From Implementation Barriers to Instructional Scaffolds: An ADDIE-Guided Learning Kit for Web-Based Programming Education

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ABSTRACT

This article examines how implementation barriers identified during use of a web-based programming resource were translated into an evidence-informed instructional learning kit for resource-constrained schools. It draws on the implementation and development strand of a broader developmental study involving 105 purposively selected respondents—65 students, 30 ICT teachers, and 10 IT professionals. Structured challenge items and open-ended feedback identified interconnected technical, content-related, usability, and pedagogical problems. The parent study highlighted slow loading times (59.0%), unclear instructions (43.8%), lack of practice exercises (41.0%), and lack of teacher tools (60.0%) as prominent concerns. Guided by the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model, these findings informed a learning kit comprising a comprehensive user's manual, teacher guides, offline activities, and troubleshooting protocols. The article contributes a design pathway in which user-reported barriers become explicit scaffolds for continuity, teacher facilitation, practice, and first-line technical support. The approach is particularly relevant where connectivity and instructional resources are uneven.

Keywords: ADDIE; instructional learning kit; programming education; implementation barriers; pedagogical scaffolding; resource-constrained schools

INTRODUCTION

Digital learning resources are often evaluated as products, yet successful educational implementation depends on more than software functionality. Learners may face slow access, unclear directions, limited practice opportunities, and device constraints; teachers may lack tools for lesson integration, assessment, monitoring, and troubleshooting. These problems are especially consequential in resource-constrained schools, where a temporary technical failure can become an instructional interruption.

Research on Philippine online learning has documented technological, environmental, and learner-related barriers (Barrot et al., 2021), while broader work on educational technology cautions against assuming that access to technology automatically produces better learning (UNESCO, 2023). A structured instructional-design process is therefore needed to convert contextual evidence into implementation support. The ADDIE framework offers such a process through iterative Analysis, Design, Development, Implementation, and Evaluation (Branch, 2009).

This article is deliberately distinct from the separately prepared stakeholder-gap and ISO/IEC 25010 article. Its contribution is developmental: it focuses on implementation barriers and the evidence-informed instructional kit created in response.

OBJECTIVES

The study aimed to identify major barriers encountered in using the web-based programming resource and to explain how those findings were translated, through ADDIE, into an instructional learning kit for constrained educational contexts.

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METHODOLOGY

The parent study used a developmental quantitative design with qualitative support. The dissertation abstract reports 105 purposively selected respondents: 65 students, 30 ICT teachers, and 10 IT professionals. Challenge data covered technical issues, content-related challenges, and usability or pedagogical limitations. Open-ended responses supplied contextual detail. Thematic analysis was used in the parent study to organize qualitative feedback.

The ADDIE model guided development. Analysis included curriculum review, consultation with ICT teachers, and identification of learner challenges. Design established learning objectives, module structure, navigation, assessments, exercises, and supplementary resources. Development produced application content and associated support materials. Implementation involved deployment, orientation, and technical support. Evaluation combined iterative refinement with survey evidence, learning-outcome analysis, and user feedback.

RESULTS

The parent study identified barriers that crossed technical and pedagogical boundaries. Four prominent concerns were slow loading times (59.0%), unclear instructions (43.8%), lack of practice exercises (41.0%), and lack of teacher tools (60.0%). Open-ended feedback additionally described lag, nonresponsive features, and access problems. The pattern indicates that implementation problems cannot be addressed solely through software modification; some require instructional continuity mechanisms and teacher-facing support.

Observed barrier	Reported proportion	Implementation needs
Lack of teacher tools	60.0%	Facilitation, lesson integration, assessment support
Slow loading times	59.0%	Low-bandwidth continuity and offline alternatives
Unclear instructions	43.8%	Step-by-step guidance and clearer task directions
Lack of practice exercises	41.0%	Additional guided and independent practice

ADDIE-GUIDED TRANSLATION INTO THE LEARNING KIT

Analysis converted user problems into requirements. Connectivity and loading concerns created a requirement for continuity when the platform was unavailable or slow. Unclear instructions created a requirement for explicit user guidance. Insufficient practice created a requirement for supplementary activities. Limited teacher tools created a requirement for structured teacher-facing materials.

Design mapped these requirements to four principal components: a comprehensive user's manual, teacher guides, offline activities, and troubleshooting protocols. Development produced the materials and aligned them with the intended programming-learning context. Implementation included orientation and technical support. Evaluation used user feedback and the broader study findings to refine the final kit.

Evidence from use	Kit component	Intended scaffold
Unclear instructions	Comprehensive user's manual	Reduce ambiguity; support independent navigation
Lack of teacher tools	Teacher guides	Support facilitation, lesson planning, and assessment
Slow loading / unreliable access	Offline activities	Preserve learning continuity
Lack of practice exercises	Supplementary and offline practice	Increase opportunities for deliberate practice
Login, loading, upload, compatibility problems	Troubleshooting protocols	Enable first-line problem resolution

The final resource included teacher support tools, offline alternatives such as printable worksheets and unplugged programming exercises, and troubleshooting guidance for common login, loading, upload, and

compatibility problems. This design treats the kit as a bridge between platform capability and classroom reality.

DISCUSSION

The principal contribution is the translation logic from barrier to scaffold. Slow loading is not merely a performance complaint; instructionally, it creates a continuity risk. The appropriate response therefore includes both technical optimization and an alternative learning pathway. Similarly, unclear instructions are not only a content defect; they increase dependence on teacher intervention and can suppress independent learning. A user manual and task-oriented guidance directly address that mechanism.

The lack of teacher tools was the most prominent of the four highlighted concerns. This supports the view that teacher readiness and facilitation are central to educational technology implementation. Teacher guides, planning templates, and assessment supports can make platform use more coherent with curriculum and classroom routines.

ADDIE was useful because it linked diagnosis with iterative development rather than treating the kit as an afterthought. In resource-constrained settings, this approach is valuable: implementation supports can be designed around actual interruptions, user confusion, and teacher needs. The resulting kit is therefore best understood as pedagogical infrastructure surrounding the web application.

LIMITATIONS

The barrier frequencies are context dependent and should not be generalized to all schools. The study used purposive sampling and mixed perception-based evidence rather than a randomized comparison. The instructional kit was derived from empirical findings, but its incremental effect over the platform alone requires separate evaluation. Future studies should compare platform-only and platform-plus-kit conditions, measure teacher fidelity of use, and test offline components during actual connectivity disruptions.

CONCLUSION

Users encountered interconnected technical, content, usability, and pedagogical barriers. Prominent concerns included lack of teacher tools, slow loading, unclear instructions, and insufficient practice exercises. Through ADDIE, these findings were translated into a user's manual, teacher guides, offline activities, and troubleshooting protocols. The study demonstrates a practical principle for constrained contexts: implementation problems should become explicit design inputs for instructional scaffolding and continuity planning.

DECLARATIONS

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