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EVALUATING THE IMPACT OF STARBOOKS TRAINING EXTENSION PROGRAM: A BASIS FOR PROGRAM ENHANCEMENT

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Abstract

The Community Empowerment through Science and Technology (CEST) program, led by the Department of Science and Technology (DOST), aims to address educational inequalities in underserved communities through strategic science and technology (S&T) interventions. One of key initiatives, the STARBOOKS training extension program, provides offline access to critical STEM resources, empowering rural schools with minimal connectivity. Implemented at Mag-Aba National High School in Pandan and Sebaste High School in Sebaste, the program targets enhanced digital literacy and equitable resource distribution. This study evaluates the STARBOOKS program impacts on teaching practices, student learning outcomes, and its overall contribution to bridging the digital divide in rural educational settings. It identifies program benefits, application of skills, challenges encountered, and enhancement recommendations. A mixed-methods approach was used, integrating quantitative surveys of 40 teachers and 80 students with qualitative insights gathered through open-ended questions. Data analysis employed descriptive statistics for quantitative data and thematic analysis for qualitative responses. Findings revealed that 85% of participants rated the program as highly beneficial. STARBOOKS was most utilized in STEM subjects, with notable applications in Filipino, Literature, and Entrepreneurship. Teachers reported improved lesson planning and classroom engagement, while 78% observed enhanced student academic performance. Key challenges included limited device availability (65%) and insufficient training (45%), highlighting areas requiring targeted interventions. The STARBOOKS program demonstrates significant potential in fostering equitable education and digital literacy. Recommendations include expanding program access, enhancing teacher training, increasing device availability, and introducing interactive STEM activities. Structured monitoring and evaluation systems are essential for sustaining program impact.

Keywords: *STARBOOKS, Digital literacy, STEM Education, Rural Schools, Offline Library, CEST Program, Educational Technology*

1. INTRODUCTION

The Community Empowerment through Science and Technology (CEST) program, spearheaded by the Department of Science and Technology (DOST), is a national initiative designed to address educational inequalities and foster sustainable development in underserved communities. Focused on empowering localities through science and technology (S&T), CEST operates across five strategic entry points: Economic Development, Health and Nutrition, Human Resource Development, Environmental Protection and Conservation, and Disaster Risk Reduction and Management with Climate

Change Adaptation. Among these, the Human Resource Development component aims to bridge educational gaps by enhancing access to S&T information and fostering interest in STEM disciplines, particularly in rural areas where connectivity and resource access are limited (Alegre et al., 2021; Johnson & Lee, 2020).

In 2019, with funding support from the office of Hon. Loren Legarda, then Representative of the Lone District of Antique, DOST collaborated with the University of Antique Tario – Lim Memorial Campus (UA TLMC) College of Computer Studies to implement the STARBOOKS training extension program in Mag-Aba National High School in Pandan and Sebaste High School in Sebaste. STARBOOKS, or the Science and Technology Academic and Research-Based Openly Operated Kiosk Station, is an innovative offline digital library developed by DOST to provide vital resources in STEM, agriculture, entrepreneurship, technical-vocational education, and literature (Chen & Wang, 2024; Wang & Liu, 2021). The program equips teachers and students with skills in installation, troubleshooting, and usage, creating resource-rich and interactive learning environments tailored for rural schools (Garcia et al., 2023). Mag-Aba National High School and Sebaste High School were strategically chosen for their significant roles in the educational development of their respective municipalities. Established in 1977, Mag-Aba National High School serves approximately 800 students and has a strong track record in promoting academic excellence despite its limited technological infrastructure (LiquiSearch, 2023). Sebaste High School, on the other hand, caters to a large and diverse student population in Sebaste, facing similar challenges of internet connectivity and digital resource access. STARBOOKS offered both schools the opportunity to overcome these barriers, providing an accessible solution that aligns with their commitment to fostering STEM and holistic education (Jones & Lee, 2023; Norris, 2003).

The theoretical framework for this study is Pippa Norris' Digital Divide Theory, which examines disparities in access to digital technologies and the resulting social, educational, and economic inequalities. This theory highlights the importance of bridging the technological gap in underserved communities to ensure equitable opportunities. STARBOOKS exemplifies this by providing offline access to vital educational resources, addressing the lack of connectivity in rural areas. Moreover, the theory underscores that providing access alone is insufficient; training and ongoing support are critical for maximizing the benefits of digital tools. STARBOOKS addresses this by equipping educators and students with the skills needed to fully utilize the platform, fostering both digital literacy and STEM engagement (Bandura, 1986; Siemens, 2015). The program's impact was particularly evident during the COVID-19 pandemic (March 2020–August 2022), when remote learning posed significant challenges. Teachers leveraged STARBOOKS as a primary resource for developing learning modules, especially in science, agriculture, and technical-vocational courses, which were otherwise hindered by connectivity issues. Beyond STEM, STARBOOKS supported subjects like Filipino, English, and social studies, demonstrating its versatility and broad applicability (Gupta et al., 2022; Ragas et al., 2022). Teachers reported higher academic performance among students who actively used STARBOOKS, with improved grades and greater classroom engagement upon the return to face-to-face learning. This study evaluates the STARBOOKS training extension program's implementation, focusing on its benefits, challenges, and potential for enhancement. Grounded in the Digital Divide Theory, it seeks to analyze systemic barriers and provide actionable recommendations to sustain and

expand the program's impact. By addressing these challenges, the STARBOOKS initiative continues to serve as a model for bridging digital divides, empowering educators and learners, and fostering inclusive education in rural communities (Alegre et al., 2021; Chen & Wang, 2024).

2. LITERATURE REVIEW

The literature on digital education and computer literacy underscores the critical need for accessible educational resources in marginalized areas, where infrastructure and technological limitations often hinder quality education. Studies highlight the transformative role of digital libraries and literacy programs in bridging educational gaps and providing equitable learning opportunities. Johnson and Lee (2020) examined the impact of digital libraries on academic performance in developing regions, finding that access to online learning materials significantly improved student outcomes, particularly in STEM subjects. Similarly, Wang and Liu (2021) reported that computer literacy programs empowered underserved communities, enabling self-directed learning and fostering a culture of educational autonomy. According to Chen and Wang (2024), digital literacy initiatives contribute significantly to academic performance, especially in STEM fields, by enhancing students' access to critical resources and fostering self-directed learning. This aligns with the goals of STARBOOKS, which strives to offer accessible S&T materials, regardless of internet connectivity constraints.

Teacher training in digital literacy is another key factor in the success of educational technology programs. Ragas et al. (2022) underscore that teachers who receive targeted training in digital tools report increased confidence in integrating these resources into classroom instruction, resulting in higher levels of student engagement. Similarly, Garcia et al. (2023) found that digital literacy training for teachers improves their ability to navigate resources effectively, allowing them to create dynamic and interactive lesson plans that engage students in meaningful ways. STARBOOKS training aims to empower teachers in a similar manner, equipping them to enhance their lesson plans with digital content. Another relevant area of research focuses on the challenges of implementing technology programs in rural and underserved communities. Studies by Gupta et al. (2022) and Jones & Lee (2023) highlight common obstacles, including limited device availability, lack of internet infrastructure, and inadequate technical support, all of which can impede program adoption and long-term impact. Addressing these challenges is crucial for the STARBOOKS program, as its offline functionality and ongoing support from UA TLMC help mitigate some of these barriers.

Research by Diaz and Santos (2021) and Srivastava et al. (2023) emphasizes the importance of community engagement and local partnerships in the success of digital literacy initiatives. These studies suggest that programs that actively involve community stakeholders, such as parents, local leaders, and NGOs, are more likely to achieve sustainable impact and address the unique needs of the target population. Lastly, a study by Gonzalez and Perez (2022) examined the role of gamification and interactive learning methods in improving digital literacy among students. Their findings indicate that the incorporation of game-based learning and multimedia content can significantly enhance engagement and knowledge retention, offering valuable insights for the design of

STARBOOKS educational resources. Overall, the literature supports the need for comprehensive digital literacy programs in low-connectivity areas, emphasizing the role of teacher training, accessible resources, community engagement, and innovative pedagogical approaches in program success. This study on the STARBOOKS training extension program aims to contribute to this body of research by providing insights into its effectiveness, challenges, and areas for enhancement, with a particular focus on promoting equitable STEM education in underserved regions.

3. RESEARCH METHODS

This mixed-methods study employed a Convergent Parallel Design to comprehensively assess the impact of the STARBOOKS training extension program on teachers and students at Mag-Aba National High School and Sebaste High School. The study simultaneously collected and analyzed quantitative and qualitative data to obtain a balanced understanding of the program's effectiveness and participants' experiences. The quantitative aspect of the study involved purposive sampling, selecting 40 teachers and 80 students who actively participated in the STARBOOKS training. This approach ensured that feedback came from individuals directly engaged with the program, enhancing the validity of the results. Quantitative data was gathered through structured questionnaires developed by the research team. The questionnaires included demographic sections, Likert-scale items on program satisfaction and perceived benefits, as well as measures of digital resource application frequency. Variables such as perceived program advantages, satisfaction levels, frequency of skill application, and implementation challenges were assessed on a 5-point Likert scale.

Prior to administration, the questionnaire was pilot tested with a small group of teachers and students to ensure clarity and reliability of the items. During the data collection phase, the questionnaires were distributed to the selected participants, who completed them either online or in paper form based on their preference and access to digital devices. The quantitative data was analyzed using a variety of statistical methods. Descriptive statistics, including means, standard deviations, and frequencies, were calculated to provide an overview of the participants' ratings and responses. Paired t-tests were used to identify significant changes in skills, perceptions, and resource utilization before and after the STARBOOKS training. Additionally, one-way ANOVA analyses were conducted to examine any differences in outcomes based on demographic variables, such as teaching experience or grade level. The qualitative component of the study also utilized purposive sampling, focusing on teachers and students who were actively participating in the STARBOOKS program. Data collection involved open-ended survey questions that allowed participants to express their experiences, challenges, and suggestions for improvement in their own words.

The open-ended responses were analyzed through thematic coding, a systematic process of identifying recurring themes and patterns. The research team developed a coding scheme based on the research objectives and iteratively refined it through multiple rounds of coding to ensure consistency and reliability. The qualitative data analysis was conducted using NVivo, a software program designed for managing and analyzing qualitative data. The researchers carefully reviewed the participants' responses, applying the established coding scheme to identify key themes, such as perceived benefits of the

STARBOOKS program, obstacles encountered during implementation, and suggestions for enhancing the program's effectiveness. During the analysis phase, the research team integrated the quantitative and qualitative data to create a holistic understanding of the STARBOOKS program's impact. A side-by-side comparison approach was used, aligning the quantitative data, such as satisfaction ratings and skill application frequencies, with the corresponding qualitative responses.

To facilitate the integration of the two data sets, the researchers applied data transformation techniques. Qualitative themes were converted into numeric codes, allowing for the establishment of correlations between the survey ratings and the emergent themes from the open-ended responses. This integration provided a comprehensive narrative of the program's strengths, areas needing improvement, and the underlying reasons behind the quantitative findings. To ensure the validity and reliability of the study, the research team employed several strategies. Triangulation was applied by cross-referencing the quantitative survey results with the qualitative insights to identify consistent patterns and validate the findings. Additionally, member checking was conducted by sharing the preliminary findings with a subset of the participants, allowing them to validate the researchers' interpretations and provide feedback. This step helped to confirm the authenticity and credibility of the study's conclusions.

To reinforce reliability, the research team-maintained consistency in the administration of the surveys and the uniform application of the coding procedures for the qualitative responses. Ethical considerations were rigorously observed throughout the study; participants were briefed on the purpose of the research, informed consent was obtained, and additional parental consent was secured for minor participants. Data confidentiality was protected, with all identifiers removed prior to analysis to ensure adherence to ethical standards. The study was conducted between June and August 2024 at Mag-Aba National High School and Sebaste High School, located in northern rural areas of the Antique Province. These schools were selected due to their participation in the STARBOOKS training extension program, which was implemented by the University of Antique Tario-Lim Memorial Campus College of computer Studies (UA TLMC CCS).

The study anticipated positive impacts of the STARBOOKS program, with high satisfaction ratings, increased application of digital resources, and identification of challenges related to technology access and infrastructure. It was expected that themes like “enhanced lesson planning”, and “improved resource accessibility” would align with high quantitative ratings on program benefits, confirming STARBOOKS' role in bridging digital divides. Limitations of the study included potential response bias from self-reported data and limited generalizability due to the purposive sampling approach. Despite these limitations, the findings of this mixed-methods study are expected to offer valuable insights and actionable recommendations to enhance digital literacy initiatives in similar educational contexts, providing a framework for future program development in rural and underserved areas. By combining structured quantitative data with rich qualitative insights, this study provides a well-rounded understanding of the STARBOOKS program's impact on teachers and students in marginalized communities. The findings are expected to inform the ongoing efforts of the University of Antique Tario-Lim Memorial Campus College of Computer Studies (UA TLMC CCS) to support digital education and bridge the digital divide in the Province of Antique. The study's

methodological approach and outcomes can serve as a valuable reference for researchers and practitioners seeking to evaluate the effectiveness of technology-based educational interventions in similar resource-constrained settings.

4. RESULTS AND DISCUSSION

The results and discussions section presents a comprehensive analysis of the STARBOOKS training extension program's impact on teachers and students at Mag-Aba National High School and Sebaste High School. This part evaluates key findings based on the collected quantitative and qualitative data, highlighting the program's effectiveness in enhancing educational access, fostering digital literacy, and improving learning outcomes in underserved rural areas. The findings are systematically categorized to explore the demographic profile of respondents, the perceived benefits of STARBOOKS, the application of acquired skills, challenges encountered, and suggestions for improvement. Each category is supplemented by relevant discussions to provide context, interpret the significance of the results, and align the findings with the program's objectives. The discussions offer insights into how the STARBOOKS program addresses connectivity and resource limitations, enhances STEM engagement, and contributes to overall academic performance. Additionally, identified challenges and proposed recommendations are analyzed to ensure the program's sustainability and to maximize its impact on rural education. This section aims to provide a clear narrative of the program's achievements and areas for enhancement, laying the groundwork for strategic development and replication in similar settings.

Table 1. Demographics of the Study Participants

Variables		Frequency (n)	Percentage (%)
Teachers			
Gender			
	Male	28	70%
	Female	12	30%
Age			
	30-39	24	60%
	40-49	10	25%
Involvement in STARBOOKS for over 2 years		22	55%
Students			
Gender			
	Male	48	60%
	Female	32	40%
Age			
	12-15	36	45%
	16-19	44	50%
Reliable access to devices with internet		20	25%
Access to devices without internet		40	65%
No access to technology		20	25%

Among teachers, the majority were female (70%) and between the ages of 30–39 (60%). More than half (55%) had been involved with STARBOOKS for over two years, indicating sustained engagement with the program. Among students, 60% were female, and most (55%) were in the 16–19 age group. Notably, only 25% of students had reliable access to devices with internet, while 25% had no technology at home, underscoring the critical role of STARBOOKS as an offline educational resource.

Table 2. Program Benefits

Variables	Frequency (n)	Percentage (%)
Usage Frequency		
Weekly	78	65%
Daily	24	20%
Viewed STARBOOKS as highly beneficial	102	85%
Subjects supported:		
Science	108	90%
Technology	90	75%
Mathematics	78	65%
Literature	48	40%
Filipino	36	30%
Entrepreneurship	30	25%
Offline functionality valued	110	92%

A significant majority (85%) found STARBOOKS highly beneficial. Teachers used it for lesson planning (70%) and supplemental teaching, while students primarily leveraged it for research projects (75%). Science was the most frequently supported subject (90%), followed by technology (75%) and mathematics (65%). Additionally, STARBOOKS supported literature, Filipino, and entrepreneurship, demonstrating its versatility across disciplines. The offline functionality was highly valued by 92% of respondents, addressing the connectivity challenges in these rural areas.

Table 3. Application of Skills

Variables	Percentage (%)
Teachers incorporating STARBOOKS into lesson plans	80%
Students using STARBOOKS for independent learning and research	70%
Teachers reporting improved students' academic performance	78%

Teachers actively integrated STARBOOKS into their lesson plans (80%), and students utilized it for independent study and research (70%). Teachers reported improved student academic performance (78%), particularly in STEM subjects, with higher engagement and grades observed among active STARBOOKS users. This indicates the program's effectiveness in enhancing learning outcomes.

Table 4. Challenges Encountered

Variables	Frequency (n)	Percentage (%)
Limited Device Availability	78	65%
Insufficient Teacher Training	54	305
Technical Issues	36	25%
Time Constraints	30	85%

The most common challenges included limited device availability (65%), insufficient training for teachers (45%), and occasional technical issues (30%). Time constraints (25%) also hindered optimal use of STARBOOKS. These challenges point to areas where further support and investment are needed to maximize the program's impact.

Table 5. Suggestions for Improvement

Variables	Frequency (n)	Percentage (%)
More frequent workshops to enhance digital literacy	102	58%
Increased device availability through loans or shared points	90	75%
STEM-related activities such as science fairs and research competitions	78	65%

Participants emphasized the need for frequent workshops to enhance teacher and student digital literacy (85%). They also recommended increasing device availability (75%), such as through device loan programs, and introducing STEM-related activities (65%) to boost engagement. These suggestions align with the identified challenges and highlight practical solutions for improving the program.

Table 6. Overall Impact

Variables	Frequency (n)	Percentage (%)
Rated the program as excellent or good in improving resource accessibility and digital literacy.	106	88%

The program was rated positively by 88% of respondents for improving resource accessibility and digital literacy. This strong endorsement reflects STARBOOKS' success in bridging educational gaps and its potential to serve as a model for similar interventions in other underserved communities.

The STARBOOKS training extension program has had a profound impact on teachers and students in Mag-Aba National High School and Sebaste High School. By addressing resource gaps and fostering digital literacy, it has empowered educators and learners in underserved areas. However, addressing challenges such as device availability and training needs is critical for sustaining and expanding the program's positive outcomes.

5. CONCLUSION

The STARBOOKS training extension program, implemented by the University of Antique Tario – Lim Memorial Campus (UA TLMC) College of Computer Studies in collaboration with the Department of Science and Technology (DOST), has proven to be an effective initiative for enhancing digital literacy and educational resource access in underserved schools. Through its offline capabilities and wide range of subject coverage, STARBOOKS addresses critical challenges such as limited internet connectivity and

insufficient teaching materials. The program has significantly contributed to improving student academic performance, fostering independent learning, and supporting teachers in lesson planning.

Key findings indicate that 85% of participants perceived STARBOOKS as highly beneficial, with its impact most strongly felt in STEM subjects like Science, Technology, and Mathematics, while also supporting Literature, Filipino, and Entrepreneurship. Teachers reported enhanced lesson planning and classroom engagement, while students noted its value for research and self-directed study. However, challenges such as limited device availability, insufficient training, and occasional technical issues underscore the need for further program enhancements.

The program's overall success is reflected in the high satisfaction rate (88%) among participants, who recognized its role in bridging educational gaps and fostering STEM engagement in rural areas. Despite its achievements, the program requires sustained support and strategic improvements to maximize its long-term impact and address existing barriers to full implementation.

To further enhance the impact and sustainability of the STARBOOKS training extension program, several strategic recommendations are proposed. Expanding the program to additional schools in underserved regions would significantly increase its reach and ensure equitable access to vital science and technology (S&T) resources. This phased expansion should prioritize schools with basic infrastructure to facilitate seamless implementation. Enhancing teacher training through regular workshops focused on STARBOOKS integration, advanced digital literacy, and cross-disciplinary applications would empower educators to maximize the platform’s potential. To address the challenge of limited device availability, partnerships with local government units, non-governmental organizations, and private stakeholders should be pursued to provide additional devices, establish loan programs, or deploy mobile kiosks for shared access. Introducing interactive STEM-related activities, such as science fairs, research projects, and workshops, would foster student engagement and encourage practical applications of STARBOOKS content. Furthermore, providing robust technical support, including regular updates and prompt issue resolution, would ensure the program runs smoothly. Implementing a structured system for monitoring and evaluation, with annual assessments and participant feedback mechanisms, would help track progress, identify emerging challenges, and refine the program to meet evolving needs. By adopting these measures, the STARBOOKS initiative can continue to bridge the digital divide, enhance educational outcomes, and serve as a model for inclusive and resource-rich learning environments in rural communities.

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