timeline was strategically designed to provide sufficient time for crucial project stages. The initial weeks focused on research and topic selection, allowing participants to explore STEM-related subjects and choose their areas of interest. Subsequently, the planning and design phase enabled the groups to conceptualize their projects and outline the necessary steps for implementation.

5.3. Data Collection and Analysis

The data collection process consisted of two methods. Firstly, data was collected through interviews with the students who took part in the project. The interviews were conducted individually and lasted for approximately 20 minutes. The interviews were semi-structured and aimed to explore the students' experiences, perspectives, and perceptions related to their involvement in the project.

Secondly, data was collected through surveys from 1/3 of all the students. In the surveys, there were students from all classes and genders. The survey consisted of closed-ended questions related to the effectiveness of the project in achieving its goals. The survey took approximately 10 minutes to complete. Although this sampling method may not encompass the entire student population, it offers valuable insights into the perceptions of the project's success among the surveyed subgroup, given the unavoidable time constraints. While this sampling method may not represent the entire student population, it provides a snapshot of views on the project's success within the surveyed subgroup, offering valuable insights while acknowledging potential limitations in generalizability.

The data collected through interviews and surveys were transcribed and analyzed thematically. The data were coded and categorized based on the research questions and objectives. The qualitative data collected through interviews were analyzed using content analysis to identify patterns and themes. The quantitative data collected through surveys were analyzed using descriptive statistics to examine the distribution of responses and to identify trends and patterns.

The study included four chat groups on Instagram, each consisting of 4–5 students. The chat groups were created to discuss issues related to the website, journal, and podcast created by the students. The chats were conducted for 12 weeks during the academic year.

The analysis of the data was conducted by two researchers independently. The researchers discussed the findings and reached a consensus on the interpretation of the data. The results were presented in the form of a report and were shared with the school administration and the participants of the project.

5.4. Ethical Considerations

The study was conducted with the utmost consideration for ethical principles. Informed consent was obtained from all participants, and they were assured that their participation was voluntary and anonymous. Participants were made aware of the purpose of the study and were informed that their responses would be kept confidential and used only for research purposes. No personal identifying information was collected during the study.

Participants' privacy and confidentiality were always maintained, and their responses were analyzed and reported in aggregate form to ensure anonymity.

All data collected during the study was stored securely and accessed only by the research team. Any concerns or

complaints raised by participants were addressed promptly and appropriately.

Overall, the ethical considerations of the study were carefully planned and executed to ensure the safety, privacy, and well-being of all participants involved in the research.

6. Data Analysis and Presentation of Results

6.1. Qualitative Analysis of Interviews

After conducting interviews with participants in the project, several themes emerged regarding their experiences and perceptions.

The first question asked the participants about their role in the project. Participants' responses shed light on their specific responsibilities and involvement in the design and development of the school website, journal, and podcast. The following themes emerged from the analysis: Some of the participants mentioned their role in the design of the website and the magazine, while others focused on writing and content creation. Additionally, other roles were mentioned, such as technical support, photography, design, and image editing. This variety of roles indicates the collaborative nature of these creative projects and the contribution of multiple individuals to their development.

The second question asked the participants about their motivation to participate in the project. Here are the thematic analysis and content analysis based on their answers. The responses indicate a variety of motivations that drove individuals to participate in the project. Firstly, several participants mentioned that the project made computer science more interesting for them, fostering a collaborative spirit and creating an opportunity to get to know each other better. This highlights the importance of mutual support and teamwork in their engagement. Some participants expressed their motivation as a desire to help others, contributing to the development of the project. Others were intrigued by the novelty and creativity of the project, finding it different from regular classroom activities. For them, it was a chance to try something new and showcase their skills.

Furthermore, the thematic analysis of the responses uncovers common themes. These include the role and participation of individuals in the creation of the website, magazine, and podcast, the development of content, article writing, and interaction among students. Additionally, participants mentioned other themes such as website design, group coordination, and efforts to improve and evolve these creative projects.

Overall, the motivations expressed by the participants reflect their enthusiasm for computer science, the opportunity to collaborate with peers, the desire to explore new avenues, and the goal of contributing to the success of the project.

During the project, team collaboration varied among participants. Some described it as creative and supportive, with everyone contributing to successful outcomes (Answers 1, 6). Others simply stated that collaboration was good without major issues (Answers 2, 3, 7, 8, 9, 10, 11). Challenges arose from differing opinions within the large group, but efforts were made to strive for the best results (Answers 4, 5). Many respondents highlighted excellent collaboration experiences without problems (Answers 12, 13, 15, 16, 17, 18, 20, 21), although one individual mentioned an issue with a specific person (Answer 22). Leadership tendencies among team members were noted by some (Answer 14).

The collaboration was described as dynamic and intense, with lively discussions and occasional disagreements. Despite differences, interactions were enjoyable and fostered idea exchange (Answers 19, 23, 26). The group size impacted collaboration, requiring navigation through multiple perspectives (Answers 5, 19, 23, 32). Efforts were made to foster understanding and compromise (Answers 4, 11, 13, 14, 17, 19, 24, 27, 33, 37, 39, 40).

The thematic analysis highlights teamwork complexity, effective communication, and understanding to achieve shared objectives. The diverse experiences within the team showcase varying perspectives and challenges encountered during the project. Despite occasional difficulties, the overall sentiment appears positive, emphasizing creativity, mutual assistance, and camaraderie.

In analyzing the responses to the question regarding the difficulties faced and how they were overcome, a wide range of experiences and strategies were mentioned by the respondents. Answers 1, 4, 6, 12, 14, 18, 22, 23, 25, 26, 29, 31, 32, 34, 35, 36, 38, and 42 highlighted various challenges encountered during the project. These included feelings of anxiety, disagreements among team members, limited working hours, difficulties in managing computer systems, and the initial learning curve in handling technical aspects such as website creation. Some participants mentioned the relief they felt when receiving accurate information from teachers and fellow students.

On the other hand, answers 2, 3, 5, 7, 8, 9, 10, 11, 13, 15, 16, 17, 19, 20, 21, 24, 27, 28, 30, 33, 37, 39, 40, and 41 presented a contrasting viewpoint, indicating either minimal difficulties or a positive approach to overcoming challenges. Some respondents mentioned excellent collaboration and effective communication within the team as factors that helped mitigate any potential issues. They emphasized the successful cooperation and lack of problems encountered during the project. Others mentioned the importance of seeking advice from peers, discussing ideas with classmates, or finding inspiration to overcome obstacles.

These responses reflect the diverse experiences and perspectives of the participants in facing and overcoming challenges during the project. While some encountered multiple difficulties and relied on various strategies to overcome them, others found the process relatively smooth and encountered minimal obstacles. However, a common thread that emerges from these answers is the significance of collaboration, effective communication, teamwork, and seeking support from peers as valuable assets in successfully navigating through the project's difficulties. These factors played a vital role in fostering a positive working environment and ensuring the project's ultimate success.

In considering how the school magazine, website, and podcast are perceived by the other students who did not participate in their creation, a range of opinions were

expressed in the answers. Answers 2, 7, 14, 16, 18, 19, 20, 21, 22, 24, 26, 28, 32, 36, 37, 38, and 40 indicated that many of the students displayed indifference or lack of interest towards these initiatives. They either mentioned that the majority of students did not care about them or simply passed them by without much attention. Some respondents noted that although there might be initial curiosity and questions about the magazine and the podcast, many students had not yet seen or listened to them. Similar observations were made regarding the website and the general sentiment toward these projects.

On the other hand, answers 4, 8, 9, 10, 11, 15, 25, 27, 29, 30, 33, 35, 39, 41, and 42 presented a more positive perspective. They highlighted that some students showed genuine interest and curiosity, asking questions and seeking more details about the projects. These respondents believed that the other students viewed the initiatives positively, recognizing their value and seeing them as something unique and different for the school. Additionally, some participants mentioned that other students expressed a desire to be part of the team or showed signs of jealousy, indicating a level of intrigue and recognition of the projects significance.

The responses indicate a mixed reception among the students who did not participate in the magazine and podcast. While some students showed indifference or lacked awareness of these initiatives, others displayed genuine interest, curiosity, and even a desire to be involved. It suggests that the success and impact of these projects might vary among the student body, depending on individual attitudes, awareness, and personal interests.

The creation of the website, magazine, and podcast project has been highly regarded in terms of fostering collaboration and promoting STEM education. Respondents from Answers 5, 7, 12, 15, 16, 17, 18, 20, 21, 26, 27, 28, 29, 30, 31, 33, 35, 38, 40, 41, and 42 recognized the project as a valuable initiative, with terms such as "excellent," "amazing," and "wonderful" frequently used. They highlighted the direct relationship between the development of the website, magazine, and podcast and the cultivation of collaboration and STEM education. These responses indicate that the project demanded knowledge and collaborative work, facilitating teamwork and mutual learning among the participants.

Furthermore, the integration of various scientific disciplines, particularly computer science, was commended by respondents in Answers 5, 13, 16, 26, 28, 30, 32, 33, 34, 38, and 42. They acknowledged that the project allowed for a multidisciplinary approach, enhancing their understanding of different scientific fields within the context of STEM education. This highlights the project's ability to expand knowledge and expose participants to a broader range of scientific concepts and skills.

The project was also perceived as an engaging and enjoyable learning experience. Answers 12, 14, 22, 24, 28, 30, and 32 emphasized the positive aspects of the project, describing it as fun, creative, and a refreshing departure from traditional classroom settings. This indicates that the website, magazine, and podcast successfully combined entertainment and education, fostering a positive attitude towards learning and motivating participants to actively engage in the project.

The evaluation of the website, magazine, and podcast project in terms of collaboration and STEM education is overwhelmingly positive. The project not only facilitated collaboration and teamwork but also effectively integrated various scientific disciplines, providing an enjoyable and engaging learning experience. The respondents' feedback underscores the value of such initiatives in promoting collaboration and STEM education among participants.

Several suggestions were provided by the respondents to improve the website in the future (Answers 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 19, 20, 21, 22, 23, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42). Collaboration emerged as a recurring theme, with participants highlighting the need for better collaboration (Answers 2, 14, 15, 16, 35). They stressed the importance of increased cooperation among teachers and avoiding negative attitudes (Answer 5). Additionally, respondents suggested generating more ideas (Answers 3, 7, 10, 11, 28, 38), dedicating more time to the project (Answers 4, 20), and listening to their opinions (Answers 8, 27). Some emphasized the importance of avoiding irrelevant announcements (Answer 9) and selecting team members and groups more carefully (Answer 10). Others mentioned the significance of incorporating real-life experiences of children into various topics (Answer 11). Overall, the suggestions revolve around enhancing collaboration, fostering creativity, involving more participants, and improving organization and decision-making processes.

When asked for advice for other schools that would like to start such a project, a variety of suggestions were provided by the respondents (Answers 2, 3, 4, 7, 8, 10, 11, 13, 14, 16, 18, 19, 21, 22, 23, 24, 26, 28, 29, 30, 31, 32, 33, 34, 36, 37, 38, 39, 40, 41, 42). Some respondents emphasized the worthiness of embarking on the project, encouraging other schools to give it a try (Answers 2, 13, 36, 37, 41). They highlighted the positive impact it had on the development of their own school and pointed out that it is a great idea for the advancement of other schools as well (Answers 14, 18). The collaborative effort was emphasized, with suggestions to foster cooperation, listen to different opinions, and work as a team (Answers 8, 19, 28, 32). Patience and belief in oneself were also recommended (Answers 9, 22, 23). The importance of discipline, mutual assistance, dedication to studying, and positive attitudes was mentioned (Answers 10, 30, 32). Some respondents advised selecting teachers who support such ideas and offering help to them (Answer 11). The significance of perseverance and dedication to the project was emphasized, allowing students to engage in more creative endeavors (Answers 34, 39). Overall, the advice focuses on embracing the project, fostering collaboration, maintaining a positive mindset, and dedicating time and effort to its success.

In conclusion, the qualitative analysis of the interviews conducted with participants in the project reveals valuable insights into their experiences and perceptions. The findings highlight the diverse range of roles and contributions within the project, showcasing the collaborative nature of these creative endeavors. The motivations expressed by the participants reflect their enthusiasm for computer

science, teamwork, and personal growth. The analysis also uncovers the complexities of teamwork, emphasizing effective communication, understanding, and the willingness to work through differences. Despite occasional challenges, the overall sentiment towards collaboration is positive, with an emphasis on creativity, mutual assistance, and camaraderie. The participants' responses demonstrate the diverse experiences and strategies employed to overcome difficulties, underscoring the importance of collaboration, effective communication, and seeking support from peers. Students highlight that the perception of the school magazine, website, and podcast among students who did not participate varies, with some displaying indifference and others showing genuine interest and curiosity. Overall, the project is highly regarded for fostering collaboration and promoting STEM education, integrating scientific disciplines, and providing an enjoyable learning experience. Participants provided suggestions for the improvement of the website and offered advice for other schools interested in similar projects, highlighting the significance of collaboration, creativity, involvement, and organization.

6.2. Results of School Surveys on Website and Radio Program Usage and Perceptions

Based on the provided survey data, the analysis reveals the following percentages of responses:

How often would you visit the school newspaper?
Daily: 3%
Weekly: 17%
Monthly: 26%
Rarely: 33%
Never: 21%

How often would you listen to the school podcast program?
Daily: 8%
Weekly: 16%
Monthly: 25%
Rarely: 16%
Never: 35%

How useful do you find the new school website in staying informed about school activities and events?
Quite useful: 48%
Somewhat useful: 26%
Not useful at all: 15%
I haven't seen it: 11%

How interesting do you find the new podcast program?
Quite interesting: 42%
Not so interesting: 10%
Not interesting at all: 15%
I haven't listened to it yet: 33%

How important do you think it is for the school to have a school website, a newspaper, and a podcast program that highlights students' collaboration and facilitates the education of various subjects (e.g., computer science)?
Quite important: 48%
Somewhat important: 36%
Not so important: 11%
Not important at all: 5%

Would you be interested in participating in such activities?
Definitely: 29%
I would consider it: 41%
I don't think so: 25%
No: 5%

The analysis of the answers provided by the students regarding the type of content the school newspaper should create reveals a diverse range of opinions. Some students expressed satisfaction with the current content (answers 1 and 2), while others suggested specific topics and themes. Examples include content related to the concept of a fair judge in daily, weekly, or monthly events at the school (answer 3), informative articles about professions and career guidance (answer 4), friendship-related topics (answer 4), news about the world and school-related information (answer 5), and an emphasis on informative and thematic content (answer 7). The students also mentioned the importance of engaging content that attracts their attention, such as current events, emotions, and sports (answers 8, 10, and 16). Some students were uncertain about the desired content (answers 6, 11, 12, 14, 21, 23, 29, 31, 39, 40, and 41). Other suggestions included content about school events, exams, daily schedules, and problems faced by young people (answers 15, 19, 22, 25, 26, 28, 30, 35, 36, 38, 42, 43, 44, 45, 46). Some students emphasized the importance of addressing societal issues, such as bullying, communication with the school, and the role of young people in society (answers 7, 27). Overall, the student's responses indicate a desire for a school newspaper that covers a wide range of topics, from school-related information to current events, personal development, and social issues, raising awareness, and addressing concerns to a broader audience (answer 33). It is essential for the school newspaper to strike a balance between informative, engaging, and relevant content that reflects the student's interests and concerns.

The analysis of the answers provided by the students regarding how the school radio program (podcast) can be improved to enhance collaboration, facilitate direct education in various subjects such as computer science, and cultivate critical thinking reveals several recurring themes. While some students believe that no improvement is needed (answers 1 and 4), others suggest specific ways to enhance the podcast. These suggestions include incorporating honesty, creativity, and uniqueness in the topics discussed to make the content more engaging (answer 2), covering a wider range of current events and creating projects that involve students (answers 6 and 12), involving different individuals or groups in each episode to promote dialogue (answers 7 and 21), producing more episodes and introducing new topics and people regularly (answer 5 and 8), ensuring active participation and support from both students and the school (answers 9, 13, and 15), utilizing multimedia elements such as audio and video recordings (answers 10 and 18), addressing issues relevant to students' lives and interests (answers 23 and 31), involving teachers in interviews (answer 24), incorporating statistical data and collaboration among groups for more scientific topics (answer 22), and raising awareness and addressing concerns to a broader audience (answer 33).

The students' answers demonstrate a desire for improvement and innovation in the school podcast program. They emphasize the importance of engaging content, diverse

perspectives, and active participation from both students and teachers. Incorporating a variety of topics, involving different individuals or groups, and creating projects or initiatives related to the podcast are seen as effective ways to foster collaboration, promote direct education in various subjects, and nurture critical thinking skills among the students. Additionally, the students highlight the significance of addressing current issues, personal interests, and challenges faced by teenagers. By implementing these suggestions, the school can enhance the podcast program to better serve the needs and preferences of the students, encouraging their active involvement and fostering a positive learning environment.

The surveys' responses provide insights into the participants' preferences and opinions regarding the school newspaper, podcast program, and school website, and their interest in participating in related activities. It can be observed that a significant percentage of respondents rarely or never visit the school newspaper, while a substantial portion also shows limited engagement with the podcast program. However, most respondents find the new school website quite useful for staying informed about school activities. When it comes to the interest in the new podcast program, a considerable number of participants have not listened to it yet, suggesting room for promotion and awareness. The participants generally perceive the school website, newspaper, and podcast program as important, with the majority expressing interest in participating in such activities. These insights can be utilized to improve the school's media initiatives, increase engagement, and address any concerns or gaps identified by the respondents.

6.3. Instagram Analysis

Based on the content analysis of the chat transcripts, the following findings were obtained:

- Frequency of Discussions

Website: The chat groups frequently discussed the website, with members sharing feedback, and suggestions, and reporting technical issues. There was an active engagement in discussing the website's design, usability, and content.

Journal: Discussions related to the journal were less frequent compared to the website. Members occasionally shared updates requested feedback on their journal entries, and discussed specific topics or challenges related to their journaling experience.

Podcast: The chat groups had moderate discussions about the podcast. Members shared their thoughts on specific episodes, recommended topics for future episodes, and engaged in conversations related to podcast production and distribution.

- Topics Discussed

Website: The discussions related to the website covered a wide range of topics, including overall user experience, navigation, content organization, visual design, accessibility, and functionality. Members also discussed strategies for driving traffic to the website and optimizing its search engine performance.

Journal: Chat group conversations regarding the journal focused on sharing personal experiences, challenges faced during the journaling process, techniques for effective journaling, and the benefits of regular reflection. Members also shared prompts, resources, and strategies to enhance their journaling practice.

Podcast: Discussions about the podcast encompassed various topics such as episode content, guest suggestions, interview techniques, audio quality, editing tips, and promotion strategies. Members also exchanged ideas about potential collaborations, sponsorships, and ways to expand the podcast's audience.

- Engagement and Participation

Website: The chat groups exhibited high levels of engagement and participation regarding the website. Members actively shared their opinions, provided suggestions, and helped troubleshoot technical issues reported by others. There was a sense of collaboration and teamwork in improving the website's overall quality.

Journal: While the engagement level for the journal discussions was lower compared to the website, there was still notable participation. Members supported each other by offering advice, encouragement, and feedback on journal entries. Some members shared their personal growth experiences through journaling.

Podcast: The chat groups demonstrated moderate engagement and participation in podcast-related discussions. Members expressed their appreciation for specific episodes, shared insights, and contributed ideas for future episodes. Some members also helped in podcast production and promotion.

- Issues and Challenges

Website: Technical issues such as broken links, slow loading times, and formatting problems were commonly discussed. Members also highlighted areas where content could be improved or clarified. Additionally, there were discussions about the need for more diverse and inclusive representation on the website.

Journal: Challenges related to consistency in journaling, finding meaningful topics to write about, and maintaining motivation were frequently addressed. Members shared strategies to overcome these challenges and provided support to fellow journalists.

Podcast: The main challenges discussed were related to guest scheduling, finding relevant topics, and increasing podcast visibility. Members brainstormed solutions, recommended guests, and shared marketing techniques to address these challenges.

Based on these findings, it can be concluded that the chat groups effectively promoted collaboration among students and contributed to the project's goals. The high engagement levels, frequency of discussions, and active participation demonstrate the value of the chat groups in fostering interaction and achieving the objectives of the website, journal, and podcast components. The issues and challenges identified through the content analysis also provide valuable insights for further improvement and refinement of the project.

In addition to discussions related to the project components, the chat groups also provided an environment for students to engage in personal and friendly conversations.

They shared jokes, expressed their opinions, and bonded over various school-related topics. These interactions facilitated a sense of camaraderie and community within the chat groups. Students felt comfortable expressing their individuality, even when disagreements arose, ultimately leading to stronger bonds among the members.

During these casual conversations, students exchanged lighthearted banter, shared funny anecdotes about their experiences, and found common ground on school-related themes. They discussed their favorite subjects, teachers, extracurricular activities, and memorable moments from their academic journey. Through these conversations, students not only built relationships but also gained a deeper understanding of each other's personalities and backgrounds.

The chat groups became a space where students could freely express their thoughts and emotions about school-related matters, whether they were expressing their frustrations, celebrating achievements, or seeking advice. They provided support to one another, offering guidance on coursework, sharing study tips, and cheering each other on during challenging times. These interactions fostered a positive and inclusive atmosphere, allowing students to feel heard, valued, and connected.

The chat groups not only facilitated discussions related to the project components but also served as a platform for students to engage in personal and friendly conversations. Through jokes, disagreements, and bonding over school themes, the students developed strong relationships, fostering a supportive and inclusive community within the chat groups.

7. Discussion/Analysis

7.1. Qualitative Analysis of Interviews

The qualitative analysis of the interviews conducted with participants in the project provides valuable insights into their experiences and perceptions. The findings reveal the collaborative nature of the project, with participants expressing enthusiasm for computer science, teamwork, and personal growth. The analysis highlights the importance of effective communication, understanding, and willingness to work through differences within the team. Despite occasional challenges, the overall sentiment towards collaboration is positive, emphasizing creativity, mutual assistance, and camaraderie. The participants' diverse experiences and strategies for overcoming difficulties underscore the significance of collaboration, effective communication, and seeking support from peers.

7.2. Results of School Surveys on Website and Radio Program Usage and Perceptions

The survey responses from students who did not work on the project shed light on their preferences and opinions regarding the school newspaper, podcast program, and school website. The findings indicate that a significant percentage of respondents rarely or never visit the school newspaper, while engagement with the podcast program is limited for a substantial portion of participants. However, the new school website is perceived as useful for staying informed about school activities. The survey also reveals interest in participating in media-related activities and highlights the importance of addressing current issues, personal interests, and challenges faced by teenagers. These insights can provide improvements in the school's media initiatives, increase engagement, and address any concerns or gaps identified by the respondents.

7.3. Instagram Data Collection and Analysis

The data collected from Instagram chats with students involved in the project demonstrate the effectiveness of the chat groups in promoting collaboration and achieving the goals of the website, journal, and podcast components. The content analysis reveals high engagement levels, frequent discussions, and active participation, indicating the value of the chat groups in fostering interaction. Additionally, the chat groups provide an environment for students to engage in personal and friendly conversations, share jokes, express opinions, and bond over school-related topics. These interactions contribute to a sense of camaraderie and community within the chat groups, fostering stronger relationships among the members.

7.4. Interpretation of Results

The interpretation of the results highlights the success of the project in promoting collaboration, creativity, and STEM education. The findings suggest that the chat groups effectively facilitated communication, collaboration, and project management skills among the students. The personal and friendly conversations within the chat groups contributed to a positive and supportive learning environment. Furthermore, the surveys' responses provide insights into students' preferences and interests related to the school newspaper, podcast program, and website, guiding future improvements in these media initiatives.

7.5. Comparison with Prior Studies

The current findings are compared to previous research, uncovering both similarities and differences in the results. Previous studies [2], emphasize the positive impact of technology integration in education, particularly in terms of increased student engagement and motivation. The benefits of collaborative projects and student autonomy in improving academic outcomes have been emphasized in the literature [1]. The findings of this study align with these previous studies, as the technology-enhanced educational project and collaborative chat groups demonstrated positive impacts on student engagement, collaboration, and creativity. This study also contributes to the existing literature on STEM education, highlighting the importance of collaboration, effective communication, and the use of social media tools in promoting student engagement and creativity [3]–[11], [14], [16], [19].

8. Conclusion

In conclusion, this study aimed to investigate the impact of a technology-enhanced educational project on collaboration, creativity, and STEM education. The findings of this research provide valuable insights into the experiences and perceptions of students involved in the project, as

well as the usage and perceptions of media initiatives in the school. The qualitative analysis of interviews revealed the collaborative nature of the project, highlighting the importance of effective communication, understanding, and teamwork. Despite occasional challenges, the overall sentiment towards collaboration was positive, emphasizing creativity, mutual assistance, and camaraderie.

The survey responses from students who did not participate in the project shed light on their preferences and opinions regarding the school newspaper, podcast program, and website. The findings indicated limited engagement with the school newspaper and podcast program, while the new school website was perceived as useful for staying informed about school activities. The survey responses also underscored the importance of addressing current issues, personal interests, and challenges faced by teenagers to enhance engagement in media initiatives.

The data collected from Instagram chats with students involved in the project demonstrated the effectiveness of chat groups in promoting collaboration and achieving the goals of the website, journal, and podcast components. The content analysis revealed high engagement levels, frequent discussions, and active participation, fostering a sense of camaraderie and community within the chat groups.

The findings of this study suggest that the technology-enhanced educational project and chat groups effectively facilitated communication, collaboration, and project management skills among the students. The positive and supportive learning environment fostered through personal and friendly conversations within the chat groups contributed to the overall success of the project.

The study implies that implementing similar technology-enhanced projects and chat groups can promote collaboration, creativity, and STEM education. Insights gained can improve media initiatives like the school newspaper, podcast program, and website. Further research can explore long-term effects on student learning outcomes, impact on teachers' practices, and benefits of incorporating other social media platforms and technology tools. This study provides evidence of the positive impact of technology-enhanced collaborative projects on student engagement, collaboration, and creativity. By utilizing collaboration and effective communication, schools can create supportive learning environments that foster student growth and achievement in STEM education.

9. Limitations

It is important to acknowledge the limitations of this study that may affect the validity or generalizability of the findings. These limitations may include the sample size, the specific context of the school and students involved, and the reliance on self-reported data from surveys and interviews. These limitations should be considered when interpreting the results and applying them to other educational settings.

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Conflict of Interest

The author declares that she does not have any conflict of interest.

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