International Journal for Educational Media and Technology
2025, Vol.19, No. 1, pp.36-49

Developing an Online Job Aid to Help Middle Leaders Design Professional Development Training for School Teachers

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Middle leaders in educational settings often struggle to design professional development (PD) programs for technology integration due to time constraints and limited specialized knowledge. This study addresses this challenge by proposing an online job aid as a workplace learning mechanism. Guided by instructional design principles, the system provides a structured step-by-step approach to developing PD programs. To guide this study, the following research question was posed: How can an online job aid be designed to support middle leaders in planning and facilitating effective in-school PD programs for ICT integration, while addressing limitations of traditional support tools? A mixed-methods evaluation, comprising a questionnaire survey and interviews, was conducted to assess the job aid's effectiveness.
Results show that the job aid significantly enhanced middle leaders' training design capabilities by providing features such as guided design processes, essential information inputs, and access to shared training designs. While outcomes were promising, the study also identified areas for improvement in design flexibility and the user interface. This research offers a practical solution for supporting technology integration in educational professional development and has potential for future AI-enhanced capabilities.

Keywords: Professional Development, Middle Leadership, Technology Integration, Job Aid, Instructional Design

Background

Creating an environment where teachers learn from one another is essential for improving classroom instruction. Research on professional learning communities (Westheimer, 2006; Lieberman & Miller, 2008) and lesson studies (Lewis, 2000) underscores the value of collaborative learning. According to the OECD TALIS survey (OECD, 2020), "formal school initiatives such as peer observation, self-observation, and coaching activities" are widely recognized as key components of professional development, with 49.3% of teachers participating in these activities. To promote a productive learning environment, it is crucial to have individuals within the school who can provide leadership and facilitate collaboration among teachers.

Middle leaders—defined as teachers who hold formal or informal leadership responsibilities within their schools while maintaining classroom teaching duties—play a key role in fostering a collaborative learning culture and improving schools. Unlike senior administrators, they work within teaching teams, offering direct support to colleagues while ensuring school-wide policy implementation (Harris & Jones, 2017). Their role is crucial in bridging the gap between teachers and administrators, aligning instructional practices with institutional goals. By mentoring colleagues, organizing professional development initiatives, and leading pedagogical discussions, middle leaders contribute to building a culture of continuous learning. Consequently, their professional growth is a critical driver of sustainable school improvement.

According to Irvine and Brundrett (2019), middle leaders must shift from teaching students to mentoring fellow educators, requiring skills such as leadership, relationship management, and time management. Gurr and Drysdale (2013) emphasized that the success of middle leaders depends on proper guidance, mentoring, and professional development (PD) programs. To support the development of school middle leaders, universities and training organizations offer various programs, such as graduate programs and specialized workshops and certifications. These initiatives enable teachers assuming middle leadership roles to acquire essential skills.

However, middle leaders often have workload pressures and limited time for professional learning, along with other challenges such as relationships with colleagues and parents (Kavanagh et al., 2021). To enhance their skills, middle leaders require both—a strategic vision and individualized support abilities (Gear & Sood, 2021).

Developing a new learning framework for middle leaders that considers time constraints is essential to addressing these challenges. Traditional training programs often face logistical and scheduling limitations, and their content may not always align with the realities of day-to-day responsibilities. A more practical and effective approach involves creating an environment where middle leaders can learn through hands-on experience in the workplace. For instance, utilizing on-the-job training and peer coaching allows middle leaders to apply their learning directly to their practice. This approach minimizes travel requirements and additional time commitments associated with conventional training while enabling continuous professional growth within their daily work environment.

This study proposes the development of an online job aid as a workplace learning mechanism. A job aid is defined as "a repository for information, processes, or perspectives that is external to the individual and that supports work and activity by directing, guiding, and enlightening performance" (Rossett & Schafer, 2007). It is a tool that facilitates learning through daily tasks by providing necessary information in real-time, thereby mitigating time constraints typically associated with traditional learning processes. This approach helps middle leaders acquire essential knowledge and skills while simultaneously carrying out their responsibilities. Furthermore, utilizing a job aid enables middle leaders to deepen their learning through direct application in their work, enhancing their professional competencies.

Building on existing theories and practices related to job aids and information and communication technology (ICT) integration, this research introduces a new approach to addressing challenges faced by middle leaders in designing and managing in-school training programs, especially time constraints and a lack of specialized knowledge. The originality of this study lies in demonstrating a concrete method through which middle leaders can efficiently guide and promote ICT integration through job aids.

The selected theme for the job aid is the design of PD programs for Technology Integration, equipping middle leaders with the tools to plan and implement training initiatives for their colleagues. This theme was chosen due to the high demand for PD in ICT utilization for teaching and its central role in school reform. In schools where ICT is integrated into education, middle leaders are expected to effectively plan and manage in-school training programs (Terashima, 2019). The global relevance of this topic has been highlighted in recent studies. For example, the OECD TALIS 2018 survey indicates that the demand for PD in ICT use in teaching surpasses that for other instructional methods, such as differentiated learning and student assessment strategies (OECD, 2020).

To address these demands, this study develops a job aid to facilitate ICT integration, enabling middle leaders to effectively guide and promote the use of technology in the classroom through well-designed training programs. The implementation and evaluation of this job aid will be explored in detail in the subsequent sections. Specifically, this study investigates the following research question: How can an online job aid be designed to support middle leaders in planning and facilitating effective in-school PD programs for ICT integration, while addressing limitations of traditional support tools?

Related Literature

This study positions technology integration not merely as an instructional goal within classrooms, but as a process that must be supported by middle leaders through in-school professional development programs. From this perspective, the following review addresses two key areas: (1) job aids as tools for workplace learning, and (2) the role of middle leaders in facilitating ICT-related training within schools.

Job Aids and Workplace Learning

Workplace learning, the process of acquiring knowledge and skills through job-related activities, has long been a focus of educational technology research. Unlike traditional training programs, workplace learning is integrated into daily tasks, enabling employees to develop expertise in real-time contexts. In particular, the field of Human Performance Improvement (HPI) has emphasized creating environments that support workplace learning without relying solely on formal training programs (Reiser & Dempsey, 2012). HPI considers learning an integral part of job performance, highlighting the development of knowledge and skills through practical experience.

As part of HPI, the Electronic Performance Support System (EPSS) has been introduced as a tool designed primarily to enhance job performance rather than learning itself (Gery, 1995). EPSS is characterized by features such as "real-time accessibility during tasks," "computer-based support," and "a reduced need for pre-training" (Sleight, 1993; Suzuki, 2015). These features allow workers to retrieve relevant information as needed, thereby improving efficiency and performance.

Despite its conceptual significance, the widespread adoption of EPSS has been limited by high development costs and technological constraints (Suzuki, 2015). The expenses associated with system design and maintenance have posed significant challenges, often preventing EPSS from functioning effectively in practice. Additionally, adapting EPSS to fit diverse work environments has proven complex, further restricting its broader implementation.

To address these limitations, Rossett and Schafer (2007) emphasized the value of job aids as a practical alternative to EPSS. While both EPSS and job aids provide real-time task support, their structures and implementation differ significantly. EPSS typically requires extensive system integration, ongoing technical maintenance, and substantial investment in software development. These requirements make EPSS a costly and complex solution, limiting its accessibility and widespread adoption.

In contrast, job aids function as "self-contained tools" that do not require extensive system integration. They provide immediate, task-relevant guidance at a lower cost and with greater flexibility, making them a more viable option for many workplace learning and educational settings. Unlike EPSS, which often requires prior training to use effectively, job aids are designed for intuitive, on-the-spot use, reducing the need for extensive onboarding or technical expertise.

Given these advantages, job aids have become an increasingly practical solution for supporting workplace learning and enhancing performance. In educational settings, they enable teachers and middle leaders to access instructional guidance in real time, facilitating more effective lesson planning and PD. Their ability to provide on-demand support makes them particularly valuable in dynamic educational environments.

The effectiveness of job aids has been demonstrated in various empirical studies. For example, McManus and Rossett (2006) found that Performance Support Tools (PST), a form of electronic job aid, enable users to access necessary information while performing tasks, thereby improving learning outcomes, increasing work efficiency, and improving accuracy.

More recent empirical studies have further validated the effectiveness of digital job aids in educational contexts, demonstrating that web-based tools can reduce planning time while maintaining quality and enhance teachers' confidence in technology integration.

Technology Integration Support by Middle Leaders

This study focuses on supporting the integration of ICT into classroom instruction through school-based professional development facilitated by middle leaders. Technology integration has been widely recognized as a critical topic in education, but effective implementation requires not only classroom practices but also institutional support. In this context, middle leaders are expected to play a vital role in bridging the gap between school policies and daily teaching practices by designing and leading ICT-focused training programs. The implementation of 1-to-1 computing (one device per student) has gained global traction, resulting in a substantial body of educational research and evaluation studies. For instance, Reichert and Mouza (2018) analyzed the process and impact of implementing 1-to-1 computing, while Falloon (2015) examined the benefits of collaborative learning using iPads. Additionally, Haßler, Major, and Hennessy (2016) critically assessed the effects of tablet devices on learning outcomes, underscoring the need to evaluate the concrete impact of ICT use in education.

With advancements in digital technology, approaches to ICT integration in education continue to evolve. One practical strategy involves applying the principles of EPSS to the development of job aids, which offer a feasible means of supporting ICT integration in classrooms. Job aids, in particular, are recognized as effective tools for addressing time constraints and resource limitations (McManus & Rossett, 2006). However, job aids alone are insufficient for fostering ICT adoption; they must be supplemented with collaborative learning strategies such as lesson study and in-school PD led by middle leaders (Terashima & Itagaki, 2020).

Middle leaders play a critical role in promoting ICT use across schools (Terashima, 2019). As facilitators, they bridge the gap between administrative directives and classroom practice, guiding teachers in collaboratively exploring and integrating ICT into their teaching. For example, Terashima and Itagaki (2020) documented initiatives in which middle leaders organized lesson studies and in-school training programs to enhance ICT utilization. Such collaborative and practice-based learning approaches not only improve teachers' technological pedagogical content knowledge but also foster a school-wide culture of effective ICT integration.

Building on these prior studies, this research proposes a job aid specifically designed to support middle leaders in developing training programs for ICT integration. By doing so, this study aims to overcome the existing limitations of EPSS and job aids, such as high development costs and their tendency to function solely as informational tools. Instead, the proposed job aid is intended to enhance middle leaders' ability to design and facilitate effective in-school PD programs, ultimately contributing to the broader goal of strengthening ICT adoption in education through the empowerment of middle leaders and the promotion of in-school professional development.

Development of the Online Job Aid

(1) Objectives and Overall Structure of the Online Job Aid

The primary objective of the online job aid developed in this study is to support the design of in-school training programs based on instructional design (ID) principles. The developed system is accessible via a web browser and enables users to create, publish, and modify structured in-school training designs (hereafter referred to as "design sheets") on a single platform. Users can also browse and adopt design sheets shared by others.

To fulfill its objective, the system incorporates four key support features:

1. Guided design process for in-school training programs
The system employs a structured five-step process that ensures users address all critical components in a logical order. Each step must be completed before moving forward, reducing the risk of overlooking essential training elements.

2. Mandatory input of essential information
Users are required to input key details at each step to ensure clarity and completeness of the training design. Predefined fields guide users through the process, preventing omissions and inconsistencies.

3. Automated generation of a training reference sheet
After finalizing a design, the system generates a printable reference sheet to support facilitators in conducting training sessions. This sheet helps users align their instruction with the established objectives and structure, improving delivery efficiency.

4. Access to shared training designs
Users can explore and modify training designs shared by others. The system categorizes examples based on training components, allowing users to easily find relevant references.

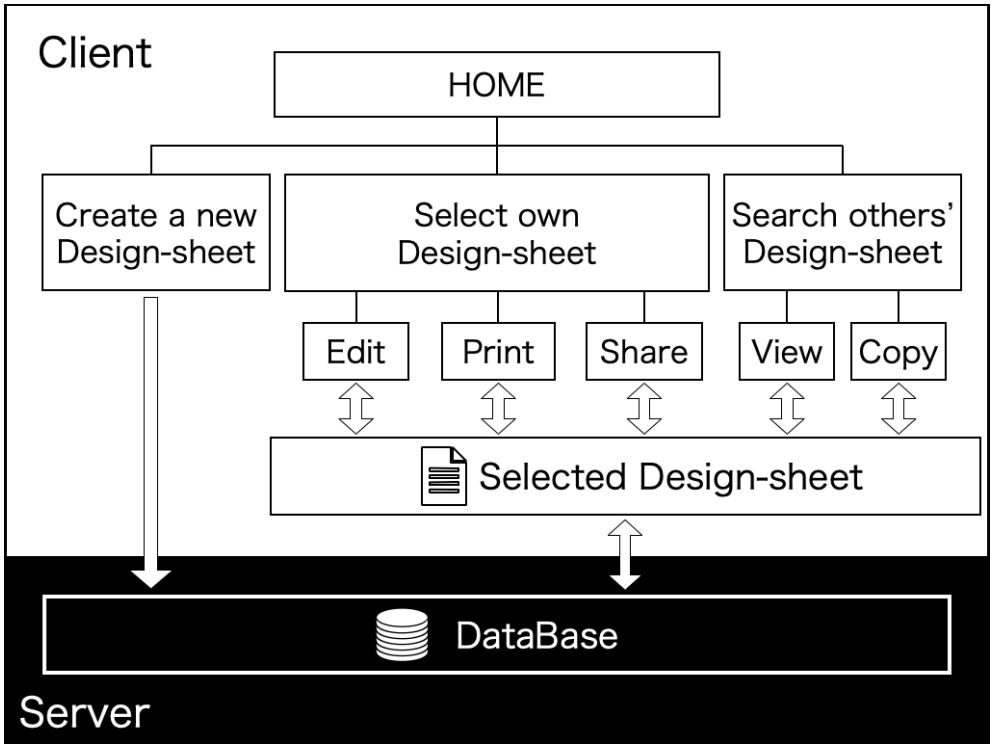
(2) Creating the Design Sheet

The design sheet is structured to guide users through a series of steps to create a detailed training plan. These steps are as follows:

1. Define the training objectives.
2. Develop a follow-up plan, including evaluation methods, post-training support, and follow-up assessments.
3. Design the training content, covering activity modules, participant engagement, and finalizing content.
4. Enhance engagement through interactive strategies.

Figures 2 and 3 illustrate the user interface of the online job aid for defining training objectives. Users can select from three categories and refine their objectives using examples and external references.

Figure 1.
Overall structure of the Online Job Aid.



Step 1: Defining the Training Objectives
This step focuses on establishing clear learning objectives. Users determine the category of their training while defining specific goals.

Step 2: Developing a Follow-up Plan
Users define the timeframe for achieving training objectives and establish methods to track progress. Additionally, post-training support mechanisms, specifying who provides support and how, are determined.

Step 3: Designing the Training Content
Training is structured into pre-training and in-person sessions. Users can access sample cases provided by developers and other users.

Step 4: Enhancing Engagement Strategies
To ensure interactive learning, users explore ways to enhance engagement. Each step requires input before progressing, ensuring adherence to ID principles. Users can access and customize sample cases provided by developers or shared by other users, facilitating efficient training design. Users have the option to return to previous steps to make modifications as needed. Furthermore, before finalizing a design, users can review their inputs using a checklist to ensure completeness and clarity.

Users can print their design sheets, which include the following:

- A "Planner" checklist to verify the quality of the training design.
- A "Sidekick" checklist to assist facilitators during training sessions.

For example, the "Planner" checklist under Step 1 includes prompts such as

- Are the training objectives aligned with participants' skill levels, needs, and expectations?
- Do the objectives also align with the administrative goals?

By integrating these features, the online job aid not only supports the structured development of training programs but also provides real-time assistance during training implementation, ensuring a well-organized and impactful learning experience.

Figure 2.
Example of the online Job Aid input interface (planning the goals of the training).

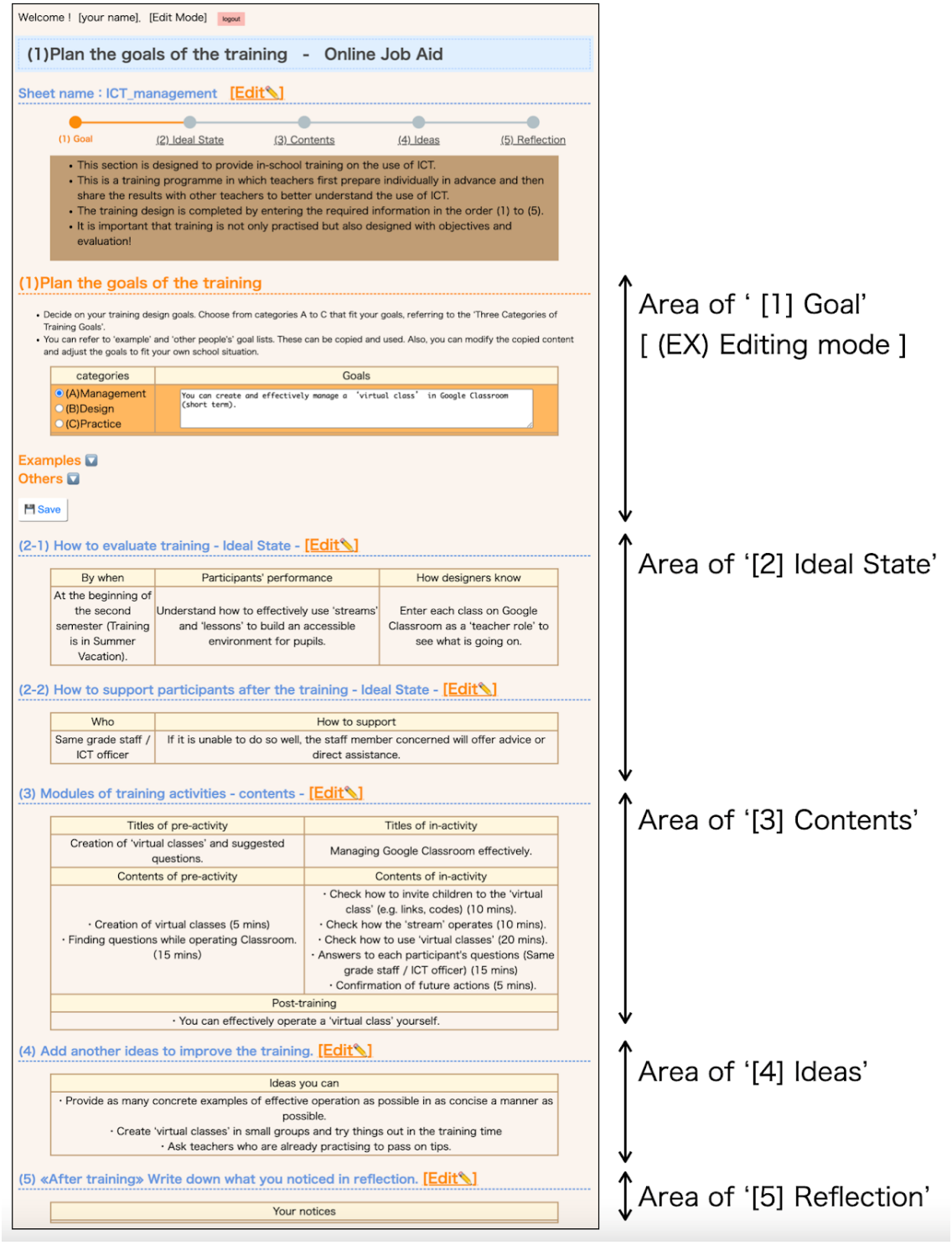
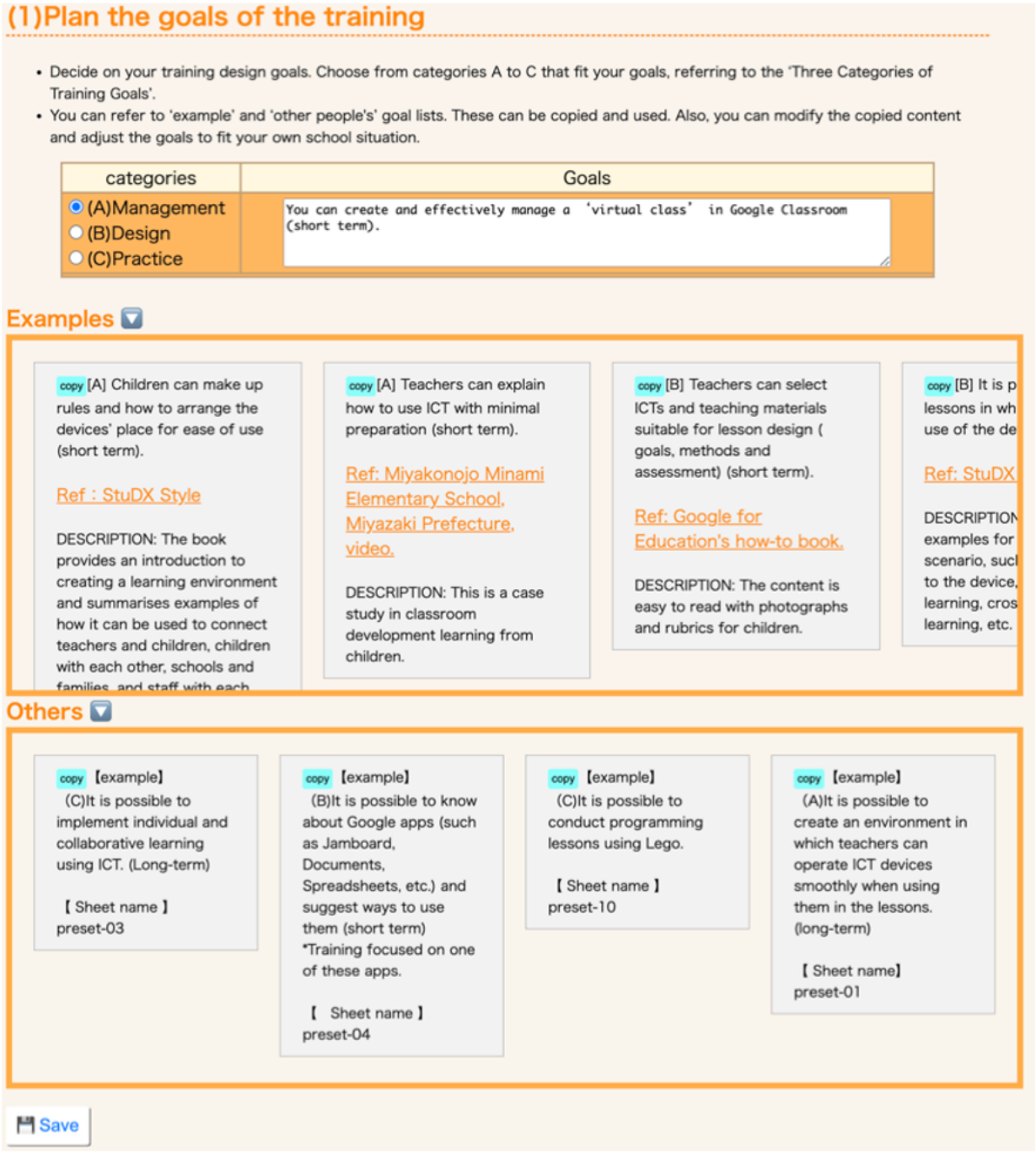


Figure 3.
A list of relevant examples in the input interface.



(3) Design Sharing

As shown in Figure 1 ("Share"), after completing a training session using a design sheet, users can add reflective comments and a training summary before sharing their sheet with others. The system not only provides sample templates but also offers a mechanism for users to voluntarily share their training designs. If users consent to make their entries public, their design sheets become accessible to both registered users and guest users of the online job aid.

Users can search for design sheets by navigating to the search page, where they can filter results based on specific categories or authors. Once a relevant design sheet is found, users can view its content for reference and, if needed,

duplicate and modify it to suit their own training needs. This feature enables users to build upon existing training designs rather than starting from scratch, thereby facilitating a more efficient training design process.

Evaluation Method

This study employed a mixed-methods approach, combining a questionnaire survey and interview to evaluate the job aid. The questionnaire assessed system usability and areas for improvement, while the interview explored job aid applications, training program design, and potential enhancements. This approach strengthened the study's reliability and validity (Flick, 2022). By integrating both quantitative and qualitative data, we provided a comprehensive evaluation of the research objectives.

Questionnaire Survey

To collect feedback for refining the job aids developed in this study, participants were asked to use the system and design a 60–90-minute training plan. Following this, a questionnaire survey was administered. The questionnaire items were designed to assess the system's primary objectives and functions. Specifically, the questions focused on four key features supporting the ID of in-school training: (1) clarification of training content through necessary input, (2) facilitation of procedural steps, (3) access to case study references, and (4) generation of training implementation checklists. Additionally, the questionnaire included items evaluating users' independence and effectiveness in training design, as well as the role of sample materials in guiding each step. This approach enabled us to determine whether the system's intended support functions were effectively utilized in actual training design processes.

Data were collected from nine teachers who voluntarily participated in the study. Their teaching experience varied: one had less than 5 years, three had 11–15 years, four had 16–20 years, and one had over 21 years. Regarding experience as facilitators of ICT-related training sessions, four participants had led attended 1–4 training sessions, whereas five had led participated in more than 4. While the sample size was small, efforts were made to ensure diversity in participants' professional backgrounds. However, due to the limited number of participants, no statistical correlation was analyzed between teaching experience and questionnaire responses. Observationally, there were no notable response tendencies directly tied to experience levels.

In terms of system usage time, one respondent spent less than 30 minutes, 1 spent 31–45 minutes, four spent 45–60 minutes, and three spent 60–75 minutes interacting with the system. Although system logs were not collected, the self-reported time suggests variation in how deeply users engaged with the system. These differences may have influenced their perceptions of effectiveness and checklist usability.

(1) Interview Survey

An interview survey was conducted with an instructional supervisor who had 10 years of experience as a public elementary school teacher and 3 years as an instructional supervisor. The participant used the job aids to plan and conduct training sessions and subsequently reflected on the experience. Two main criteria guided the selection of this interviewee: (1) the relevance of their role to the system's intended users and (2) an established rapport with the research team, which facilitated open and candid discussions.

Given the system's early-stage development, qualitative data collection was necessary to complement the quantitative questionnaire data and to identify specific areas requiring improvement. Rather than gathering broad but superficial insights from a large participant pool, an in-depth interview approach was deemed more suitable for obtaining detailed feedback on user experiences and suggested improvement. This aligns with prior studies emphasizing the importance of qualitative evaluation in the initial stages of educational technology research. Consent was obtained from participants after explaining the study's purpose, the management of recorded data, and measures to protect personal information.

A semi-structured interview lasting 65 minutes was conducted through video chat on August 30, 2024, involving the research subject and two authors. The interview focused on three key areas, with specific questions designed to elicit detailed feedback:

(a) the overall training process

- Q1: How did you input information into the job aid when planning your training session?
- Q2: Were there any changes from your initial plan during implementation?
- Q3: Did you refer to the "Sidekick" checklist while using the system?

(b) differences compared to prior training experiences
- Q4: How did this planning process differ from your previous training design approaches?
- Q5: Which aspects of the job aid changed your usual planning workflow?
- Q6: Did the system enable you to do anything you couldn't do before?

(c) evaluation of the system's effectiveness
- Q7: To what extent did the system help you achieve your training objectives?
- Q8: What aspects of the system should be improved?

The interview was recorded, transcribed verbatim, and analyzed using MAXQDA24. The analysis followed a systematic approach:
1. Initial coding: Transcripts were read multiple times, and meaningful segments were identified and coded based on their relevance to the research questions.
2. Category development: Codes were grouped into conceptual clusters based on thematic similarity. For example, responses about "planning visualization" and "systematic thinking" were grouped under "metacognition of planning."
3. Category refinement: Through iterative analysis, five main categories emerged, each containing 2-4 related concepts.
4. Validation: The categories and their interpretations were shared with the interviewee for member checking to ensure accuracy.

Results

(1) Questionnaire Survey Results

Table 1 presents the mean and standard deviation (SD) of the responses to the eight survey items. All items received an average rating of 3.0 or higher on a four-point scale, indicating an overall positive evaluation of the system.

As shown in Items 6 and 7, one of the system's key features is its ability to modify and integrate preexisting training plans. The responses varied regarding how well this feature aligned with users' needs: four participants indicated that it "fit well," two responded "fit fairly well," one noted "not so well," and two stated "did not fit at all." Further analysis revealed that all participants who found the feature helpful had made only minor modifications to the sample plans.

The open-ended responses included various individual comments and specific suggestions for improving the usability of the checklist feature. Some participants suggested that accessing the checklist during the training planning phase, rather than only when finalizing the plan, would be beneficial. Others noted that while the checklist was useful for guiding training design, ensuring complete coverage of all aspects of the training implementation remained challenging.

Table 1
Summary of the Questionnaire Survey Results

Number	Questionnaire Item	Mean	SD
1	This system could be used for ICT training.	3.78	0.42
2	This system helped create a more effective plan.	3.44	0.50
3	The system enables an independent training design.	3.33	0.67
4	The system clarifies the key training elements.	3.78	0.42
5	The training process became more structured.	3.89	0.31
6	Sample references were useful.	3.44	0.68
7	The sample materials assisted in planning.	3.78	0.63
8	The output checklist facilitated the training execution.	3.56	1.20

(2) Interview Survey Results

Table 2 summarizes the key categories and concepts identified from the interview data analysis.

Table 2
Category and Concepts Identified from Interviews

Category	**Concept**
(1) Improving the quality of the training design	① Objectification and metacognition of planning ② Encouraging reflection on the training content ③ Addressing constraints limiting flexibility in the training design
(2) Clarifying and supporting the design process	④ Providing manuals and instructional videos to enhance understanding ⑤ Structuring the system with visually intuitive elements for usability ⑥ Strengthening input support functions to facilitate data entry
(3) Enhancing the design through case study references	⑦ Evaluating the effectiveness of referencing case studies in the training design ⑧ Improving the clarity, accessibility, and diversity of case study presentations
(4) Expanding ICT-based support and job aids	⑨ Encouraging interactive and participatory training methods ⑩ Enhancing post-training support mechanisms for continuous learning ⑪ Strengthening information ethics and security education ⑫ Ensuring real-time updates and adaptability of the training materials
(5) Improving usability and user convenience	⑬ Reducing initial operation difficulties through better onboarding ⑭ Enhancing the user interface to ensure smooth navigation ⑮ Optimizing mobile accessibility for greater flexibility ⑯ Expanding printing capabilities for easy reference and offline usage

The analysis of interview regarding the job aid, which supports the design of ICT training programs, generated five primary categories:

The first category, "Improving the quality of training design," emerged primarily from Q1 (information input process), Q4 (differences from previous approaches), and Q7 (achievement of objectives). Within this category, three concepts were identified: objectification and metacognition of planning, encouraging reflection on training content, and addressing constraints limiting flexibility in training design.

The second category, "Clarifying and supporting the design process," was derived from Q1 (information input), Q3 (use of Sidekick checklist), and Q5 (workflow changes). This category encompasses concepts related to instructional support materials, visual interface design, and input support functions.

The third category, "Enhancing design through case study references," resulted from responses to Q4 (differences from prior experience), Q5 (workflow changes), and Q6 (new capabilities enabled). Two main concepts emerged: the effectiveness of referencing case studies and the need for improving their presentation.

The fourth category, "Expanding ICT-based support and job aids," was identified through Q2 (implementation changes), Q6 (new capabilities), and Q7 (objective achievement). This category included four concepts ranging from interactive training methods to real-time content updates.

The fifth category, "Improving usability and user convenience," emerged from Q1 (input process), Q8 (suggested improvements), with additional insights from Q3 (checklist usage). Four concepts were identified addressing operational difficulties, interface navigation, mobile accessibility, and printing capabilities.

These categories represent the key dimensions through which the job aid influences middle leaders' training design capabilities, with each category reflecting specific aspects of user experience captured through the structured interview questions.

Discussion and Conclusion

This study investigated the research question: How can an online job aid be designed to support middle leaders in planning and facilitating effective in-school PD programs for ICT integration, while addressing limitations of traditional support tools? Through the development and evaluation of a web-based job aid, this study provides both theoretical and practical insights.

Synthesis of Quantitative and Qualitative Findings

The mixed-methods evaluation revealed complementary insights into the job aid's effectiveness, with questionnaire data (n=9) and interview findings mutually reinforcing key themes about the system's strengths and limitations.

The highest questionnaire ratings were for process structuring (M=3.89, Item 5) and clarifying training elements (M=3.78, Item 4), indicating that the system successfully guides users through comprehensive training design. These quantitative findings align with Category 1 from the interview analysis, where "objectification and metacognition of planning" emerged as a key benefit. The participant described how the structured approach forced systematic consideration of previously overlooked elements, explaining the high satisfaction scores. However, the interview also revealed constraints in flexibility for rapidly evolving content, a limitation not captured in the questionnaire data.

While the questionnaire showed moderate ratings for independent training design (M=3.33, Item 3), the interview data (Category 2) provided context for this result. The participant valued the visual guidance through manuals and instructional videos but noted that users with limited ICT proficiency might struggle with data entry. This explains why independence scores were lower than other items—the system provides structure but still requires baseline technical competence.

Items 6 and 7 regarding sample references and materials received positive but varied responses (M=3.44 and M=3.78 respectively), with some participants finding them highly useful while others did not. The interview data (Category 3) illuminated this variation: the participant successfully adapted case studies from other schools but noted that examples could become quickly outdated. This suggests that the value of shared resources depends heavily on their relevance to specific contexts and currency.

The checklist feature (Item 8, M=3.56) showed the highest standard deviation (SD=1.20), indicating divergent user experiences. The interview findings explain this variance through Categories 4 and 5. While the system promoted "interactive and participatory training methods" and provided post-training support mechanisms, usability issues created barriers for some users. The participant's emphasis on mobile accessibility and printing capabilities suggests that implementation challenges may have affected checklist utilization differently across users.

The strong agreement that the system could be used for ICT training (Item 1, M=3.78) and helped create effective plans (Item 2, M=3.44) was substantiated by the interview data showing successful shifts from lecture-style to participatory approaches (Category 4). However, the interview also revealed critical gaps in addressing rapidly changing content like information ethics, suggesting that while the system works well for established ICT topics, it may struggle with emerging technologies.

The convergence of quantitative and qualitative findings indicates that the job aid effectively supports middle leaders through structured guidance and knowledge sharing opportunities. The high

ratings for core design features correspond with interview themes of enhanced metacognition and systematic planning. However, both data sources reveal consistent challenges: balancing structure with flexibility, accommodating diverse user proficiencies, and maintaining content currency. These limitations help explain the moderate scores for independence and the high variance in checklist utilization, suggesting that while the job aid achieves its primary objectives, its effectiveness varies based on user characteristics and training contexts.

Addressing the Research Question

Based on the synthesis of findings, the developed job aid successfully addressed the research question through four key design features:

1. Cost-effective web-based implementation eliminating infrastructure barriers

2. Structured five-step process ensuring comprehensive coverage while allowing customization

3. Knowledge sharing through access to existing training designs, enabling adaptation of proven examples to local contexts

4. Practical support via generated checklists bridging planning-implementation gap

These features directly respond to the limitations of traditional tools identified in the literature, particularly addressing time constraints and specialized knowledge gaps that middle leaders face.

Theoretical and Practical Implications

The synthesis of findings reveals both theoretical and practical contributions. Theoretically, this study extends job aid literature by demonstrating that structured digital tools can promote metacognitive learning beyond procedural compliance, supporting McManus and Rossett's (2006) framework. Practically, the study offers a scalable model for embedding professional development into daily practice, with design principles adaptable to various educational contexts.

Limitations and Future Directions

Despite positive findings, this study has several limitations. First, the small sample size (n=9 for questionnaire, n=1 for interview) drawn from voluntary participants limits generalizability. The variation in participants' teaching experience and system usage time may have influenced perceptions, though current data do not allow detailed correlation analysis.

Second, the study cannot establish causality without control group comparisons. Positive evaluations may reflect novelty effects or participants' heightened awareness rather than the job aid's inherent effectiveness.

Third, reliance on self-reported data lacks objective measures of training quality or subsequent classroom implementation outcomes. The single interview participant, while aligned with the intended user profile, may not represent diverse user experiences.

Finally, the study evaluated only short-term impressions. Long-term impacts on professional practice and instructional outcomes remain unknown. Future research should employ experimental designs with larger samples, incorporate objective evaluation measures, and conduct longitudinal studies across diverse contexts. The potential integration of generative AI for dynamic training design support also warrants investigation.

Conclusion

This study addressed how an online job aid can be designed to support middle leaders in planning effective in-school PD programs for ICT integration while overcoming traditional tool limitations. The developed system successfully demonstrated that structured, web-based approaches can enhance middle leaders' training design capabilities through cost-effective implementation, guided processes, knowledge sharing, and practical support tools.

The mixed-methods evaluation confirmed these design features' effectiveness while revealing ongoing challenges in balancing structure with flexibility and accommodating diverse user proficiencies. Despite limitations in sample size and study design, this research contributes a practical model for embedding professional development into middle leaders' daily practice, offering schools a scalable solution for strengthening ICT integration through internal capacity building. The findings provide a foundation for future development of AI-enhanced job aids and longitudinal impact studies, ultimately supporting the broader goal of sustainable technology integration in education.

Acknowledgment

This work was supported by JSPS KAKENHI Grant Number JP21K02856.

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