Archives of Interdisciplinary Education ISSN: 3068-9317

PRIME OPEN ACCESS

Volume 2, Issue 2

Research Article

Date of Submission: 01 May, 2026
Date of Acceptance: 27 Apr, 2026
Date of Publication: 13 May, 2026

Empowering Information and Communication Technology (ICT) Teachers Through a Behavioral Approach to Computer-Aided Design (CAD) for Curriculum-Oriented Instruction: A Community-Based Approach to Pedagogical Challenges

Olatoye Mukaila Ayinde[1], Ahmed Orilonise Salami[2*], Muideen Akintunde Ademola[3], Obiabuchi Martin Nnanna[2] and Chikodili Odirachukwumma Anosike[4]

[1]National Open University, Lagos, Nigeria

[2]University Mohammed VI Polytechnic, Rabat, Morocco

[3]University of Lagos, Lagos, Nigeria

[4]Nnamdi Azikiwe University, Nigeria

***Corresponding Author:** Ahmed Orilonise Salami, University Mohammed VI Polytechnic, Rabat, Morocco.

Citation: Ayinde, O. M., Salami, A. O., Ademola, M. A., Nnanna, O. M., Anosike, C. O. (2026). Empowering Information and Communication Technology (ICT) Teachers Through a Behavioral Approach to Computer-Aided Design (CAD) for Curriculum-Oriented Instruction: A Community-Based Approach to Pedagogical Challenges. *Arch Interdiscip Educ, 2*(2) 01-10.

Abstract

This community-based educational service program focused on empowering Information and Communication Technology teachers through a behavioral approach to Computer-Aided Design to address curriculum-oriented pedagogical challenges. Teachers and prospective instructional designers collaboratively developed and evaluated Computer-Based Instruction resources within a community service framework. Instructional quality and teacher perceptions were assessed using structured instruments. The results show that behavioral Computer-Aided Design enhances instructional effectiveness and is positively received for classroom use. The program demonstrates that community-based initiatives grounded in behavioral instructional design can strengthen teachers' pedagogical competence, improve learner engagement, and support curriculum alignment, offering a sustainable and replicable model for teacher empowerment.

Keywords: Behavioral Computer Aided Design, Computer Based Instruction, Expert Touch Inventory, Instructional Objectives, Pedagogy

Introduction

The development of effective instructional practices remains a central concern in educational communities, particularly in the context of rapid technological advancement. Information and Communication Technology teachers are increasingly expected to design and implement computer-based instructional materials that are aligned with curriculum standards and responsive to learners' needs. However, in many school communities, teachers continue to face pedagogical challenges related to instructional design, content organization, and the effective integration of technology into teaching and learning processes, especially in technology-supported classrooms. These challenges are often associated with limited professional support and insufficient opportunities for structured capacity-building programs within school communities.

Computer-Aided Design has been recognized as a technological approach that supports instructional planning, material development, and learning optimization in computer-based environments. Although initially developed for engineering and technical applications, its use in education has expanded to support multimedia-based instruction and interactive learning experiences (see https://digitalcommons.odu.edu/cgi/viewcontent.cgi?article=1046&context=ots_masters_projects). From a behavioral perspective, instructional effectiveness depends on the systematic organization of learning

stimuli, reinforcement mechanisms, and observable learning outcomes. A behavioral approach to Computer-Aided Design emphasizes clearly defined instructional objectives, sequenced content, and active learner engagement, which are essential for addressing pedagogical challenges in curriculum-oriented instruction [1,2].

In response to these conditions, community-based educational service initiatives play an important role in empowering teachers through collaborative learning, professional mentoring, and direct engagement with instructional technologies. Many reports regarding community service have been well-documented [3-8]. Community-oriented approaches to instructional design allow teachers to develop practical competencies while addressing real classroom needs and contextual constraints [9]. By situating teacher development within a community service framework, such initiatives promote sustainable pedagogical practices and strengthen instructional capacity at the school level. Therefore, this study focuses on empowering Information and Communication Technology teachers through a behavioral approach to Computer-Aided Design as a community-based effort to address pedagogical challenges and enhance curriculum-oriented instruction.

The primary purpose of this community-based educational service program is to empower Information and Communication Technology teachers through the application of a behavioral approach to Computer-Aided Design. The program aims to strengthen teachers' pedagogical competence by supporting the development of curriculum-oriented computer-based instructional materials that address identified pedagogical challenges within school communities. Specifically, the program seeks to (i) examine the adequacy of Behavioral Computer-Aided Design templates used by teachers and prospective instructional designers, and (ii) explore teachers' perceptions of Computer-Based Instruction as a pedagogical tool within classroom practice. Through expert evaluation and teacher feedback, the program emphasizes professional learning, reflective practice, and sustainable instructional improvement as core components of community service.

Based on these purposes, the following research questions guide the implementation and evaluation of the community-based educational service program

- Is the technique used in assessing the pedagogical adequacy of Behavioral Computer-Aided Design appropriate for supporting teacher empowerment in curriculum-oriented instruction?
- What are the views of Information and Communication Technology teachers regarding the use of Computer-Based Instruction as part of a community-based instructional improvement program?
- What are the implications of the findings for pedagogical practices and sustainable teacher development within educational communities?

Literature Review

State of the Art in Computer-Aided Design for Instructional Practice

The literature on the adoption of Computer-Aided Design in instructional contexts indicates that CAD plays an important role in supporting teachers' pedagogical practices, particularly in technology-assisted learning environments. In educational communities, CAD has been increasingly utilized to assist teachers in designing, organizing, and delivering computer-based instructional materials that align with curriculum objectives and learners' cognitive needs (see https://digitalcommons.odu.edu/cgi/viewcontent.cgi?article=1046&context=ots_masters_projects). However, the effectiveness of CAD implementation largely depends on teachers' pedagogical competence and their ability to address instructional challenges through structured design approaches. From an instructional perspective, CAD is closely related to cognitive processing demands and instructional organization.

Previous studies have identified several CAD types that support learning through the integration of verbal, visual, and interactive elements. These types emphasize the balance between learners' mental representations and instructional media, which is essential for addressing pedagogical challenges in curriculum-oriented instruction [1]. Furthermore, the effectiveness of CAD-based instruction is influenced by how instructional content is structured, sequenced, and aligned with learning objectives, particularly within community-based educational settings where teacher capacity varies [2,10].

The major CAD types identified in the literature, along with their supporting definitions and contributing authors, are summarized in Table 1. This classification provides a conceptual foundation for understanding how CAD can be adapted to support pedagogical practices and teacher empowerment initiatives. Table 1 presents the types of Computer-Aided Design, their supporting definitions, and corresponding authors.

CAD-types	Supporting Definitions	Authors
Input equilibrium	"Logogens and images" are mental representations generated through balanced verbal and visual information, enabling learners to process instructional content without cognitive overload.	[1].
Cognitive outcome	Focuses on learners' cognitive processing, including intrinsic, extraneous, and germane cognitive outcomes that influence schema construction and learning effectiveness.	[2,10,11].

Table 1: CAD-Types; Supporting Definitions and their Authors.

The application of CAD in instructional settings has also expanded to include interactive tutorials, simulations, and educational games. These forms of CAD allow learners to interact directly with instructional content while receiving immediate feedback, thereby supporting individualized learning experiences https://digitalcommons.odu.edu/cgi/viewcontent.cgi?article=1046&context=ots_masters_projects) [12]. Such interactive designs are particularly relevant in community-based teacher development programs, as they enable teachers to experiment with instructional strategies that respond to diverse learner needs. Previous studies have shown that drill-and-practice CAD, simulations, and game-based designs can enhance learners' engagement and facilitate concept formation through repeated interaction and reinforcement [9]. In community-oriented instructional contexts, these CAD forms support teachers in addressing pedagogical challenges related to learner motivation, content mastery, and instructional consistency.

Behavioral Computer-Aided Design and Pedagogical Challenges

The present study places specific emphasis on Behavioral Computer-Aided Design and its relevance to pedagogical practices within educational communities. Behavioral CAD is grounded in behavioral learning theory, which emphasizes observable learning outcomes, reinforcement mechanisms, and structured instructional stimuli. From this perspective, instructional materials should be designed to actively engage learners while providing clear feedback and reinforcement to support behavioral change and learning retention. Behavioral CAD plays a significant role in addressing pedagogical challenges faced by teachers, particularly those related to learner engagement, instructional clarity, and curriculum alignment. By structuring instructional materials around behavioral objectives and sequenced learning activities, teachers can create learning environments that support gradual skill acquisition and meaningful learning experiences (see https://digitalcommons.odu.edu/cgi/viewcontent.cgi?article=1046&context=ots_masters_projects). This approach is especially relevant in community-based teacher empowerment initiatives, where teachers require practical strategies to improve instructional effectiveness. Psychological perspectives on learning emphasize the importance of learner involvement in instructional activities. When learners actively participate in learning tasks, they are more likely to engage in critical thinking and problem-solving processes that support knowledge construction. Behavioral CAD facilitates such involvement by incorporating structured activities, interactive elements, and reinforcement strategies that respond to learners' actions during instruction.

Steps Required in Designing Behavioral Computer-Aided Design

The design of Behavioral Computer-Aided Design follows a systematic process that ensures instructional materials are aligned with pedagogical objectives and learner needs. The design process involves preliminary planning, detailed design, and continuous evaluation to ensure instructional adequacy. These stages are particularly important in community-based educational service programs, where instructional materials must be adaptable to diverse teaching contexts. The steps required in designing Behavioral CAD, as identified in the literature, emphasize instructional objectives, content organization, and the selection of appropriate CAD types [13].

Clear instructional objectives guide teachers in determining expected learning outcomes and observable behavioral changes. These objectives typically reflect different levels of cognitive processing, including knowledge acquisition, comprehension, application, analysis, synthesis, and evaluation. Instructional Design models, such as the ADDIE framework, further support the systematic development of instructional materials through analysis, design, development, implementation, and evaluation stages. This process enables teachers to refine instructional content based on learner feedback and instructional effectiveness, which is essential for addressing pedagogical challenges in curriculum-oriented instruction. The stages of instructional design applied in this study are illustrated in Figure 1, which outlines the sequential steps involved in developing effective instructional materials.

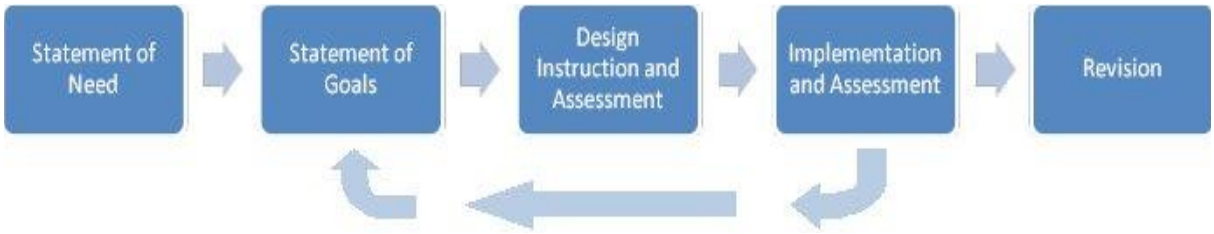

Figure 1: Five Steps of the Instructional Design Model.

Conceptualizing the Expert Touch Inventory (ETI) in Community-Based Teacher Empowerment

The Expert Touch Inventory (ETI) was conceptualized as an evaluative instrument to support the assessment of instructional materials developed through Behavioral Computer-Aided Design within educational communities. In the context of community-based educational service, ETI functions as a structured tool for examining the pedagogical adequacy of computer-based instructional resources produced by teachers and prospective instructional designers.

The inventory emphasizes the alignment of instructional objectives, content organization, activity sequencing, and evaluation procedures, which are essential components of effective instructional practice [2]. ETI is grounded in the assumption that well-designed instructional materials can influence teachers' pedagogical competence and learners' behavioral responses. The conceptual basis of ETI reflects principles from behavioral learning theory, which highlight

the importance of reinforcement, observable outcomes, and systematic instructional stimuli in facilitating learning. Within community service initiatives, ETI supports reflective practice by enabling experts to provide structured feedback that assists teachers in improving instructional design quality and addressing pedagogical challenges. The predictors assessed by ETI include the balance of logogens and images, clarity of instructional objectives, adequacy of content organization, and appropriateness of evaluation strategies, as emphasized in multimedia learning and cognitive load theories [1]. By applying ETI in a community-based empowerment program, instructional designers and teachers are supported in developing pedagogically sound Computer-Based Instruction that aligns with curriculum demands and classroom realities.

Methods

This community-based educational service program employed a qualitative-oriented evaluation framework supported by structured assessment instruments to examine the empowerment of Information and Communication Technology teachers through a behavioral approach to Computer-Aided Design. The methodological approach was designed to document instructional practices, gather professional feedback, and evaluate the pedagogical adequacy of computer-based instructional materials developed within the community service context. An ex post facto design was adopted because the instructional products and teaching practices evaluated in this program had already been implemented prior to the assessment stage. This design was considered appropriate for community-based service evaluation, as it allowed the examination of existing instructional resources and pedagogical practices without experimental manipulation.

Participants and Community Context

The participants in this community-based service program consisted of Information and Communication Technology teachers drawn from secondary schools in Education District III, Lagos State, Nigeria. A total of forty teachers participated in providing feedback on the use of Computer-Based Instruction resources in classroom practice.

The selection of participants followed a purposeful stratified sampling approach to ensure representation across school zones and teaching contexts within the community. In addition to the teachers, instructional materials produced by final-year undergraduate students specializing in instructional technology were included as part of the service activity. These materials were developed under academic supervision and evaluated as practical outputs intended to support teaching and learning in partner schools within the community.

Community-Based Instructional Intervention

The core service activity involved the development and evaluation of Computer-Based Instruction resources designed using a behavioral approach to Computer-Aided Design. These instructional materials were produced to support curriculum-oriented instruction and address pedagogical challenges identified by participating teachers. The intervention emphasized learner-centered instructional strategies, structured instructional objectives, and the integration of multimedia elements to enhance engagement and comprehension. The instructional resources were shared with participating schools as part of the community service initiative. Teachers were encouraged to review, utilize, and reflect on the materials based on their classroom experiences, thereby fostering professional learning and collaborative engagement between instructional designers and school communities.

Instruments for Community Service Evaluation

Two structured instruments were employed to support the evaluation of the community-based service program. The Expert Touch Inventory was used by instructional design and educational technology experts to assess the pedagogical adequacy of the Computer-Based Instruction materials. The inventory focused on instructional objectives, content organization, activity sequencing, multimedia integration, and evaluation alignment. In addition, the Information and Communication Technology Teachers Scale was administered to participating teachers to elicit their perceptions of the instructional materials and the usefulness of Computer-Based Instruction in classroom practice. The scale examined teachers' views on instructional clarity, curriculum relevance, learner engagement, and the practicality of implementing the materials in real teaching contexts.

Data Collection Procedures

Data collection was conducted through expert review sessions and teacher feedback activities organized as part of the community service program. Instructional materials were evaluated using the Expert Touch Inventory, while teachers completed the perception scale after reviewing selected instructional resources. These procedures allowed the collection of reflective and evaluative data that informed the assessment of the service program's pedagogical impact.

Data Analysis

The data obtained from expert evaluations and teacher responses were analyzed using descriptive and inferential procedures consistent with the objectives of the community-based service program. The analysis focused on identifying patterns related to instructional adequacy, teacher perceptions, and pedagogical implications. The results were interpreted in relation to teacher empowerment, instructional improvement, and the sustainability of Computer-Aided Design–based community service initiatives.

Results and Discussion

Results of the Program

This section presents the results of the community-based educational service program aimed at empowering Information and Communication Technology teachers through a behavioral approach to Computer-Aided Design for curriculum-oriented instruction.

The results are organized according to the research questions, focusing on the pedagogical adequacy of Behavioral Computer-Aided Design instructional materials and teachers' perceptions of Computer-Based Instruction as a tool for instructional improvement within school communities.

Pedagogical Adequacy of Behavioral Computer-Aided Design

To evaluate the pedagogical adequacy of Behavioral Computer-Aided Design instructional materials developed as part of the community service program, expert assessments were conducted using the Expert Touch Inventory. Sixty Computer-Based Instruction compact discs produced by prospective instructional designers were evaluated to determine the extent to which instructional objectives, content organization, activity sequencing, and evaluation procedures aligned with pedagogical standards and curriculum requirements. This evaluation process provided evidence of the instructional quality of the materials shared with participating schools and supported reflective practice among teachers and instructional designers. The results of the regression analysis examining the relationship between the instructional components assessed by the Expert Touch Inventory and overall instructional adequacy are summarized in Table 2.

The analysis indicates a strong association between the structured elements of Behavioral Computer-Aided Design and the pedagogical quality of the instructional materials. These findings suggest that instructional resources developed through a behavioral approach to Computer-Aided Design are capable of supporting curriculum-oriented instruction when systematically designed and evaluated. Table 2 presents the regression summary explaining the performances of the Behavioral Computer-Aided Design compact discs.

Variable	Value
Multiple R	0.92856
R Square	0.85631
Adjusted R Square	0.81920
Standard Error	0.50863

Table 2: Regression Summary of ETI Explaining the Performance of BCAD Compact Discs.
Note: F = 25.0512, significant at $p < 0.05$.

The strong relationship observed in Table 2 indicates that the techniques adopted for assessing the pedagogical adequacy of Behavioral Computer-Aided Design materials are appropriate and reliable for evaluating instructional resources used in community-based teacher empowerment initiatives. From a service perspective, this result highlights the value of structured expert feedback in supporting teachers' professional learning and improving the quality of instructional materials shared within educational communities. Further evidence of the reliability of the Expert Touch Inventory is presented through the Guttmann split-half reliability coefficients of its four sections, as shown in Table 3. These coefficients demonstrate the internal consistency of the inventory across different instructional components, including instructional objectives, content organization, activity sequencing, and evaluation alignment. Table 3 summarizes the Guttmann split-half reliability coefficients for the four sections of the Expert Touch Inventory.

Variable Section	Reliability Coefficient
Section A	0.8563
Section B	0.9021
Section C	0.6708
Section D	0.8146

Table 3: Guttmann Split-Half Reliability Coefficient of the ETI.

The reliability values reported in Table 3 indicate that the Expert Touch Inventory provides a consistent framework for evaluating the pedagogical quality of instructional materials developed through Behavioral Computer-Aided Design. Section B recorded the highest reliability coefficient, reflecting strong consistency in the assessment of content organization and alignment with instructional objectives. Section C recorded a relatively lower coefficient, which may be attributed to variations in the use of multimedia elements such as audio and animation. Within the context of community-based educational service, this finding underscores the need for continued professional support to enhance teachers' skills in multimedia integration and instructional media design.

Teachers' Perceptions of Computer-Based Instruction

In addition to expert evaluations, the perceptions of Information and Communication Technology teachers regarding the use of Computer-Based Instruction were examined to understand the practical relevance of the instructional materials within classroom settings. Teachers' responses were collected using the Information and Communication Technology Teachers Scale and analyzed to identify trends related to instructional confidence, curriculum alignment, and perceived pedagogical value. The summary of teachers' responses is presented in Table 4, which highlights their views on various aspects of Computer-Based Instruction, including usability, instructional relevance, and contribution to learners' scientific and technological literacy. The results indicate generally positive perceptions of Computer-Based Instruction as a supportive tool for classroom practice. Table 4 presents the responses of Information and Communication Technology teachers on the use of Computer-Based Instruction compact discs in teaching.

Item	Mean
Confidence in using CBI CDs	2.69
Usefulness for all students	3.01
Curriculum-based content	3.48
Organization around objectives	2.57
Subject- and topic-based design	3.65
Use of simple and clear language	3.52
Optional use of CBI CDs	2.11*
Relation to teacher qualification	2.04*
Contribution to scientific and ICT literacy	3.25
Curriculum-driven production	1.98*

Table 4: ICT Teachers' Responses on the Use of CBI CDs in Teaching.

Note : Negative items.

The results presented in Table 4 indicate that teachers strongly supported the use of Computer-Based Instruction materials that are aligned with curriculum content and instructional objectives. Teachers expressed confidence in using these materials and recognized their potential to enhance learners' understanding and engagement. The negative responses associated with optional usage and teacher qualification suggest that teachers perceive Computer-Based Instruction as a pedagogical necessity rather than an optional supplement, reinforcing the importance of structured instructional design in community-based teacher development programs.

Discussion: Implications for Community-Based Teacher Empowerment

The findings of this community-based educational service program demonstrate that Behavioral Computer-Aided Design can effectively address pedagogical challenges faced by Information and Communication Technology teachers in curriculum-oriented instruction. The strong alignment between instructional design quality and pedagogical adequacy observed in the expert evaluations reflects the relevance of behavioral principles in guiding instructional material development. By emphasizing clear instructional objectives, sequenced learning activities, and reinforcement mechanisms, Behavioral Computer-Aided Design supports meaningful learning and instructional consistency. From a community service perspective, the positive perceptions expressed by teachers highlight the value of collaborative instructional development and reflective practice.

Teachers' recognition of Computer-Based Instruction as a tool for enhancing curriculum delivery and scientific literacy aligns with previous studies emphasizing the role of structured instructional design in improving teaching effectiveness (see https://digitalcommons.odu.edu/cgi/viewcontent.cgi?article=1046&context=ots_masters_projects) [1]. These findings suggest that community-based initiatives that integrate instructional technology and pedagogical support can contribute to sustainable teacher empowerment and instructional improvement. The instructional design process applied in this program is consistent with established models of instructional development, as illustrated in Figure 1, which outlines the sequential stages involved in designing effective instructional materials. This model supports systematic planning, development, and evaluation, enabling teachers to refine instructional practices based on feedback and classroom experiences.

The positive outcomes observed in this community-based educational service program also reflect the importance of structured evaluation mechanisms in supporting teacher empowerment. The use of the Expert Touch Inventory as an evaluative framework enabled experts to provide systematic feedback on instructional materials, thereby fostering reflective practice among teachers and instructional designers. In community service contexts, such structured feedback mechanisms are essential because they allow practitioners to identify strengths and areas for improvement without relying solely on informal or subjective judgments [2]. The relatively lower reliability coefficient observed in the multimedia-related section of the Expert Touch Inventory suggests that teachers and instructional designers may require additional support in integrating auditory and visual elements effectively. This finding aligns with multimedia learning

theory, which emphasizes that instructional effectiveness depends not merely on the presence of multimedia elements but on their appropriate integration to support cognitive processing [1]. Within community-based teacher development initiatives, this highlights the need for targeted capacity-building activities that focus on multimedia design principles and their pedagogical applications.

Teachers' responses further reinforce the role of Computer-Based Instruction as a practical tool for addressing pedagogical challenges in classroom settings. The strong agreement on curriculum alignment and instructional relevance indicates that teachers value instructional materials that are directly connected to prescribed learning objectives and classroom realities. This perspective is consistent with instructional design principles that emphasize alignment between objectives, content, activities, and assessment as a foundation for effective teaching and learning. In the context of community service, such alignment contributes to the sustainability of instructional innovations, as teachers are more likely to adopt and maintain practices that support curriculum demands. The negative responses related to optional use and teacher qualification reveal an important insight into teachers' professional beliefs. Rather than viewing Computer-Based Instruction as an optional enhancement, teachers perceive it as an essential component of modern instructional practice. This perception underscores the evolving role of Information and Communication Technology teachers within educational communities, where technological competence is increasingly linked to pedagogical effectiveness and professional identity. Similar observations have been reported in studies emphasizing the role of structured instructional processes in improving teaching performance [9]. From a behavioral perspective, the findings support the assumption that instructional materials designed around clear objectives, reinforcement mechanisms, and observable outcomes can influence teaching practices and learner engagement. Behavioral learning theory emphasizes that structured instructional stimuli and feedback play a critical role in shaping behavior and learning outcomes. In this community-based program, the behavioral approach to Computer-Aided Design provided teachers with a practical framework for organizing instructional content in ways that support gradual skill development and learning retention. The implications of these findings extend beyond individual classrooms to the broader educational community. By engaging teachers in the evaluation and reflection process, the program fostered a sense of shared responsibility for instructional quality and professional growth. Community-based educational service initiatives that prioritize collaborative learning and reflective practice contribute to the development of professional learning communities, where teachers learn from one another and collectively address pedagogical challenges. Such collaborative environments are particularly valuable in contexts where access to formal professional development opportunities may be limited. The instructional design process employed in this program also reflects the principles of systematic instructional development models.

As previously noted, the stages of instructional design illustrated in Figure 1 emphasize analysis, design, development, implementation, and evaluation as interconnected processes that support instructional improvement. These stages enable teachers to refine instructional materials based on feedback and classroom experiences, thereby promoting continuous improvement in teaching practices. In addition to the instructional design model, the evaluation procedures applied in this program relied on structured rating criteria to ensure consistency and clarity in expert assessments.

The rating scale used to evaluate instructional materials provided a common reference point for experts and supported objective judgment of instructional quality. This evaluation framework is illustrated in Figure 2, which outlines the rating scale used for sectional test items.

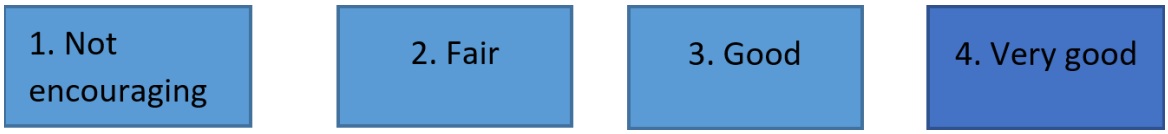

Figure 2: Rating Scale for Sectional Test Items.

The use of a structured rating scale is particularly relevant in community-based educational service contexts, where evaluators may come from diverse professional backgrounds. By providing clear criteria for assessment, the rating scale minimizes subjectivity and enhances the reliability of expert feedback. This approach aligns with best practices in instructional evaluation, which emphasize the importance of clear benchmarks and transparent assessment procedures. The findings of this study also resonate with social constructivist perspectives on learning, which emphasize the role of social interaction and collaboration in knowledge construction. Although the instructional materials were designed using a behavioral framework, their implementation and evaluation occurred within a collaborative community setting.

Teachers engaged with instructional designers and experts, shared experiences, and reflected on instructional practices, thereby creating opportunities for social learning and professional growth. This integration of behavioral design principles with community-based collaboration represents a balanced approach to instructional improvement. Furthermore, the emphasis on curriculum-oriented instruction reflects the practical realities faced by teachers in school communities.

Teachers are often required to balance innovative instructional approaches with strict curriculum requirements and assessment standards. The behavioral approach to Computer-Aided Design adopted in this program supported teachers in navigating these demands by providing structured instructional templates that align with curriculum objectives while

allowing flexibility in instructional delivery. This balance is critical for ensuring that instructional innovations are both pedagogically sound and contextually relevant.

The sustainability of the community-based educational service program is also an important consideration. Teachers' positive perceptions of Computer-Based Instruction suggest a willingness to continue using and adapting instructional materials beyond the duration of the program. Sustainability in community service initiatives depends on the perceived relevance, practicality, and impact of the intervention on participants' professional practice. By addressing pedagogical challenges that teachers encounter in their daily work, the program increased the likelihood of sustained adoption and long-term impact. Finally, the findings underscore the potential of community-based educational service programs to contribute to broader educational improvement efforts. By focusing on teacher empowerment and instructional quality, such programs can support systemic change in teaching practices and learning environments. The integration of behavioral instructional design principles, expert evaluation, and teacher reflection provides a comprehensive framework for addressing pedagogical challenges and enhancing instructional effectiveness within educational communities. An important contribution of this community-based educational service program lies in its emphasis on sustainability and long-term pedagogical impact. Unlike short-term training interventions, the program focused on empowering teachers with transferable instructional design skills that can be applied across subjects and teaching contexts. The use of Behavioral Computer-Aided Design provided teachers with a structured framework for organizing instructional objectives, learning activities, and evaluation procedures, thereby supporting consistent instructional practice over time. Such sustainability is a key indicator of effective community service in education, as it ensures that benefits extend beyond the immediate duration of the program. The findings further suggest that the integration of expert evaluation and teacher reflection plays a crucial role in strengthening pedagogical competence. By engaging experts to assess instructional materials using the Expert Touch Inventory, teachers received targeted feedback that informed their instructional decisions and design practices. This process aligns with instructional design literature emphasizing the importance of formative evaluation in improving instructional quality and professional practice. In community-based contexts, expert-supported reflection enables teachers to refine instructional strategies while maintaining alignment with curriculum standards. From a behavioral learning perspective, the structured nature of the instructional materials evaluated in this program reinforces the importance of reinforcement and feedback in shaping teaching and learning behaviors. Behavioral theory posits that observable outcomes and systematic reinforcement contribute to learning retention and skill development.

The instructional materials developed through Behavioral Computer-Aided Design incorporated these principles by emphasizing clear instructional objectives, sequenced content, and immediate feedback mechanisms. As a result, teachers were able to design learning experiences that support gradual mastery and learner engagement.

The pedagogical challenges addressed through this community-based initiative are common in many educational settings, particularly those undergoing rapid technological change. Teachers often face difficulties related to instructional organization, integration of multimedia elements, and alignment of instructional materials with curriculum requirements. The findings of this program demonstrate that structured instructional design approaches can effectively address these challenges by providing teachers with practical tools and conceptual frameworks grounded in educational theory [1,12,14,15]. This reinforces the relevance of instructional design principles in community service initiatives aimed at improving teaching quality. The collaborative nature of the program also contributed to its pedagogical impact.

Teachers participated not only as recipients of instructional materials but also as active contributors to the evaluation and reflection process. This collaborative engagement fostered a sense of ownership and professional agency among teachers, which is essential for sustained instructional improvement. Social constructivist perspectives emphasize that learning and professional growth occur through interaction, dialogue, and shared experience. By embedding collaboration within the community service framework, the program supported collective problem-solving and professional learning.

Another significant implication of the findings relates to curriculum-oriented instruction. Teachers expressed strong support for instructional materials that are directly aligned with curriculum objectives and classroom needs. This preference highlights the importance of contextual relevance in instructional innovation.

Instructional materials that are perceived as disconnected from curriculum demands are less likely to be adopted or sustained in practice. The behavioral approach to Computer-Aided Design supported curriculum alignment by emphasizing instructional objectives as the foundation of material development, thereby enhancing the practical value of the instructional resources shared with schools. The evaluation results also highlight areas for further development in community-based teacher empowerment initiatives. The relatively lower consistency observed in the multimedia-related assessment component suggests that teachers may benefit from additional support in integrating audio, animation, and visual elements effectively. Multimedia learning theory cautions that poorly designed multimedia can increase cognitive load and hinder learning [1,16-18]. Community service programs should therefore include targeted capacity-building activities focused on multimedia design principles to enhance instructional effectiveness. The use of structured evaluation tools, such as the rating scale illustrated in Figure 2, further contributed to the clarity and reliability of the assessment process. By providing explicit criteria for evaluation, the scale supported consistent judgments across evaluators and minimized subjective interpretation. Such structured assessment approaches are particularly

valuable in community-based programs where evaluators may have diverse professional backgrounds. Clear evaluation criteria enhance transparency and trust in the assessment process, which are essential for constructive feedback and professional growth.

The instructional design framework illustrated in Figure 1 also played a central role in guiding the development and evaluation of instructional materials. The systematic stages of analysis, design, development, implementation, and evaluation provided a coherent structure for instructional improvement. Teachers were able to identify instructional needs, design appropriate materials, implement them in classroom contexts, and reflect on their effectiveness. This cyclical process supports continuous improvement and aligns with best practices in instructional design and educational development. Beyond individual teacher development, the program has broader implications for educational communities and policy. Community-based educational service initiatives that focus on teacher empowerment can contribute to systemic improvement by enhancing instructional capacity at the school level. When teachers are equipped with effective instructional design skills, they are better positioned to support learner achievement and adapt to changing educational demands. Such initiatives complement formal professional development programs and can play a critical role in addressing gaps in instructional support, particularly in resource-constrained contexts.

The findings of this study also suggest that integrating instructional technology into community service programs can enhance the relevance and impact of such initiatives. By focusing on practical instructional challenges and providing teachers with hands-on experience in instructional design, the program bridged the gap between theory and practice.

This approach aligns with contemporary views of teacher professional development, which emphasize experiential learning, reflection, and collaboration as key components of effective professional growth. Finally, the results underscore the importance of aligning community service initiatives with both pedagogical theory and practical classroom realities.

The behavioral approach to Computer-Aided Design provided a theoretically grounded framework for instructional development, while the community-based implementation ensured contextual relevance and sustainability.

This integration of theory, practice, and community engagement represents a holistic approach to educational service that can be adapted and replicated in other educational contexts. Overall, the findings of this community-based educational service program demonstrate that empowering Information and Communication Technology teachers through a behavioral approach to Computer-Aided Design can effectively address pedagogical challenges, enhance instructional quality, and support sustainable professional development. The program highlights the potential of instructional design–based community service initiatives to contribute meaningfully to educational improvement by fostering teacher competence, collaboration, and reflective practice.

Conclusion

This community-based educational service program demonstrates that empowering Information and Communication Technology teachers through a behavioral approach to Computer-Aided Design effectively addresses pedagogical challenges in curriculum-oriented instruction. The integration of structured instructional design, expert evaluation, and teacher reflection strengthened teachers' pedagogical competence and supported the development of meaningful computer-based instructional resources. Teachers' positive perceptions indicate the practical relevance and sustainability of the program within school communities. By combining behavioral instructional principles with collaborative community engagement, the program offers a replicable model for enhancing instructional quality and professional development through educational technology–based community service initiatives.

Authors' Note

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

References

1. Mayer, R. E. (2003). The promise of multimedia learning: using the same instructional design methods across different media. Learning and instruction, 13(2), 125-139.
2. Sweller, J. (2002, July). Visualisation and instructional design. In Proceedings of the International Workshop on Dynamic Visualizations and Learning (Vol. 18, pp. 1501-1510). Tübingen: Knowledge Media Research Center.
3. Arciosa, R. M., Perfecio, J., & Cerado, E. C. (2022). Community extension: Literacy and numeracy enhancement program for alternative learning system and out-of-school youth learners. ASEAN Journal for Science Education, 1(2), 75-80.
4. Lawal, S. O. (2024). The economics of recycling: A review compiled with tax and subsidiary, implication for government, decision-makers, enterprises, community, and analysis cost/benefit and market. ASEAN Journal of Economic and Economic Education, 3(2), 165-188.
5. Oladimeji, R.M., Odefunsho, O.A., and Adeoye, M.A. (2023). Community service perspective on intervention strategies by parents-teachers associations: Challenges and prospect. ASEAN Journal of Community Service and Education, 2(1), 45-50.
6. Saadu, U.T. (2023). Influence of parenting styles on moral skills acquisition of primary school pupils: Community

service perspective. ASEAN Journal of Community Service and Education, 2(2), 105-116.
7. Jibril, A. O., Issa, U. A., & Abidemi, S. R. (2023). Unveiling social consequences: Examining effects of tricycle transportation's riders (keke napep) growth from a community service perspective. ASEAN Journal of Community Service and Education, 2(2), 117-126.
8. Ademilua, O. S., Gbotoso, A. O., & Abulude, F. O. (2024). Promoting community learning strategies to promote library services to rural dwellers in Nigeria. ASEAN Journal of Community Service and Education, 3(2), 95-110.
9. OLATOYE, M. A. (2017). Structured Instructional Process And Performance of Junior Secondary School 2 Students in Mathematics. Jurnal Pendidikan Malaysia, 42(2).
10. Sweller, J., & Chandler, P. (1994). Why some material is difficult to learn. Cognition and instruction, 12(3), 185-233.
11. Paas, F., Renkl, A., & Sweller, J. (2004). Cognitive load theory: Instructional implications of the interaction between information structures and cognitive architecture. Instructional science, 32(1/2), 1-8.
12. Hasselbring, T. S. (1986). Research on the effectiveness of computer-based instruction: A review. International review of education, 32(3), 313-324.
13. Mayer, R. E. (1992). Cognition and instruction: Their historic meeting within educational psychology. Journal of educational Psychology, 84(4), 405.
14. Perez, E., Manca, S., Fernández-Pascual, R., & Mc Guckin, C. (2023). A systematic review of social media as a teaching and learning tool in higher education: A theoretical grounding perspective. Education and Information Technologies, 28(9), 11921-11950.
15. Lindqvist, H., & Forsberg, C. (2023). Constructivist grounded theory and educational research: Constructing theories about teachers' work when analysing relationships between codes. International Journal of Research & Method in Education, 46(2), 200-210.
16. Liu, D. (2024). The effects of segmentation on cognitive load, vocabulary learning and retention, and reading comprehension in a multimedia learning environment. BMC psychology, 12(1), 4.
17. de Muñoz, J. H. O., & Letouze, P. (2022). Some considerations on the principles of the Cognitive Theory of Multimedia Learning for instructional video design for the elderly. Research, Society and Development, 11(10), e499111032333-e499111032333.
18. Krieglstein, F., Beege, M., Rey, G. D., Ginns, P., Krell, M., & Schneider, S. (2022). A systematic meta-analysis of the reliability and validity of subjective cognitive load questionnaires in experimental multimedia learning research. Educational Psychology Review, 34(4), 2485-2541.