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Impact of Non-Formal Education in the Development of Digital Literacy: A Mixed Method Research in the Khulna Region

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ABSTRACT

Purpose of the study: The aim of the study is to determine the effectiveness of Non-Formal Education programs in enhancing digital literacy, the issues faced by learners, and the possibilities to reinforce NFE-based digital literacy programs.

Methodology: The study used a mixed-methods explanatory sequential design that involved a combination of quantitative data (218 NFE participants who were sampled using a stratified random sample) and qualitative data (20 participants purposely sampled). Survey questionnaires and semi-structured interviews were used. Quantitative data were analyzed through descriptive statistics and qualitative data were analyzed through thematic analysis.

Main Findings: Results show that NFE programs have a substantial positive effect on digital literacy, especially basic computer skills, internet navigation, and social media skills, and data analysis skills among a relatively small number of learners. The participants indicated increased employability and real-world digitalization consistent with the principles of experiential and transformative learning. Nevertheless, systemic challenges such as insufficient equipment, poor internet connectivity, the inconsistency of the teaching standards, and insufficient post-training care remain the obstacles to overall fair digital learning experiences.

Novelty/Originality of this study: The present study incorporated mixed-method evidence to unveil the role of NFE as an effective avenue of digital inclusion among marginalized communities of Bangladesh It reveals gaps like a shortage of cybersecurity, social stigma, and post-training constraints and provides system-wide perspectives that contribute to current knowledge on digital literacy development in the non-formal education systems.

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1. INTRODUCTION

Digital literacy has become one of the most important skills in the 21st century to ensure effective social, economic, and civic involvement [1], [2]. The growing infiltration of information and communication technologies (ICTs) in every sphere has changed how people learn, work and relate [3]. Consequently, digital literacy has ceased to be an auxiliary skill but a condition to personal and employability growth and even social inclusion [4], [5]. However, the disparities in digital access and skills, or referred to as digital divide, remain an issue on a global scale, and developing nations like Bangladesh struggle with this problem on a sharp basis [6], [7]. Although formal education systems have achieved a lot of progress that incorporates the use of ICT-based education, their coverage is still discriminatory especially to the marginalized communities, rural communities, and out-of-school children [8]-[10]. It is in this context that the idea of non-formal education (NFE) has been brought to the attention as a

strategic supplement to formal education in providing flexible, context-fitting, and learner-focused opportunities to gain the necessary digital skills [11]-[13].

Although policies have been made and substantial resources are spent on maximizing access to digital services, big parts of Bangladeshi population remain locked out of the digital realm [14]. The disadvantaged groups such as women, the rural areas, and the poor are still overly impacted as they not only lack infrastructural facilities but also do not receive sufficient training opportunities [15]-[17]. Worsening the problem is the fact that the formal education system is usually not as effective as it should be because it lacks practical hands-on training of digital competencies [18], [19]. Despite the fact that the different NFE programs have been initiated by the government and non-governmental actors, lack of systematic studies to explore their effectiveness, durability, and inclusiveness is evident [20]. As a result, there are still apprehensions about the ability to mobilize non-formal education in a strategic manner to close digital divides to enable a fair contribution towards a fast-digitizing society [21], [22].

Despite these NFE initiatives, the literature reveals a critical gap between policy intent and empirical understanding. Although there are several non-formal education (NFE) programs on digital literacy in Bangladesh, a lack of systematic evidence exists regarding the effectiveness of programs in developing functional, critical, and employability-oriented digital skills, especially in marginalized populations [20]. Current literature is more descriptive or program-focused, providing limited information on such aspects as long-term outcomes, inclusiveness, and situational adaptability of NFE-based digital literacy interventions [23].

Non-formal education is a solution to this gap with the flexibility, need-based and community-centred approaches to digital skills development [24]. Whereas the strict formal education systems are unyielding to the socio-cultural and economic realities of disadvantaged learners, NFE can be re-modeled to reflect the realities of those learners, which can empower the latter to interact with technology in a manner that is immediately relevant and practically applicable [25]. Examples of NFE can be the community-based digital literacy centers, mobile learning programs, NGO-based skill-building courses, and so forth, and they demonstrate how these organizations can expand opportunities to people who are systematically marginalized by institutional channels [26], [27]. Besides, NFE focuses on lifelong learning whereby learners have been empowered to keep on upgrading their competencies to match the changing technological trends [28], [29]. Therefore, a closer look at the possibilities of NFE in digital literacy progress can be made to form inclusive and robust knowledge societies [30]. However, without evidence-based guidance on program design, pedagogical approaches, and learner engagement strategies, the potential of NFE to function as a scalable solution to digital exclusion remains underutilized.

The existing literature highlights the complexity of the concept of digital literacy that goes beyond the simple realization of technical competence to critical thinking, ethical interaction, and collaboration in digital spaces [31], [32]. Ali [33] and Reedy & Parker [34] are a few of the scholars who have conceptualized digital literacy as a set of various dimensions: information, media, and socio-emotional literacies. In the Bangladeshi setting, non-formal education has traditionally been a decisive factor in the spread of literacy and professional abilities, especially in the case of marginalized groups [20]. Most recently, NFE has been used to overcome digital divides, including BRAC mobile-based post-literacy programs and government-sponsored Community Information Centers [35]. However, the literature demonstrates serious gaps in comprehending the efficiency of such interventions, especially their scalability, inclusiveness, and the long-term effects of such interventions on the socio-economic empowerment of the learners [20], [24].

This study is urgently needed because of the rapid digital transformation agenda in Bangladesh [36]. In the absence of prompt empirical evaluation of the grassroots digital literacy system such as NFE, there is also a threat that the existing digital inequalities can only increase further especially to the rural learners, women and climate vulnerable group [37]. This gap is thus not only an academic requirement but also a policy requirement that comes at the appropriate time [38].

The development of digital literacy through Non-Formal Education (NFE) relies on some powerful learning theories [39]. The Experiential Learning Theory [40] and Transformative Learning Theory [41] underline the importance of practical activity and critical thinking to facilitate the acquisition of all digital knowledge by learners and redesign technological attitudes. Community of Practice model [33] focuses on collaborative learning, whereas Human Capital Theory [42] places digital literacy as an investment that improves the level of employability and financial capacity. NFE also finds its place as an empowerment space through Critical Pedagogy [43]. However, there is a lack of empirical data to explain how these theoretical concepts are translated into effective NFE practice in rural Bangladesh.

The research aims to add to the existing knowledge base by investigating the role of non-formal education in the development of digital literacy in Bangladesh in a systematic manner. The study is placed at the crossroads of educational equity and digital inclusion, which involves paying attention to how NFE programs address the needs of the diverse population groups, such as rural people, women, youth, and other underrepresented in society [44]. This work is justified by the fact that it can inform policy-making, resource distribution, and programmatic strategies to increase the power of NFE as a means of inclusive digital development [13]. With increased focus on digital transformation and the Sustainable Development Goals (SDGs) in the world, and especially SDG 4 on

quality education and SDG 10 on reducing inequalities, the topic of the study is national and globally relevant [45], [46].

Furthermore, the main aim of the study is to examine and investigate how effective non-formal education programs are to improve the digital literacy skills in Khulna region. In particular, it will help determine the advantages and shortcomings of current NFE programs, the training approaches used in imparting digital skills, and socio-economic effects on learners. Placing NFE in the wider context of digital equity, the study aims to point out how such programmes can play a key role as a mechanism of closing the enduring digital gaps [47], [48].

The study is informed by the following research questions to meet the stated purpose:

1. How do non-formal education programs contribute to improving digital literacy skills among participants in Bangladesh?
2. What are the major challenges and opportunities of integrating non-formal education into the development of skills on digital literacy?

2. RESEARCH METHOD

2.1. Research Design

This research used a mixed-methods explanatory sequential research design to examine the role of non-formal education (NFE) in developing digital literacy. In the first phase, quantitative data were collected to identify overall patterns, levels, and trends of digital literacy among NFE learners. During the second stage, qualitative data were collected to contextualize and explain the quantitative findings using the lived experiences of the participants. The combination of quantitative and qualitative results provided the possibility of methodological triangulation, which made the study more robust and credible [49].

2.2. Population and Sampling Technique

The research was carried out in the Khulna Division of south western Bangladesh. The study population was composed of learners enrolled in NFE digital literacy programs and also educators and facilitators of the program implementation. In the quantitative phase, data were collected through stratified random sampling method. Population was initially stratified into urban and rural groups in order to provide proportional representation. This twofold selection provided diversity in the geographical regions and breadth in the context [50]. Then, around 218 respondents (131 urban and 87 rural) were selected randomly across each stratum depending on population size. In the qualitative stage, the participants were selected via purposive sampling to include individuals with rich and relevant experience in NFE and digital literacy. The interviews were conducted with 20 participants (consisting of learners and educators) to gather detailed information on the learning reinforcement processes, issues, and the possibility of using digital skills in practice [51].

2.3. Research Instruments

In this study, a self-developed structured questionnaire was used in the quantitative phase to collect data. The questionnaire included 17 closed-ended questions using a 5-point Likert scale gauging access to NFE, perceived digital skill development, relevancy of the acquired skills, and implementation issues [52]. Internal consistency reliability was assessed using Cronbach's alpha ($\alpha = 0.893$), indicating high reliability. For the qualitative phase, a semi-structured interview guide was designed by the researcher. The semi-structured interviews guide were open-ended interviews, which encompassed in-depth experiences of learners and educators concerning acquisition and application of digital skills [53], [54].

2.4. Data Collection Techniques

Quantitative data were collected through face-to-face questionnaire administration to ensure clarity and completeness of responses [55]. After analysis of survey results, qualitative interviews were performed to expand and clarify major quantitative results. All the interviews were also audio-recorded with the informed consent and transcribed verbatim [56].

2.5. Data Analysis Techniques

Quantitative data were analyzed using descriptive statistics (frequencies, percentages, and mean scores) with SPSS to identify patterns and trends in digital literacy outcomes. Qualitative data were analyzed using thematic analysis following Braun and Clarke's framework [57], involving familiarization, coding, theme development, reviewing, defining, and interpretation. It facilitated the systematic determination of recurring patterns and contextual meanings [58]. The combination of the two forms of analysis made it easier to draw a strong conclusion, and the meaning of the quantitative trends was enhanced with the help of qualitative analysis, which guaranteed the breadth and depth of comprehension [59].

2.6. Research Procedures

The research was conducted in a sequential manner: development of the instruments, pilot testing, quantitative data collection, analysis, qualitative data collection, thematic analysis and synthesis of results to interpret and discuss the research.

3. RESULTS AND DISCUSSION

3.1 Result

3.1.1 Quantitative findings

The results below are based on the quantitative survey questionnaire (N=218), to demonstrate the patterns and trends, and their more generalized findings on the development of the digital literacy in NFE programs.

3.1.1.1 Contribution of Non-Formal Education Programmes to Digital Literatcy.

There was an overwhelming majority of participants who indicated that they had attended at least one NFE digital literacy program. The engagement rate is high implying that the community is highly aware of the relevance of the digital literacy in the non-formal learning systems.

Digital skills that improved through NFE programme: The respondents have mentioned various NFE models, such as Basic computer skills, Internet navigation, Social media proficiency, Coding/Programming, Data analysis, Cybersecurity awareness, community-based workshops, NGO-led digital literacy camps, and youth-focused tech programs.

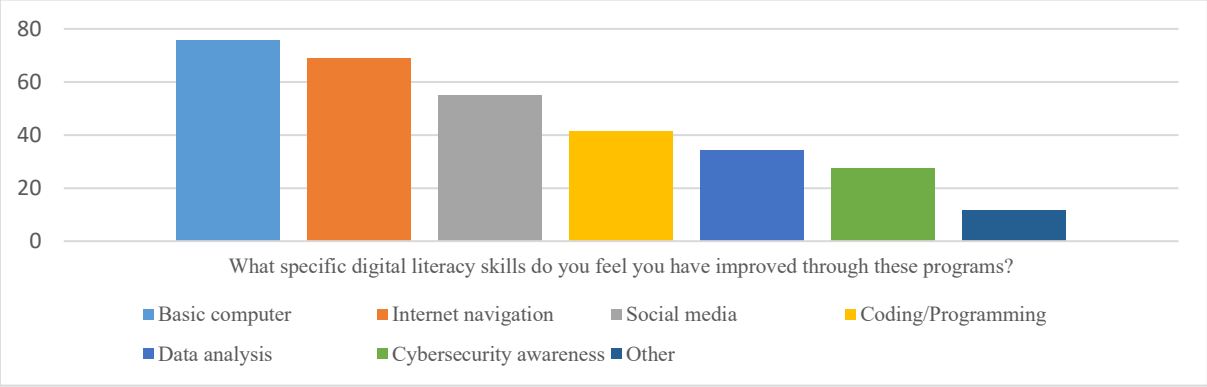

Figure 1. Digital skills that improved through NFE programme

Most of them have been found to have improved basic computer skills (75.7%), internet navigating (68.8%), and this indicates that basic competencies comprise the main backbone of NFE curricula. Further, 55 % had advanced social media skills, 41.3% acquired coding/programming abilities and 34.4% acquired data analysis skills, all of which signify progressive diversification into intermediate and advanced digital skills groups. Cybersecurity awareness was only noted among 27.5% individuals, which is an indication of a severe weakness in the content of the NFE programs on digital safety.

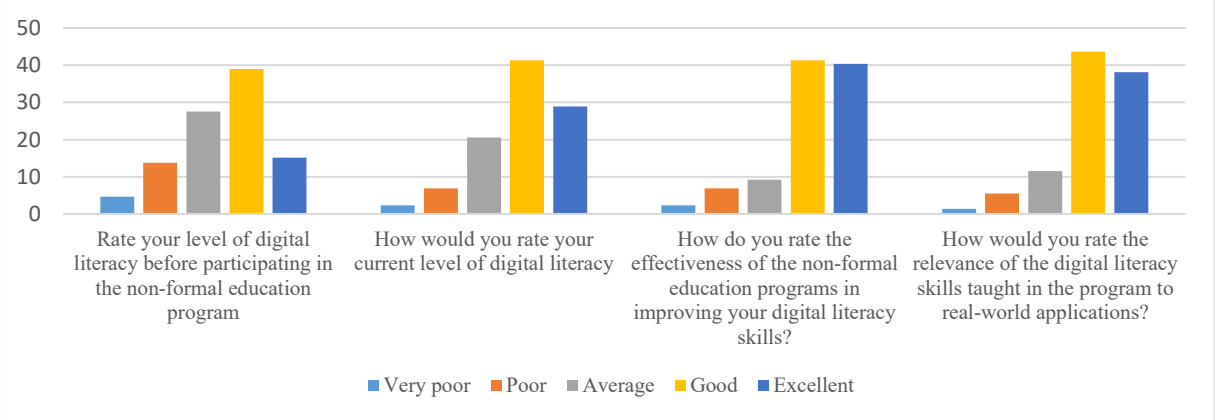

Figure 2. Contribution of Non-Formal Education Programmes to Digital Literatcy

Digital Literacy Level before NFE Participation: Respondents to NFE programs before entering the program mostly rated their digital literacy as average (27.5%), good (39%), or excellent (15.1%), and 18.4% reported being poor or very poor. This distribution suggests that the familiarity with digital tools at the baseline is average across the majority of learners but a large portion still comes in with weak or very low skill sets.

Current Digital Literacy Level after NFE Participation: Ratings of post-participation are strongly positive: 41.3% considered themselves to be good, 28.9% excellent, and only 9.2% stayed at the level of poor or

very poor. This increase in levels of proficiency represents a statistically significant positive impact of learning that can be credited to NFE programming.

Perceived Effectiveness of NFE Programs: The NFE programs were seen largely as effective in enhancing digital literacy by the participants. The programs in total were perceived to have worked or worked very well by 81.7% (41.3% and 40.4% respectively). And dissatisfaction was very low since only 2.3% found them not to be effective. These findings are indicative of high learner satisfaction and display good congruency between the design of the program and the expectations of the participants. The effectiveness rating is also high, which might also signify the existence of the learner-centered instruction practices and practical digital training that can appeal both to adult learners and to youths.

Relevance of Taught Skills to Real-World Application: The skills were perceived by the vast majority of the participants as very relevant (43.6%) and as extremely relevant (38.1%), summing up to 81.7%. The percentage that found the contents irrelevant was only 1.4. These findings validate the great functional fit of NFE material with practical, academic or employment needs of learners.

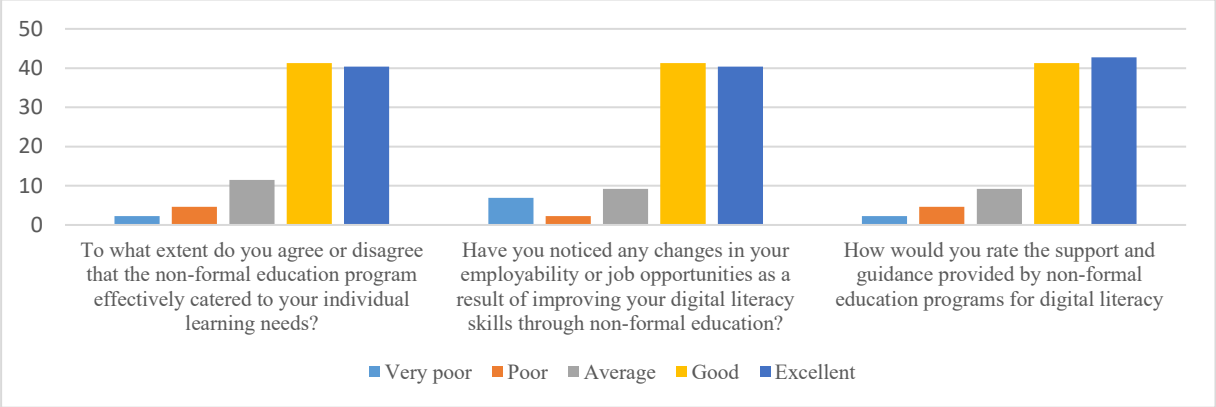

Figure 3. Contribution of Non-Formal Education Programmes to Digital Literatcy

Responsiveness of NFE to Individual Learning Needs: Individualization towards the needs of learners is yet another important issue of NFE program quality. Combined 81.7% of the respondents either agreed (41.3) or strongly agreed (40.4) with the program that it met their individual learning needs. This observation indicates that a good number of NFE practitioners adopt adaptive, flexible and learner-centered pedagogies, which enable the participants to advance at their pace and level. The lowest percentage of 6.9% disagreed, which can be an indication of a weak area of instructional differentiation that needs a specific enhancement.

Impact on Employability and Job Opportunities: A major percentage 81.7% had reported an increase in employability with 40.4% saying that it had increased significantly and 41.3% that it had increased slightly. Just 6.9% did not see any change, and 2.3% also said that there was only a slight decrease. This trend signifies that the NFE-based digital literacy training is not only an educational intervention tool but also an employability improvement tool in digital-competencies-oriented labor markets.

Support and Guidance Provided by NFE Programs: The support given by the instructors and program facilitators was rated with high ratings as 84% rated it either as good (41.3%), or excellent (42.7%). A very few rated the support as poor or very poor (6.9% combined). It implies that mentorship, clarity, and support mechanisms of the instructional process are good elements of NFE system, which plays a big part in satisfaction to the program and understanding retention.

3.1.1.2 Challenges in Integrating NFE into Digital Literacy Skills Development

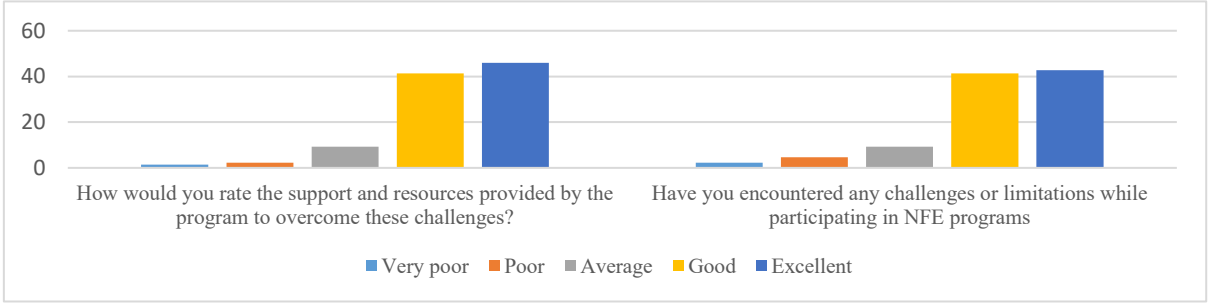

Figure 4. Challenges in Integrating NFE into Digital Literacy Skills Development

Challenges Encountered During NFE Participation: The responses portray different experiences. Although approximately 84% said that the challenge was moderate to high, the challenges are probably associated with structural, infrastructural, or contextual challenges often encountered in NFE settings, such as the lack of device access, unstable internet connection, or time. The result of this finding implies that NFE programs are effective, but the experience of the participants is determined by other socio-technical conditions.

Program Support and Resources for Overcoming Challenges: In determining whether sufficient support and resources were adequately provided to overcome barriers that were experienced during the learning process, 79.4% rated the support as being very good (39%), or excellent (40.4%). These answers reveal that there are systems established in programs to solve the problem of resource limitations, digital access, and challenges faced by learners. The poor or fair ratings (6.9% being low) show that some challenges are present, but most of the programs have sufficient capabilities to alleviate them.

3.1.1.3 Opportunities for Enhancing Digital Literacy through NFE

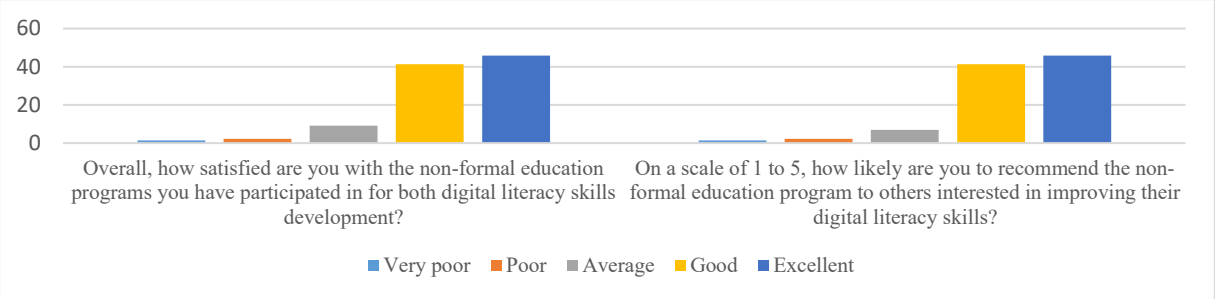

Figure 5. Opportunities for Enhancing Digital Literacy through NFE

Overall Satisfaction with NFE Programs: The overall satisfaction rates were also high and 87.2% indicated satisfaction (41.3%) or high satisfaction (45.9%). This supports the previous research on the effectiveness, relevancy, and instructional support of the programs. The fact that the dissatisfaction rates are very low (3.7%), implies that the participants perceive NFE as a very valuable source of learning digital literacy skills.

Likelihood of Recommending NFE Programs: The participants were very strong supporters of NFE programs, 87.2% indicated that they were likely (41.3) or extremely likely (45.9) to recommend the programs to others. Strong recommendation intention indicates program credibility along with learner satisfaction and implies positive word-of-mouth spread- an indispensable instrument of NFE program expansion, particularly in rural settings.

3.1.2 Qualitative findings

This section presents the findings of semi-structured interviews with twenty people in urban and rural regions of the Khulna Division.

3.1.2.1 Contribution of Non-Formal Education programme to Digital Literacy:

How did you first become involved in non-formal education (NFE) programs related to digital literacy?

The respondents described various entry pathways to Non-Formal Education (NFE) programs depending on socio-economic conditions, community relationships, and individual factors. There were four themes that prevailed: community referral, digital outreach, institutional mobilization, and employment-related motives.

The urban respondents often reported the knowledge of the programs via social media and NGOs pages. Reflectively, P3 said he had seen a post on Facebook made by a local training center, and it seemed to be the right time to boost my own skills. Conversely, rural participants tended to mention localized and interpersonal channels. P11 said, “One of the officers of the Union Parishad had told us that there was a mobile training camp, and I went along with some of my friends.

Motivations were highly job-oriented. Some of the participants registered to improve employment opportunities or change jobs. As P5 responded, I enrolled due to the fact that the digital skills have become compulsory requirements in the job market; otherwise, I felt like I was left behind. Some of them were motivated by business interests, self-growth, or family requirements, which implies that NFE programs fulfill general, contextual desire.

Can you describe your experiences with NFE initiatives aimed at improving digital literacy skills?

There was a broad description of program experiences among the participants, which is an indication of differences in program design, institutional capacity, and local infrastructure. The experiences were concentrated around competency learning, empowerment and confidence-building, and the community support systems.

Some of the participants appreciated the practicality of the training. P7 who was present in digital farming sessions reported: the trainer made us know how to check the weather forecasts and market prices on the internet; it has transformed how I grow. Others pointed to possibilities of self-employment. P8 said, I became a graphic designer and became a freelancer. I felt like I had entered a new world.

Females, especially, focused on empowerment. P5 wrote, the women digital literacy project has given me a lot of confidence and I never thought that I could operate a computer by myself. Also, young participants paid attention to the topicality of high-level programs, including coding and robotics (P17). All these experiences point to the fact that NFE programs are not just operating as training processes, but also platforms through which people can undergo social and economic mobility.

In what specific ways do you feel NFE programs have contributed to enhancing your digital literacy skills?

Throughout the interviews, the participants identified NFE programs as important factors in developing their digital competency. The contributions were focused on practical experience, practical digital skills, acquisition of professional-level skills, and digital citizenship awareness. Practical learning was brought out as a vital process of acquiring skills. P2 said, we did everything by ourselves- typed, used Google applications, uploaded files. It is then that I realized that I was indeed getting better.

Developed competencies were also mentioned. P10, who took a web development module, said: The course provided me with sufficient skills to be able to take the job with the IT support. It was life-changing." Other ones focused on better cyber-awareness. That was the case as P12 explained that he/she learned how to secure his machines and accounts, something he had never known before. The immediate relevance of skills to daily life was also appreciated by participants, including digital banking, e-commerce or helping children with online learning. The evidence shows that NFE programs promote holistic digital literacy, which is a mixture of technical, cognitive and socio-functional skills.

3.1.2.2 Challenges in Integrating NFE into Digital Literacy Skills Development

Have you encountered any challenges or obstacles while participating in NFE programs? What were they?

In spite of positive effects, participants have indicated that they were faced with significant challenges that negatively affected the continuity of learning and acquisition of skills in their entirety. These issues were grouped into four categories namely resource constraints, structural barriers, socio-cultural limitations, and learning-related problems.

Rural participants were highly affected by resource constraints, especially the lack of devices and poor internet connectivity. P4 told me, at times the power failed out and went off hours; we were unable to practice anything. Urban students experienced the problem of digital divide on the domestic level. P9 told me, we had to share a single laptop between four individuals and therefore I lost a lot of time in practice.

The structural limitations like strict schedules and lack of support of an instructor were also pointed out. P2 added, the classes were not at the right time; I was forced to miss a number of classes. Many rural learners experienced a problem of language barrier. As observed by P8, majority of the materials were in English and this made learning challenging to us. These results show that, although NFE programs can be a potential opportunity, they still are still bound up in systemic inequalities that disproportionately target disadvantaged groups.

Conversely, what challenges or barriers have you encountered in integrating NFE into digital skills development?

Respondents cited a number of obstacles to the adoption of NFE into larger skill development models: the lack of infrastructure, the perceptions of society, the inconsistency of the program and the lack of post-training options. The most notable obstacle was the stigma of NFE. P16 commented, Non-formal training is not recognized as education by people in my village hence most people do not consider it seriously.

Urban participants cited intermittent quality of the programs, which was frequently as a result of the instructor turnover. P7 clarified that we had a new trainer every few weeks and we had to adapt to new styles of teaching. Lack of post-program support was among the main criticisms of many participants. P9 complained that once we were done with the course, no one instructed us where to go with our skills. The data above exemplifies systematic barriers that limit the functionality and sustainability of NFE programs.

3.1.2.3 Opportunities for Enhancing Digital Literacy through NFE

Based on your experience, what factors contribute to the success of NFE programs in digital literacy development?

The participants cited the flexibility of the pedagogy, availability of resources, conducive learning conditions, and relevance to a specific context as the main factors of success. It was pointed out that many stressed the importance of having interesting instructors and practical and hands on learning conditions. Participant 1 mentioned, I felt more at ease and secure when we could modify our lessons to the speed that we could manage. Others focused on structured feedback and constant mentorship, whereby Participant 3 made the following assertions, "The feedback sessions allowed me to monitor my progress and kept me motivated.

Community involvement and awareness also turned out to be important. The awards that were given by the prestigious bodies boosted the self-esteem of the learners and employment opportunities. Local mobilization by the community leaders in rural areas also helped gain a lot of acceptance of the program.

Are there strategies or practices you believe are effective in overcoming these challenges?

The suggested strategies to curb obstacles, including personalized learning, peer-led communities, instilling instruction with feedback, tangible training and mentoring networks, were perceived as effective by the participants. Individual modules were especially reliable. P1 responded, I felt less anxious and surer that I was progressing well when the lessons were as fast as I needed.

Peer learning proved to be an effective equalizer particularly in the rural areas. P2 said, we had a village study circle- that kept us going and helped us out of issues. Practical experience was always given preference. It was easier to practice in real life, as P4 explained that theory would never help in digital abilities. The learning was also enriched through mentorship that was done outside classrooms especially among the career-oriented participants.

What additional support do you think is needed to strengthen NFE-based digital literacy programs?

The key points that were overwhelmingly demanded by the participants were the development of infrastructure, the more availability of devices, and the extension of financial and institutional assistance. One of the most identified was the desire to have community digital centers where the internet is reliable and there is a continuous tutor. One member said, “Had we had a small digital center with computers in our community, we would not lag behind once the program is completed.

Some focused on job linkage support, which stated that there was a necessity of platforms between graduates and internship, freelance, or local employers. The disabled people insisted on inclusive design and trained trainers.These replies suggest that NFE needs to be brought to strength through a comprehensive ecosystem strategy, by incorporating infrastructure, pedagogy, community involvement, and post-training opportunities.

According to the semi-structured interviews, non-formal education is a very important and multi-layered concept in terms of digital literacy development. Although it allows empowerment, employability as well as social inclusion, its success is mediated by structural inequalities, cultural interactions and program-related limitations. The insights provided by participants highlight the importance of context-sensitive, inclusive, and sustainable models of the digital learning process in the framework of NFE.

3.2 Discussion

The results of this research claim that involvement in Non-Formal Education (NFE) initiatives has a significant positive impact on digital literacy among students in the Khulna area, which confirms the key principles of the Experiential Learning Theory [40]. The narratives of learning by doing among learners as they type, navigates applications, and create digital content have shown that NFE is an effective way of operationalising the experiential learning cycle to change abstract knowledge into practical competence. Quantitative statistics indicate that 75.7% of the individuals gained basic computer skills, 68.8% improved internet navigation skills. These findings comply with the argument presented by Pettersson [19], who argues that digital literacy programs in developing settings should prioritize basic skills in operations before moving on to higher-order skills. Additionally, the qualitative narratives of the participants focused on confidence-building and the attainment of practical knowledge underpin the notion of empowerment by Freire [43], who believes that the learner in participatory learning is empowered by means of the knowledge and agency they are active in constructing.

Moreover, the results justify the Transformative Learning Theory as developed by Mezirow. To a large number of learners, and particularly women, learning digital skills was not only considered to be technical training but also identity-transforming and confidence-building. As the participants pointed out, NFE helped to reconsider their possibilities, think bigger in terms of employment opportunities, and become more active in social life. This finding is in line with Rosen [5] and Bhattacharya and Rakshit [4], who state that digital literacy may lead to the improvement of personal agency and social engagement, especially in marginalized communities. In this regard, NFE seems to contribute to both the development of skills and cognitive change, and its multi-purpose in technical and socio-emotional development.

The development of intermediate and advanced skills among the learners, including coding (41.3%) and data analysis (34.4), further attests to the fact that NFE programs are keeping up with the changing requirements of the labor market. This result is aligned with the argument by Detlor et al. [27], who believe that, over time, digital education initiatives become more exposed to market-relevant competencies that improve employability. In Bangladesh, where the ICT-enabled freelance economy is growing, the development of such competences means that NFE curricula are flexible to macroeconomic changes. The reports by the participants about gaining freelance or IT employment supports the Human Capital Theory developed by Becker [42] according to which the acquisition of skills is an economic asset. Also, 81.7 percent of the respondents said that they perceived improvements in employability, which once again supports the validity of the connection between skill development and economic performance. Nevertheless, the more pronounced increase in basic-level skills

compared with high level skills is contextual; students who have little prior exposure to digital technologies need significant assistance to develop low-level skills before moving on.

Satisfaction of learners and recommendation intention were also quite high, as 87.2% of the respondents referred to a positive attitude towards the programs. This shows the relevance and responsiveness of NFE to the socio-economic and contextual realities of the learners, as Widodo and Nusantara [11] note that community-based, flexible learning strategies can, in most cases, be more accessible and practical than formal education systems. In qualitative data, adaptive pacing, supportive instructors, and contextualized instruction are important and they concur with learner centred pedagogical principles. Moreover, the results also support the importance of collective learning and the encouragement of peers, which were characterized in the Community of Practice model by Lave and Wenger [33]. Community support and collective work were also particularly significant in rural settings, which helped to reduce the scarcity of resources and keep people active. These observations indicate that social and collective aspects of NFE play a vital role in the persistence and consolidation of skills.

Employability as one of the focal outcomes of NFE participation. Participants continuously claimed that digital skills development improved their employment opportunities, be it freelance or better agricultural decision-making through digital skills. These results conform to the Human Capital Theory [42] and are supported by the research that has shown that the digital literacy is becoming more and more income generating in the Global South [18]. The connection between the applicability of digital skills and the ability to empower, as well as the economic aspect, demonstrates that NFE is a space of learning and a entryway to socio-economic mobility.

However, there are structural and contextual issues that limit the potential of NFE. Most of the respondents mentioned poor infrastructure such as the lack of devices, erratic power supply, and lack of internet connectivity. These obstacles are echoed by Aziz and Hossain [7], who emphasize the fact that systemic infrastructural poverty has a major impact on the degree of digital inequality in Bangladesh. The frequent power interruptions and shortage of devices specifically impacted rural learners, explaining how the environment can mediate the program outcomes. Moreover, the use of English-dominant instructional materials also led to language barriers as stated by Reedy and Parker [34], which impeded the shift in the level of basic to advanced digital skills. These results support the idea that technical ability-building is not enough to reach digital inclusion; systemic and contextual choices should be taken into consideration as well [17].

A surprising fact is the comparatively low coverage of cybersecurity awareness, with 27.5% of the respondents reporting it. This is opposed to modern approaches to digital literacy, which focus on safe and ethical internet behaviors [32]. Qualitative reports indicated that a significant number of the learners were not aware of optimal passwords, secure browsing, and protection of data before they joined. The lack of emphasis on cybersecurity implies that NFE programs can be more focused on the immediate employability-related competencies, neglecting the necessary skills to be a responsible digital citizen. This finding builds on the existing studies [31], where a trade-off might occur between economic utility and holistic digital literacy due to the low resources.

The other unexpected theme is a social stigma attached to NFE. Although NFE is inclusive and flexible, some rural participants said that the community believes that NFE is poor in comparison to formal education. This social underestimation has not been studied much scholarly but it gives some understanding of discouragement among learners and lack of consistent awareness of NFE credentials. These barriers might be overcome by strengthening policy-level legitimization and social awareness about NFE to increase social acceptance and institutional recognition.

The inconsistency in teaching quality also became a significant problem. Even though the support of instructors was largely favorable, the high turnover of trainers contributed to the variations in the delivery of the program. This is similar to the finding of Pettersson [19] that the competence and stability of a facilitator is the key to the effectiveness of NFE. Additionally, the students pointed to the absence of a post-program provision, including advanced learning opportunities, one-on-one mentorship, or job-placement assistance, which is a missed chance to maintain skills application. Previous studies highlight that digital literacy programs should transform into a long-term learning ecosystem to guarantee the long-term effect of digital literacy programs [27].

Moreover, the paper affirms that the advantages of NFE, such as flexibility, contextual relevance, embeddedness in communities, and empowerment of women and marginalized learners are what makes the study socio-transformative [12], [13]. Simultaneously, structural constraints, disproportionate quality, and lack of support after the training reveal that NFE does not have the ability to bridge the digital divide all by itself. The ideas that participants provide on the digital centers in their communities, mentorship, and deeper job connections imply that NFE has to be embedded into the larger digital ecosystems which encompass infrastructure, policy, and market relationships.

Besides, this paper shows that NFE is an effective means of improving digital literacy, which is consistent with the theory of experiential and transformative learning as well as economic and social empowerment. At the same time, structural, cultural, and institutional factors remain in place to indicate that the effectiveness of programs is contextualized through bigger realities. This study is relevant to the digital inclusion research because it synthesizes both quantitative and qualitative results to clarify how NFE programs were designed, how learners

were impacted, and how the systemic issues influenced both. The insights have theoretical and practical implications, which stress the importance of holistic strategies involving a combination of skill-based training with structural and policy-based change to realize sustainable digital literacy and socio-economic change in Bangladesh.

It is also recommended that non-formal education (NFE) digital literacy programmes be strengthened through improved infrastructural support, including reliable internet access, adequate digital devices, and stable power supply, particularly in rural areas. Curriculum enhancement is needed to balance basic digital skills with advanced competencies such as cybersecurity, data literacy, and ethical digital citizenship, while ensuring localized language use and inclusive design for women and marginalized learners. Consistency in instructor training, standardized teaching quality, and structured post-training support—such as mentorship, certification recognition, and job-linkage mechanisms—should be prioritized to sustain learning outcomes and employability gains. Moreover, the findings underscore the significance of NFE as a complementary pathway to formal education in advancing digital inclusion, lifelong learning, and employability among marginalized populations. Future research should adopt longitudinal and comparative designs to examine the long-term educational and socio-economic impacts of NFE-based digital literacy initiatives, as well as to explore inclusive models addressing gender, disability, and regional disparities within diverse non-formal learning contexts.

4. CONCLUSION

Non-Formal Education (NFE) is transformative in digital literacy development of learners in the Khulna region through the integration of experiential, flexible, and context-responsive learning strategies. Results indicate significant changes in the basic and intermediate digital skills, confidence, and employability. The NFE initiatives were of special benefit to marginalized communities, in which community-driven avenues to digital empowerment were easier to access. The paper highlights the importance of institutionalizing digital literacy among wider national education and digital inclusion strategies, whereby NFE programs should have long-term infrastructural and financial investments. Practitioners, especially the nongovernmental organizations and the community based organizations must reinforce the learner-centered curricula by incorporating the foundational, advanced, and cyber skills as well as enhancing the consistency of instructions. Expansion of access to devices, reliable internet and community digital hubs is necessary as a rural equity. The donors and the development partners need to give preference to long-term funding and capacity-building mechanisms, including mentorship and job -linkage pathways. Having regular monitoring, adjustment and community participation will also make the effectiveness and sustainability of NFE-based digital literacy programs even more effective.

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