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Effective Technology Integration: Closing the Digital Gap among High School Students

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Abstract. This study investigated the impact of technology integration strategies on digital inclusion among high school students, focusing on reducing disparities in access and digital literacy. Seventy-five out of 1,131 Grade 11 Senior High School students from a private school in Quezon City were surveyed to understand their demographic profiles, barriers to digital access, the effectiveness of digital literacy integration in the curriculum, the support for technology use in classroom activities, and the accessibility and inclusivity of digital resources. The research used a mixed-methods approach to assess digital access disparities and technology integration effectiveness. Quantitative data was used to analyze respondents' demographics and identify technology gaps, while qualitative insights explored contributing factors to digital disparity, ensuring comprehensive evidence and a deeper understanding of the intervention's impact and effectiveness. The findings highlight significant areas of concern, including internet connectivity, financial constraints, and access to digital devices, alongside a need for improved digital literacy, cybersecurity awareness, and teacher training. The results underscore the necessity for comprehensive support mechanisms to promote equitable and inclusive digital learning environments. To address these challenges, the study suggests implementing mechanisms such as financial support for acquiring necessary digital devices, improvements in internet infrastructure, and extensive training programs for teachers to enhance their digital literacy and teaching skills. By doing so, educational institutions can foster a more equitable and inclusive digital learning environment, ensuring that all students, regardless of their socioeconomic status, can access and benefit from technology-enhanced education. This holistic approach aims to bridge the digital divide and promote fairer educational opportunities through strategic technology integration.

Keywords: Technology integration; Digital inclusion; Digital literacy; Digital gap; Disparity reduction.

1.0 Introduction

At the height of the COVID-19 pandemic, distance learning and digital technologies became widely used not only to prevent the spread of the virus but also to ensure the continuity of education. During the lockdown period, health concerns were at the center of school reopening plans, in terms of how schools could open and under which conditions, and how remote learning could be used to complement the reliance on physical schools in times of need (Gouëdard et al., 2020). The COVID-19 crisis forced the digitization of teaching at all levels of education and highlighted the social problem of digital inequality at home (González-Betancor et al., 2021).

In today's educational landscape, digital inclusion is a critical issue due to the increasing reliance on technology for teaching and learning. It requires the minimizing of digital inequalities, thereby widening access, and also enhancing the quality of teaching and learning with the intent to provide education that is fair and equitable (European Commission et al., 2021). To sustain digital inclusion, schools need to identify digital deficiencies and digital achievements (Hatlevik & Christophersen, 2013). In developed countries, the "digital divide" has changed from referring to a lack of access to technological devices to a lack of digital skills in the use of such devices. This

has important consequences when it comes to using and getting the most out of the internet, particularly in areas of education, personal and professional training, and future employment (Garmendia & Karrera, 2019).

The advent and subsequent widespread usage of mobile devices since the dawn of the new millennium have been instrumental in the rapid expansion of the concept of digital technology (Wang et al., 2024). Technology must be interwoven with a holistic approach that considers all relevant aspects, in particular pedagogical practices and training, to prevent it from being misunderstood as a standalone factor. Inequalities in education are entwined with issues of society, economy, culture, politics, and history –on a local, regional, national, and international basis (Selwyn, 2016).

Disparity reduction highlights the goal of the research, which is to reduce or eliminate the digital divide that exists among high school students. Disparity could stem from various factors such as access to devices and the internet, digital literacy skills, and support systems. It aimed to identify challenges and proposed actionable strategies. These initiatives would center on how educational institutions might successfully incorporate technology into their teaching practices to improve learning outcomes and create digital equity among high school students. It sought to find ways that might help bridge and guarantee that all students have equitable access to digital learning materials. Another was to detect the digital literacy and skills gap among students. Some students may be adept at using technology for learning, while others may lack basic digital skills. It aimed to investigate techniques to enhance digital literacy among students and empower them to utilize technology successfully for educational purposes. Further, this study investigated how to enhance inclusive learning settings through digital inclusion.

By addressing disparity, the research hoped to contribute to creating a more equitable and inclusive learning environment. According to Van der Vlies (2020), equipping education with the right digital skills and tools is a prerequisite to keeping up with ever-increasingly demanding digital economies and societies. Access to the internet, digital skills, and devices are necessary for communities to thrive in today's world (Addressing the digital divide | UN-Habitat, n.d.). By now, there is consistent evidence that embedding digital technologies in education tends to have positive effects on students' learning outcomes (Johannes et al., 2017). The shift from the digital divide to digital inclusion resulted in a different focus for the analysis, from access to skills and to outcomes (Mascheroni et al., 2022). To better understand and alleviate digital access inequities among high school students, one has to assess the efficacy of technology integration techniques, including access to devices like computers, laptops, tablets, and internet connectivity. To use digital tools in promoting equitable and inclusive outcomes, education systems must focus on ensuring equity in terms of access to digital resources and promoting digital skills, as well as using digital technologies that are designed with inclusion in mind (Gottschalk F. & Weise C., 2023).

At the heart of reducing the digital divide is the ability of teachers to capitalize on the advantages provided by technology made available to them (Johnston T., n.d.). While some schools and teachers successfully incorporate technology into their instruction, others may have encountered difficulties or lacked the necessary support. In the process of inclusive teaching, understanding diversity and inclusion through multi-dimensional and intersectional lenses can help acknowledge and meet individual student needs while valuing their unique identities (Brussino, 2021). Overall findings of Helsper & Van Deursen (2016) suggest that access to support is another level at which the digital divide manifests and strengthens itself. Equitable and inclusive education systems support students to achieve their full educational potential irrespective of their personal and social circumstances, and help them to develop a sense of belonging and self-worth (Cerna et al., 2021).

The challenge for digital inclusion for Mintz et al. (2024), was to consider how technology could help address barriers to entry, participation, engagement, and recognition of learning for diverse and marginalized groups. Digital inclusion is important because students' lack of positive and equitable digital experiences during their school years may have widened existing educational and digital gaps in the long term (Kim et al., 2021). It could also provide access to disabled learners and learners in rural areas who might otherwise be excluded (UNESCO, 2020). The study investigated techniques for ensuring that digital inclusion activities help to create varied and inclusive educational settings, like what Sevilla (2020) said: making students' experience of home learning more equal; bringing students back into schools at different times; and offering extra resources and additional support to students to help them catch up once they are back at school.

2.0 Methodology

2.1 Research Design

The study utilized the Mixed-Methods Approach with the Quantitative Analysis focusing on demographic information, digital access challenges, digital literacy and skills gaps, resources and support, and the use of technology for inclusive learning environments. The Qualitative Analysis part explored the personal experiences of students, identifying factors contributing to digital disparity. This included open-ended survey responses and follow-up interviews or focus groups to gain deeper insights. The findings were integrated by combining quantitative and qualitative data, aimed at validating, identifying patterns and themes, and providing a comprehensive understanding of the effectiveness of technology integration strategies.

2.2 Research Participants

The study was carried out in an urban high school located in Quezon City, Philippines. The setting provided a comprehensive environment for examining issues related to digital inclusion. The high school is characterized by significant variation in students' access to technology both at school and at home, making it an ideal location to reflect the real-world challenges and opportunities associated with achieving digital literacy and inclusion. A representative sample of 75 students out of 1,131 were the research participants.

2.3 Research Instrument

This study used a modified structured survey questionnaire somewhat comparable to that of OECD (2020), of which the survey items collectively assess the infrastructure, support, and conditions necessary for effective integration of digital resources in schools, aiming to understand the challenges and opportunities in leveraging technology for educational improvement. It has also reference to "The Teaching and Learning International Survey" (TALIS) 2018, OECD (2019), which aims to gather data on the working conditions of teachers and the learning environments within schools to improve the effectiveness of teaching and enhance student outcomes.

The instrument was tailored to collect data on various aspects such as demographic information such as age, gender, and socioeconomic status. It also gathers information on barriers to digital access, perceptions of digital literacy, technology integration, and the promotion of inclusive learning environments. Included are open-ended survey questions to gain deeper insights. The survey was validated for its effectiveness and reliability by experts in educational research. It was designed to provide comprehensive data for both quantitative and qualitative analysis, ensuring a robust examination of digital access disparities and the effectiveness of technology integration strategies.

2.4 Data Gathering Procedure

Convenience sampling was employed to select participants, ensuring a diverse and accessible sample reflective of the broader student population. The students in a room were given the survey instrument and presented to them the purpose of the study and that participating in the activity is voluntary. In the open-ended questions, each participant was interviewed to validate their responses. The data collection tool, a structured survey questionnaire, was used to gather data that experts validated for effectiveness and reliability. Sample Size involved 75 high school students, representing the high school's demographic composition, including variations in age, gender, and family income.

2.5 Ethical Considerations

This research study followed ethical guidelines. All participants and their guardians (for those under 18) were provided with detailed information about the study's purpose, procedures, and potential risks. Consent forms were obtained, ensuring that participation was voluntary and informed. The identities of the participants were kept confidential. Data was anonymized to protect the privacy of the students, and personal information was securely stored, accessible only to the researcher. Participants were informed of their right to withdraw from the study at any point without any negative consequences. This ensured that participation was entirely voluntary and free of coercion. The research proposal was reviewed and approved ensuring that all ethical standards were met and that the study complied with institutional and governmental regulations.

The research aimed to benefit the educational community by identifying effective digital inclusion and literacy strategies. The findings were intended to improve educational practices and policies, ultimately enhancing student outcomes.

3.0 Results and Discussion

3.1 Demographic Profile of Respondents

The gender distribution of respondents is relatively balanced, with a slightly higher number of females (51%) than males (48%). The representation of "other" (1%) gender identity is minimal, indicating a predominantly binary gender distribution in the sample. The vast majority of respondents are between 15 to 19 years old (95%), suggesting that the data primarily reflects the perspectives and experiences of high school students. There is very limited representation from older age groups (5%), and no representation from those under 15. A significant majority of respondents come from families with a monthly income of less than Php20,000.00 (72%), indicating a predominantly lower-income demographic. Only a small fraction of respondents come from families with a higher monthly income (22%), with very few families earning Php40,000.00 or more per month (6%).

3.2 Digital Access Disparity

Table 1. Descriptive statistics of the level of digital access disparity

	Strongly Agree	Agree	Disagree	Strongly disagree	Standard Deviation	Weighted Mean	Rank	VI
1. Access to devices (e.g., computers, tablets, smartphones) is equitable among all students in school.	21	54	0	0	0.45	3.28	1	SA
2. Internet connectivity is consistently available for all students at home.	16	35	21	3	0.79	2.85	3	A
3. The school provides support for students who lack access to digital devices or the internet.	12	48	15	0	0.60	2.96	2	A

The survey indicates that a majority of respondents strongly agree or agree with a weighted mean of 3.28 that access to devices is equitable among students in school, suggesting that within the school environment, there is a high level of device accessibility. While a considerable number of respondents agree (35) that internet connectivity is consistently available at home, a significant number disagrees (21), indicating variability in-home internet access. The majority of respondents agree (48) that the school provides support for students lacking access to digital devices or the internet, though there is a notable minority who disagree (15), suggesting room for improvement in school support mechanisms.

The standard deviation range of 0.45 to 0.79 on digital access disparity indicates moderate variability in responses. This suggests differing perceptions among respondents about the equity of device access in school, with some perceiving significant gaps while others see more uniform access, highlighting an area that may need further investigation and action.

Although the respondents seem to be in better shape in terms of access to devices, internet connectivity, and school support, the most challenging based on the interview are internet connectivity issues. This highlights the critical barrier that unstable or slow internet prevents achieving digital access parity, affecting students' ability to engage in online learning effectively. This concern was raised 44 times with various descriptors such as slow, unreliable, limited, bad, weak, lagging, low signal, and unstable network connection. Financial constraint is next in rank, emphasizing the inability to afford devices or internet services due to financial instability. It significantly impedes students' access to necessary digital resources. This indicates that economic factors are a substantial barrier to achieving equitable digital access. Common issues mentioned are the financial burden of buying digital devices, lack of financial support, financial constraints in buying mobile or internet data, and difficulty in studying or attending online classes due to financial constraints.

Although access to devices in school is perceived positively in the quantitative data, the qualitative responses reveal that there are challenges in accessing and using digital devices outside the school environment. Access to

digital devices is mentioned 12 times, with concerns ranging from limited access to lack of knowledge in using digital devices. Educational challenges related to digital access indicate that the disparity in access not only affects availability but also the quality of educational engagement and support, impacting students' learning experiences. This is raised 7 times addressing issues like difficulty in completing online assignments, lack of technical support, and distractions. Infrastructure limitations though not a predominant issue are also a hindrance, pointing to the need for broader systemic improvements in internet infrastructure to support equitable digital access.

3.3 Digital Literacy and Skills Gap

Table 2. Descriptive statistics of the level of digital literacy and skills gap

	Strongly Agree	Agree	Disagree	Strongly disagree	Standard Deviation	Weighted Mean	Rank	VI
1. Students in my school have adequate training and resources to develop digital literacy skills.	9	54	12	0	0.53	2.96	3	A
2. Digital literacy development is incorporated into the curriculum effectively.	16	53	6	0	0.52	3.13	2	A
3. Students feel confident in using digital tools and resources for their learning.	19	50	6	0	0.55	3.17	1	A

The majority of respondents agree that students receive adequate training and resources for digital literacy, though there are some indications that improvements could be made, as not all respondents strongly agree. Teachers are generally perceived as effective in integrating digital literacy into their curriculum, with a high level of agreement among respondents, though there remains a small group that feels otherwise. Confidence in using digital tools and resources is relatively high among students, suggesting that current efforts to integrate digital literacy are having a positive impact on student confidence in using technology.

The standard deviations of 0.53, 0.52, and 0.55 on digital literacy and skills gap suggest consistent responses among participants, indicating moderate variability. This implies a relatively uniform perception of the digital skills gap, highlighting that while some disparity exists, it is generally viewed similarly across the surveyed group.

To validate the responses of the respondents, they were asked what specific areas of digital literacy or skills they think require more focus or improvement to enhance their ability to use technology effectively for learning purposes. There is a strong emphasis on enhancing digital literacy skills, with specific mentions of practical skills including handling digital devices, developing critical skills, learning Microsoft Office, computer tools, coding, and programming. Another is cybersecurity awareness and measures which is a significant concern among respondents, suggesting that current digital literacy programs should incorporate more comprehensive cybersecurity training. Key points are cybersecurity awareness, technology security, private and secure connections, data privacy, and enhancing digital security.

Critical thinking skills are also a major concern perceived to help respondents distinguish facts from fake news. Developing critical thinking is seen as essential, especially in the context of navigating digital information. This highlights the importance of integrating critical thinking exercises into digital literacy education. Competence in educational technology and resources through online platform tools like Google Meet, Google Classroom, computer-based functions, and enhancing technology-based learning are other areas for improvement. For better integration and usage of educational technology, respondents call for more resources and training on using these tools effectively.

Though mentioned less frequently, internet proficiency is a critical area for improvement. It includes effective navigation and proper internet usage. This suggests the need for training on efficient and safe internet browsing and research skills. Also of equal importance is Social and Online Behavior which includes awareness of cyberbullying, responsible use of technology, and avoiding negative aspects of social media. Responsible online behavior and understanding the impacts of social media are important. Finding materials online, slow learning abilities, and knowledge gaps in digital devices are part of the difficulties encountered. These notable challenges in accessing and using digital tools effectively need tailored support and resources to help bridge these gaps.

Further, programming and coding are highlighted as essential skills. This calls for including courses developing coding and programming skills in the curriculum that will foster problem-solving and logical thinking abilities. Using digital meeting platforms and developing presentation skills are also mentioned as crucial for modern education and professional environments.

3.4 Equitable Integration of Technology

Table 3. Descriptive statistics of the level of equitable integration of technology

	Strongly Agree	Agree	Disagree	Strongly disagree	Standard Deviation	Weighted Mean	Rank	VI
1. Technology is integrated seamlessly into classroom activities to enhance learning outcomes.	18	51	6	0	0.54	3.16	1	A
2. The school provides teachers with sufficient training and support to integrate technology effectively.	14	55	6	0	0.51	3.11	3	A
3. The school provides equal opportunities for all students to access technology-enhanced learning materials.	18	49	8	0	0.57	3.13	2	A

The high weighted mean suggests that most respondents believe technology is effectively integrated into classroom activities, enhancing learning outcomes. This indicates a positive perception of technology's role in education. While there is agreement that teachers receive adequate training and support, the slightly lower weighted mean indicates that there is still room for improvement in this area to ensure teachers feel fully prepared. The responses indicate that most students believe there is equitable access to technology-enhanced learning materials. However, the presence of some disagreement highlights the need to address any gaps in access to technology.

Standard deviations of 0.54, 0.51, and 0.57 respectively on equitable integration of technology indicate moderate variability in responses. This consistency suggests that respondents generally agree on the level of technology integration, though some disparity in perceptions remains. Overall, the views on technology integration equity are relatively aligned across the surveyed group.

The most frequent response for support or resources that promote equitable learning opportunities for students is access to technology tools. That means ensuring access to current technology tools, and internet connectivity and providing robust technical support are critical for the successful integration of technology in education. As perceived by the students, the need for technology training, workshops, and continuous professional development for educators are also major issues in effectively integrating technology into their teaching. It is essential to equip educators with the necessary skills and confidence to use technology effectively in their teaching practices. Providing a variety of educational resources and ongoing support helps teachers integrate technology more seamlessly into their teaching, promoting better learning outcomes.

Financial support or assistance is another need to ensure both educators and students have the resources to access the internet and digital learning tools. It can alleviate barriers to accessing necessary technology, ensuring all students and teachers can participate fully in technology-enhanced education. Internet Accessibility by ensuring reliable internet access for both teachers and students is essential for effective digital learning. Technology in education is also a factor in integrating advanced technologies, such as AI tools, to support teaching and learning, making education more engaging and effective. On the other hand, offering offline access to resources ensures that students and teachers can continue their work without interruption due to connectivity issues, promoting continuous learning.

3.4 Promoting Inclusive Learning Environments

The weighted mean of 3.04 indicates a generally positive response regarding the accessibility of digital resources for students with disabilities. However, with some respondents disagreeing, there is still a significant minority who feel that improvements are needed to fully support students with disabilities. The weighted mean of 3.01 shows that most students feel technology-based learning activities are culturally relevant and inclusive. It suggests

that the school is making efforts to incorporate diverse cultural perspectives and inclusive practices in its digital learning activities.

Table 4. Descriptive statistics of the level of promoting inclusive learning environments

	Strongly Agree	Agree	Disagree	Strongly disagree	Standard Deviation	Weighted Mean	Rank	VI
1. Digital resources and materials used in my school are accessible to students with disabilities.	15	48	12	0	0.60	3.04	1.5	A
2. Technology-based learning activities in my school are culturally relevant and inclusive.	11	56	6	2	0.58	3.01	2	A
3. Students receive personalized learning experiences through technology.	13	53	8	1	0.58	3.04	1.5	A

The presence of some disagreement indicates there are areas where the inclusivity and cultural relevance of the curriculum could be further improved. A weighted mean of 3.04 indicates that many students feel they receive personalized learning experiences through technology. It shows a strong positive perception of personalized learning. However, with a minority of respondents disagreeing it also suggests that not all students feel their individual learning needs are being met through current technological practices.

Standard deviations of 0.60, 0.58, and 0.58 on promoting inclusive learning environments suggest moderate variability in responses. This indicates a consistent but somewhat diverse range of perceptions among respondents, reflecting a general agreement with some differences in opinions on how inclusively learning environments are being promoted.

Overall, the survey results show a generally positive perception of the accessibility and inclusivity of digital resources. This suggests that the school's efforts in these areas are being recognized by the majority of students. The presence of disagreement across all three areas on the other hand highlights the need for continuous improvement. Ensuring that digital resources are fully accessible to all students, particularly those with disabilities, remains a priority.

The use of technology for multiple languages, grammar correction, translating tools, teaching cultural values, and promoting cultural learning are considered the most relevant. Technology can bridge cultural gaps by offering tools for language translation and cultural education. Integrating these tools can help students from diverse backgrounds feel more included and respected. Also, online platforms like Google Meet, Google Docs, Google Classroom, and discussion forums are crucial for fostering collaboration and inclusivity. These tools help create a participatory learning environment where all students can engage regardless of physical presence.

Ensuring everyone has access to technology, equal access across genders, and inclusive platforms are key points by respondents for equity in school. Schools need to ensure that all students, regardless of gender or other factors, have the same opportunities to benefit from digital resources. The use and improvement of technology for online learning especially for students with disabilities were mentioned in particular. There is a need for continuous improvement in technology to better support them and overall enhance their learning experiences. Practical applications of technology in education can significantly enhance learning experiences, making it more interactive and accessible.

Guidance and rules for technology use especially in spreading misinformation were stressed by respondents. Clear guidelines and policies are necessary to ensure technology is effectively and responsibly used, minimizing the risk of misinformation and misuse. Using AI for learning, promoting innovation through technology, offering new opportunities for personalized and effective learning experiences, and fostering creativity and critical thinking among students are but some ways to foster an inclusive learning environment. Also posting culturally relevant content, and promoting cultural knowledge can enhance students' understanding and appreciation of different cultures, nurturing a more equitable place to learn and engaging educational experience for all students.

3.5 Composite Scores for Independent and Dependent Variables

Composite Scores for the Independent Variable (IV), "Technology Integration Strategies" are average scores (weighted mean) across items related to access to devices, internet connectivity, support for digital access, and training resources. At the same time, the Dependent Variable (DV), "Digital Inclusion and Literacy Levels" are average scores (weighted mean) across items related to digital literacy, confidence in using digital tools, and equitable access to digital resources. The standard deviation (SD) of both IV and DV are related to the items where they are identified.

Table 5. Independent variables "Technology integration strategies"

Independent Variables	Mean	SD
1. Access to Devices	3.28	0.45
2. Internet Connectivity	2.85	0.79
3. School Support for Digital Access	2.96	0.60
4. Adequate Training and Resources for Digital Literacy	2.96	0.53
5. Effective Integration of Digital Literacy in Curriculum	3.13	0.52
6. Confidence in Using Digital Tools	3.17	0.55
7. Seamless Integration of Technology in Classroom Activities	3.16	0.54
8. Sufficient Training for Teachers	3.11	0.51
9. Equal Opportunities to Access Technology-enhanced Learning Materials	3.13	0.57

Table 6. Dependent variables "Digital inclusion and literacy levels"

Dependent Variables	Mean	SD
1. Equity in Device Access	3.28	0.45
2. Home Internet Connectivity	2.85	0.79
3. Accessibility of Digital Resources for Students with Disabilities	3.04	0.60
4. Perceived Adequate Training and Resources for Digital Literacy	2.96	0.53
5. Digital Literacy in an Inclusive Curriculum	3.04	0.60
6. Inclusive use of Digital Tools	3.17	0.55
7. Cultural relevant Technology-based Learning Activities	3.01	0.58
8. Personalized Learning Experiences	3.04	0.58
9. Inclusivity of Technology-based Learning Activities	3.01	0.58

Single-factor ANOVA results reveal that the F-value (0.44285) is less than the F critical value (4.493998) and the P-value (0.51523) is greater than 0.05. This implies that the null hypothesis "Integrating technology effectively into the school curriculum and providing comprehensive support has no significant impact on digital access disparities and enhancing digital literacy among high school students" cannot be rejected. The ANOVA results indicate that there is no statistically significant difference between the means of the independent variable (IV) and the dependent variable (DV).

The Pearson correlation coefficient between IV and DV is 0.838379. This value indicates a very strong positive linear relationship between IV and DV. A correlation coefficient close to one (1) implies that as the values of IV increase, the values of DV also tend to increase, and vice versa. Using Regression Analysis, the Multiple R value of 0.8384 reaffirms the strong positive linear relationship between IV and DV. The R Square value of 0.7029 suggests that approximately 70.29% of the variance in DV can be explained by IV, indicating a strong model fit. The regression model is statistically significant, as indicated by the F-value of 16.559 and a P-value of 0.0047 which is less than 0.05.

The slope (IV coefficient) of 0.7676 is statistically significant, implying that for every one-unit increase in IV, DV increases by approximately 0.7676 units. The intercept is not statistically significant (P-value = 0.2832), since this value is greater than 0.05.

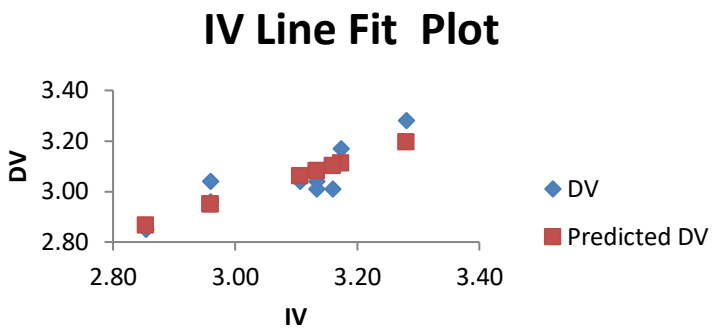

Figure 1. IV Line Fit Plot with DV and Predicted DV

In summary, the ANOVA Results show no significant difference between the means of IV and DV but the Pearson Correlation Analysis otherwise shows a very strong positive linear relationship between IV and DV. Regression Analysis reaffirms the correlation results where IV and DV are statistically significant, with IV being a strong predictor of DV. The model explains a substantial portion of the variance in DV, and the slope indicates a positive linear relationship. These analyses collectively suggest that there is a strong and significant positive relationship between the independent variable (IV) and the dependent variable (DV). The indicators thereby imply to reject the null hypothesis as against the ANOVA results.

3.6 Challenges in Digital Access

Despite efforts to ensure fair access to devices at school, major hurdles remain in establishing comparable levels of digital access at home, primarily due to budgetary constraints limiting home internet access (González-Betancor et al., 2021). The primary obstacle remains home internet access, which is frequently limited by budgetary restraints experienced by students' families.

This digital gap exacerbates educational disparities, particularly for low-income students (European Commission et al., 2021; Afzal et al., 2023) who cannot afford consistent or high-speed internet access. As a result, these students encounter barriers to completing schoolwork, accessing online resources, participating in extracurricular digital learning opportunities, and increasing educational disparities. Schools and policymakers must address this issue by looking into solutions including subsidized internet programs, collaborations with internet service providers, and community Wi-Fi efforts to guarantee that students have dependable home internet connections.

3.7. Effectiveness of Digital Literacy Programs

Digital literacy programs generally succeed in providing basic digital skills (Van der Vlies, 2020). However, gaps persist in vital areas such as cybersecurity and critical thinking. Educating students about Cybersecurity is critical in today's digital world because it protects them from online threats and teaches them safe internet practices. Equally important are critical thinking skills since they allow students to assess the large quantity of information available online judiciously. A comprehensive education on cybersecurity and activities that promote critical thinking should be in place to enhance the digital literacy programs' effectiveness. Enhancing these programs with real-world scenarios and problem-solving exercises can better prepare students for safe and effective digital navigation (Garmendia & Karrera, 2019).

3.8 Support for Technology Integration

Technology has been found to improve learning experiences by making them more interesting and participatory. Positive attitudes towards classroom technology highlight its potential to enhance learning (Johannes et al., 2017). Continuous professional development for teachers is essential for effective technology integration, addressing both technological and pedagogical strategies (Johnston, n.d.; Gottschalk & Weise, 2023). This training should address not just how to utilize new devices and software but also approaches for effectively incorporating technology into the curriculum. Furthermore, enough technical assistance and resources must be available to handle any challenges that may emerge, ensuring that technology improves rather than impedes the learning process.

3.9 Inclusivity and Accessibility

Effective digital education must prioritize inclusivity and accessibility, ensuring materials are compatible with assistive technologies and culturally relevant (Cerna et al., 2021; Brussino, 2021). There is a need to make digital materials available to all students, including those with impairments. Schools should train educators to create inclusive resources that can help provide equitable learning environments for all students (UNESCO, 2020; Mintz et al., 2024). Furthermore, culturally relevant digital resources are required to engage students from diverse backgrounds. This may be accomplished by infusing multicultural viewpoints into digital content and making certain that instructional materials represent the diversity of the student population.

4.0 Conclusion

As the persistent barriers to digital inclusion among high school students were identified, the study underscores the critical issue of home internet access, particularly for low-income students, thus advancing the understanding of digital inequality beyond mere device availability (González-Betancor et al., 2021). This emphasizes the need for holistic approaches to digital inclusion such as subsidized internet access, partnerships with internet providers, and community Wi-Fi initiatives to ensure reliable home connectivity. Digital literacy programs have equipped students with basic skills but by pinpointing gaps in cybersecurity and critical thinking within digital literacy programs, the research expands the current knowledge on essential digital skills required for safe and effective online engagement (Van der Vlies, 2020). This insight into specific skill areas advances the development of more comprehensive digital literacy curricula. Incorporating real-world scenarios and problem-solving into these programs is essential for preparing students to navigate digital spaces securely.

The research highlights the importance of ongoing professional development for teachers, addressing both technological proficiency and pedagogical strategies (Johnston, n.d.; Gottschalk & Weise, 2023). This contribution underscores the need for continuous training to keep pace with technological advancements, thus enhancing the efficacy of technology integration in education. Training should include new devices, software, and effective pedagogical strategies. To ensure inclusivity, emphasis on creating accessible and culturally relevant digital content advances the discourse on equitable education (Cerna et al., 2021; Brussino, 2021). All students, including those with disabilities and from diverse backgrounds can benefit from digital resources which align with contemporary educational goals of inclusivity.

To address the challenges identified and promote a more equitable and inclusive educational environment for high school students, the following recommendations are proposed:

a. Enhance infrastructure to provide consistent and reliable internet access. This involves improving internet infrastructure to ensure students, especially those from financially challenged backgrounds, have stable connectivity. Collaborations could include setting up community Wi-Fi areas, partnering with ISPs for affordable broadband, and school initiatives like lending portable Wi-Fi hotspots.
b. Provide financial assistance or subsidies for digital devices and internet services. Schools and government bodies should create support systems, such as device lending programs and financial aid, to relieve economic strain on households and equip students with necessary technology.
c. Develop and implement comprehensive digital literacy programs. These programs should cover cybersecurity awareness, critical thinking skills, and practical digital skills training. Curriculum updates and teacher resources are necessary for effective delivery.
d. Increase training opportunities and resources for teachers. Regular workshops on new technologies and peer mentoring programs can enhance teachers' technical skills and integration of digital tools in teaching. Reliable technical support is also important for troubleshooting and assistance with new tools.
e. Ensure digital resources are accessible and culturally relevant. This involves using assistive technologies, providing multiple means of representation, and adhering to accessibility standards. Culturally relevant content should incorporate multicultural perspectives and be available in multiple languages.
f. Establish mechanisms for continuous feedback and improvement. Regular surveys, focus groups, and pilot programs can gather feedback and test new technologies, ensuring relevant and effective technology integration.

This study significantly advances the field of digital inclusivity by highlighting the persistent challenges and proposing targeted solutions to reduce digital disparities among high school students. Future research can build on these findings contributing to a more inclusive and digitally proficient educational environment by exploring the following areas:

a. Investigating the long-term effects of subsidized internet access and community Wi-Fi initiatives on students' academic performance and digital engagement;
b. Evaluate the impact of enhanced digital literacy programs that incorporate cybersecurity and critical thinking on students' overall digital competency and safety;
c. Comparative studies on different models of professional development for teachers in technology integration;
d. Exploring best practices for creating inclusive and culturally relevant digital content, and assessing its impact on student engagement and learning outcomes.

5.0 Contributions of Authors

The sole author was responsible for writing, encoding, editing, and supervising the conduct of the survey and interview as well as data analysis of the results.

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7.0 Conflict of Interests

There is no conflict of interest in the conduct of this research.

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