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Case Report

Leading Online Professional Development for Instructional Technology Coaches with Effective Design Elements

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Abstract: This single-case study focused on the impact of design elements in online professional development for Instructional Technology Coaches to develop their TPACK. In this study, 30 participants enrolled in an online professional development series of synchronous and asynchronous sessions called Pathways. Ten design elements were implemented including content-focused, active learning, collaboration, modeling, coaching support, feedback, sustained duration and time, reflection, resources, and utilization of technology. Qualitative data were collected from 28 participants' feedback forms, interviews, and asynchronous assignments. The results showed that all ten design elements were perceived to be beneficial to Instructional Technology Coaches' learning. However, at the same time, some participants found a few hindrances to their learning from certain aspects of the six design elements. Hindrances in Pathways' design elements include ineffective modeling, collaboration challenges, off-topic discussions, unfamiliarity with Teams, technical difficulties, insufficient time, and home distractions. These findings emphasize the need for effective collaboration, time allocation, and technical proficiency. The coaches developed their TPACK through Pathways as discovered by the rubric results of the asynchronous assignments. Directions for future research and recommendations for professional development are discussed.

Keywords: online professional development; instructional technology coaches; design elements; TPACK; adult learning theory

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1. Introduction

Education was disrupted during the global COVID-19 pandemic. Online solutions came to the forefront of education during this time to keep individuals safe from the virus [1]. The Centers for Disease Control and Prevention (CDC) provided guidance for school districts across the United States of America to assist in creating and supporting safe learning environments while reducing the spread of COVID-19 [2]. Information from 3 February 2021 indicates that conducting staff training virtually has the lowest risk of spreading COVID-19, based on how the CDC characterized the risks of spreading COVID-19 [1]. One method that school leaders use to keep educators safe is moving professional development to an online format. Technology leaders within school buildings also needed to find an online solution to provide collaboration and support digital learning for educators [3]. Educators designing online professional development (PD) must think about how to design sessions effectively. As a result, empirical research is needed to examine the design of such online PD programs. Research-based best practices and design elements will greatly facilitate its effectiveness.

Thus, the purpose of this single-case study research focused on the design elements in an online PD program, particularly with the aim of maximizing the likelihood that the program is an effective learning experience for Instructional Technology Coaches to develop their TPACK. Two theoretical frameworks were used to provide a foundation for design elements to include in the online PD sessions. Adult learning theory was

used primarily by the facilitator to determine how the adult participants learn in an online environment. The participants' knowledge, based on Technological Pedagogical Content Knowledge (TPACK), was monitored throughout the online PD series to see how their knowledge was transformed, as demonstrated by classwork artifacts. Darling-Hammond et al.'s [4] conceptual framework of seven characteristics of effective professional development was adopted to design the online PD program. These three theories were applied to design elements built within an online series of PD sessions called Pathways. Pathways occurred over a duration of time with four synchronous sessions and three asynchronous assignments.

Professional development has been researched for decades in terms of effectiveness and teacher experiences while attending professional development sessions. Research studies like Darling-Hammond et al.'s [4] study have created a conceptual framework that describes the effectiveness of design elements for professional development. These types of frameworks have been applied to in-person and blended PD formats, but not necessarily online. Online PD design elements have begun to be researched in more depth since the pandemic [3]. According to Braggs et al. [3], future research needs to provide PD designers with a better understanding of design elements and learner support. Therefore, the overall goal of this study was to provide research that addresses a current gap in online PD design elements that support Instructional Technology Coaches' learning.

2. Literature Review

Professional development for PK-12 teachers has evolved over the years, focusing on three distinct modalities: in-person, blended, and online. In-person PD highlights the importance of mentorship and collaboration among teachers within the same institution. Blended learning evolved from in-person learning by discussing the challenges and strategies involved in shifting from traditional to digital platforms. Online learning provides unique aspects to PD by emphasizing the need for flexibility, engagement, and effective feedback. This review includes topics of the TPACK framework, adult learning theory, PD in PK-12 schools, PD design elements, and instructional coaches' learning. These topics are closely connected to this study because it focuses on providing PD to instructional coaches who are also teachers and designers of PD for the schools and districts they serve.

2.1. The TPACK Framework

In order to understand educator's learning, the Technological Pedagogical Content Knowledge (TPACK) framework was used to undergird this case study. According to Koehler et al. [5], "the TPACK framework for teacher knowledge is described in detail as a complex interaction among three bodies of knowledge: content, pedagogy, and technology" (p. 13). The TPACK framework "describes the kinds of knowledge required by teachers for successful integration of technology in teaching" (Mishra, [6] p. 76).

According to Kelly et al. [7], "Teachers require content knowledge of what the curriculum contains, pedagogical knowledge to know how to teach it, and technological knowledge to use the technologies that fit the curriculum along with the learning objectives" (p. 87). In this research study, Instructional Technology Coaches should have a high level of TK because of the nature of their job within the local school buildings across the school district. Therefore, Instructional Technology Coaches should be able to demonstrate significant growth in the knowledge bases within the TPACK framework.

During PD, the presenter can focus on how to use technology effectively and appropriately in order to meet the learning goals of the content [8–12]. Instructional technology workshops, a form of PD, should enhance participants' knowledge about integrating technology effectively in the classroom in the hopes of impacting their students' learning of the content [11,13–15]. When educators learn about teaching with technology in this manner, it is considered a content-centric approach, and the teachers develop TPACK [11]. Therefore, during this single-case study, the presenters ensured that the content delivered was modeled to show how to effectively integrate technology to impact the TPACK of the

participants positively. At the same time, the researchers investigated whether Instructional Technology Coaches developed their TPACK after the online PD program.

2.2. Adult Learning Theory

Instructional technology leaders at a district office provide professional learning experiences that focus on helping adult learners learn and then present the materials to other adult educators. These leaders of PD need to focus on forming relationships with the learners to find out how they learn [16]. Adult learning theory focuses on how adults learn based on the following three foundational theories: andragogy, self-directed learning, and transformative learning [17].

The first foundational theory within adult learning is andragogy. According to Merriam [16], "andragogy is primarily presented as a way of differentiating adult learners from children" (p. 56). In the late 20th century, Malcolm Knowles proposed a set of six assumptions regarding adult learners including the following: self-concept, experience, readiness to learn, problem-centered, internal motivation, and need to know [16,17]. When designing PD, these six assumptions have "implications for program design and instruction" ([16], p. 47). Self-directed learning (SDL) is the second foundational theory. According to Merriam [17], "SDL does not mean sitting in a room alone, learning something: rather SDL is all about the learner taking control of her or his own learning" (p. 24). Transformative learning is the third foundational theory in adult learning. While adults attend professional development, perspectives can be transformed as the content is taught [16,17].

Research on adult learning has not been the primary focus for implementing computer-based instruction (CBI); instead, the focus has been on educational settings [18]. Research conducted by Knowles et al. [18] states that "there is no comprehensive theory that portrays the factors leading to effective computer-based instruction" (p. 238). Therefore, Knowles et al. [18] used a systems approach to create "a theory of effective CBI for adults integrates the critical components of CBI to provide a much-needed framework for research in CBI for adults" (p. 239). The ultimate result of this theory is the learning outcome. According to Knowles et al. [18], "the learning outcome describes what the learner is able to do when learning is completed" (p. 240). Since online PD for educators involves learning on a computer and has a learning outcome, this particular theory in adult learning provides a foundation for designing instructional strategies. The online PD program examined in the current study used the three foundational theories in adult learning theory to guide its design.

2.3. Professional Development in PK-12 Schools

Professional development (PD) in PK-12 schools has seen significant evolution over the past decades. Initially, late 20th-century research focused on teacher satisfaction and willingness to modify learning philosophies rather than on the effectiveness of PD [19–21]. This research gap led to a shift toward creating a conceptual framework for effective PD. As a result, in the early 21st century, Guskey [21] introduced a five-level evaluation framework to assess PD effectiveness. These five levels include participants' reactions, learning, organizational support and change, use of new knowledge and skills, and student learning outcomes. This framework allows researchers to evaluate the effectiveness of their PD sessions [22].

At the same time, the design and modality of PD have also evolved. Initially, most PD was conducted in person. The advent of internet-enabled computers in schools led to the creation of blended PD, combining in-person and online sessions. Moreover, the COVID-19 pandemic in 2020 further increased the demand for online PD.

Despite the variety in PD formats and frameworks, [21] mentions that the three major goals of PD programs remain consistent, which include the following: changes in classroom practices of teachers, changes in their attitudes and beliefs, and changes in student learning outcomes. While many design elements are similar across different types of PD, some elements vary based on participant needs. The participants of the current

study, Instructional Technology Coaches, are also teachers, and they work with teachers in the field. Therefore, PK-12 PD formats and frameworks are relevant and important to these participants as they are usually the ones who design and organize such programs.

2.4. In-Person Professional Development Design Elements

In the 1990s, researchers began to focus on the best practices and design elements of in-person PD. Darling-Hammond and McLaughlin [23] suggested new designs for PD, including replacing in-service training with blocks of time for teachers to share their content knowledge, collaborate, and connect previous experiences with new strategies in the classroom. They also emphasized the importance of mentorship, with less experienced teachers being mentored by more experienced ones.

Garet et al. [20] conducted the first large-scale research study comparing the effects of different PD design elements. They identified three core features to focus on during PD including academic subject matter (content), opportunities for "hands-on" work (active learning), and integration into the daily life of the school (coherence). They also found that duration and collective participation were extremely important for PD designers.

In the late 2000s, five common characteristics were found to make a positive impact on teacher practices and knowledge through PD. These included content focus, active learning, coherence, duration, and collective participation [19,24]. Research showed that content needs to be relevant for the participants in PD that occurs for longer than 24 h throughout the school year [25].

Desimone and Garet [26] provided ways to refine these five characteristics, noting that changing procedural classroom behavior is easier than improving content knowledge or inquiry-oriented instruction techniques; teachers vary in response to the same PD; PD is more successful when it is explicitly linked to classroom lessons; PD research and implementation must allow for urban contexts; and leadership plays a key role in supporting and encouraging teachers to implement the ideas and strategies they learned in PD in the classroom. These insights have significantly shaped the design elements of in-person PD.

In-person PD design elements have evolved from the 1990s to the mid-2010s. Initially, the focus was on collaboration among teachers and mentorship by experienced teachers [23]. Garet et al. [20] later identified three key design elements including content, active learning, and coherence. These were expanded into a conceptual framework by Desimone [19] to include sustained duration and collective participation. These design elements are also highly significant for blended and online PD.

2.5. Blended Professional Development Design Elements

Trends in 2015 led to refinements in the PD framework. These included eliminating short, one-time workshops, linking PD to teacher evaluations, and using video recordings for better coaching [23]. These refinements and design elements provide a foundation for future research in blended and online PD.

Blended PD, a combination of in-person and online PD, emerged as a significant research topic in the mid-2010s with the rise of technology in education [27]. The design elements of blended PD involve a mix of elements from both in-person and online PD, offering benefits and concerns for participant learning.

Research conducted by Kowalski et al. [27] focused on design elements that could be applied to blended and online professional development. Certain design principles focus on participant engagement and active learning during sessions. Participants should be encouraged to make decisions on how they learn through design elements that can differentiate learning by providing a variety of online resources that accommodate different levels of difficulty and learning styles. Providing support for online applications during in-person sessions allows participants to ask experts questions and practice with the platform before completing asynchronous assignments at home as individuals [27]. Allowing participants to provide feedback and interact with the same small group throughout the entire blended professional development process creates an encouraging and supportive

accountability structure [27]. Relationships form within these small groups and strengthen during in-person sessions throughout professional development. According to Kowalski et al. [27], "planning a face-to-face meeting toward the halfway point in the course can help teachers reconnect and reinvigorate the group" (p. 7). Keeping the participants actively engaged throughout the blended format will support them in completing professional development from start to finish.

Collaboration and interactions among participants are key design elements emphasizing collective participation [20,27,28]. Blended PD often begins with an in-person session where relationships are formed, group expectations are established, and common characteristics like geographic location and content areas are identified [27]. Opportunities for participants to make connections throughout the PD sessions allow for the formation of relationships outside of structured time and peer support. Facilitators encourage rich discussions during online sessions, and participants can utilize collaboration to share work, provide advice to peers, and share classroom experiences [27–29]. Thus, collaboration is integral to blended PD, fostering a strong community of learners.

Blended PD emphasizes design elements such as reflection and self-assessment. These elements allow participants to analyze their practices and apprehensions [27,28]. Reflection on artifacts, such as student work or video recordings of their own classroom, establishes a foundation for collaboration and trust among peers. Facilitators should focus on participants' learning goals when developing discussion prompts to encourage deep reflection [27].

Philipsen et al. [28] created a framework for blended PD, integrating design elements like participant engagement, active learning, collaboration, peer support, reflection, and self-assessment. This framework was based on six synthesized findings regarding online and blended learning in teacher PD including the design and development of a supportive program and environment, determining goals and relevance, acknowledging existing context, addressing teacher change while transitioning from in-person to online, acknowledging strategies used in PD to change to online and blended learning, and disseminating knowledge, skills, and attitudes about online and blended learning and evaluating PD.

Effective PD incorporates certain design elements. Desimone [19] identified five key characteristics including the following: content focus, active learning, coherence, duration, and collective participation. Darling-Hammond et al. [4] expanded this to a seven-part framework, adding the use of effective practice models and providing coaching and expert support. Both frameworks emphasize keeping content relevant for educators, incorporating active learning through engaging activities, collaborating with individuals who share common interests, incorporating an appropriate duration for learning the material, and incorporating the learned content into classroom teaching philosophies. Blended PD incorporates Desimone's [19] framework, which includes content, active learning, coherence, sustained duration, and collective participation. Empathy towards participants in blended PD sessions allows them to acknowledge and reflect on the ongoing changes in education.

Content-focused PD emphasizes the curriculum taught by educators and aligns with district and local school priorities. It also considers the learning environment context, including student and educator populations and languages. Adult educators' experiences are valuable resources for learning new content.

Active learning, facilitated by utilizing adult educators' resources, includes collaboration, coaching, feedback, reflection, and the use of models. Teachers engaging in the same learning activities they design for their students is a form of active learning.

Collaboration, an important design element, can occur in various ways, including one-on-one, in small or large groups, and with professionals outside the school district. It can happen in person or online, with interactive elements like video recordings, collaboration boards, and virtual skill practice opportunities.

Modeling and the use of models help teachers envision practice to anchor their learning and growth. Modeling can take various forms, including video recording, watching videos, and observing other educators [4].

Effective PD also incorporates expert and coaching support, which is critical in implementing new curricula, tools, and approaches by educators [4,30]. Feedback and reflection, integrated into coaching, are distinct practices that work together to help teachers move thoughtfully toward expert visions of practice. Reflections should be built-in throughout PD sessions, allowing educators to reflect on their learning and its implementation in their teaching [4]. Feedback should include both positive aspects and constructive criticism, with video analysis activities providing a powerful form of feedback [4,31].

The sustained duration of PD has proven to be effective. PD should not occur in single, isolated events, but over a period of time focusing on the application of what is being taught. This allows for the effective incorporation of design elements including content-focused, active learning, collaboration, modeling, coaching and expert support, feedback, and reflection [4,32]. These seven characteristics of effective PD are applicable to online PD design, with several design elements of blended PD also incorporated into online PD.

All the design elements for in-person and blended PD provide a foundation for designing online PD. Some of these elements can be directly transferred to online PD, so the overlaps are evident. In other words, effective online PD incorporates some of the same design elements as in-person and blended PD. As per Darling-Hammond et al. [4], these include content focus, active learning, collaboration, effective practice models, coaching and expert support, feedback and reflection, and sustained duration.

2.6. Online Professional Development Design Elements

Online PD should be content-focused, with topics that are authentic, integrated, subject-specific, and consistent [33]. Differentiating content can assist facilitators in acknowledging various learning styles and building participant Pedagogical Content Knowledge (PCK) [3]. Key design elements include accommodating individual differences in learning styles, program length, participant engagement, learner support, development of PCK, practical learning activities, application of learned skills, and flexibility of the study mode.

Engagement through active learning is another crucial aspect. This design element involves creating conditions that stimulate and support teacher engagement [27]. Key design principles include providing choice in learning, support, a buddy system, integrating synchronous sessions, and utilizing pre-established structures for synchronous sessions [27].

Effective online PD also incorporates coaching and expert support, allowing learners to obtain assistance anytime during or after synchronous sessions [28]. A supportive environment with regular and just-in-time support and feedback fosters a personal connection between the student and the lecturer [34]. Key themes that positively impact teacher engagement in online PD include investigation, reflection, and constructive dialogue [35].

Online PD can incorporate both asynchronous and synchronous sessions. Asynchronous online PD research by Polly and Martin [36] highlighted the importance of video-based cases with discussion boards, scaffolded activities for data analysis, and teacher reflections on student performance. They suggested future designs of online asynchronous PD need richer ways to support teachers' work in their schools.

Feedback and reflection are crucial design elements in asynchronous online PD. An online facilitation system can offer feedback through structural, cognitive, and social-affective dimensions [37]. Participants valued the facilitator's presence both synchronously and asynchronously. Thus, online PD should include both asynchronous and synchronous components to keep teachers engaged and accountable for their learning.

Online PD, necessitated by the COVID-19 pandemic, requires a learning management system like Microsoft Teams for asynchronous and synchronous lessons. This platform, providing persistent chat, file storage, and integration with MS Office 365 Suite, facilitates strong teacher communication and collaboration. A study by Krasna and Pesek [38] found

that Microsoft Teams is more efficient in providing feedback on assignments compared to Moodle.

Research by Braggs et al. [3] revealed that specific design elements in online PD can accommodate individual learning styles, foster participant engagement, provide learner support, and foster the acquisition or further development of Pedagogical Content Knowledge (PCK). Future research should analyze learner support and the duration of PD, two elements that were not analyzed in the eleven studies reviewed by Braggs et al. [3]. The current study focuses on an online PD program, which utilized the design elements elaborated in the aforementioned literature.

2.7. Instructional Coaches' Learning

Online PD can enhance the seven characteristics of effective PD identified by Darling-Hammond et al. [4] through various design elements. These elements include content focus, active learning, collaboration, models of effective practice, coaching and expert support, feedback and reflection, and sustained duration. They can be incorporated into both asynchronous and synchronous PD sessions. Instructional coaches, like teachers, need to have PD to deepen their professional knowledge. Administrators can support instructional coaches by ensuring they receive school-provided PD rather than attending conferences on their personal time [39]. Research indicates that PD for instructional coaches should incorporate additional design elements, though studies in this area are limited because of instructional coaches' varied responsibilities in schools [31].

Content-focused PD is crucial for instructional coaches. Defining the coach's role and providing information on successful coaching are key content areas [31]. Ertmer et al. [40] found that the most important skill for successful PD was the interpersonal skill needed to establish trustful relationships. Thus, PD for instructional coaches should emphasize both professional learning and the soft skills associated with coaching.

Strategies to incorporate collaboration and reflection in online PD for instructional coaches include using discussion forums for problem-solving and sharing perspectives and coaching portfolios for personal notes and reflections [31]. Utilizing authentic content like video recordings and real-world problems allows for feedback in a collaborative setting. The seven design elements outlined by Darling-Hammond et al. [4] can be used in online PD for instructional coaches to focus on Pedagogical Content Knowledge (PCK) and adult learning theory with synchronous sessions on platforms like Microsoft Teams.

This single-case study aimed to conduct online PD for Instructional Technology Coaches, focusing on design elements that enhance learning. This study identified beneficial and hindering design elements in an online environment, contributing to research recommended by Braggs et al. [3], Stoetzel, and Shedrow [31].

3. Methodology

This research used a single-case study design. According to Yin [41], a case study is "a social science research method, generally used to investigate a contemporary phenomenon in depth and in its real-world context" (p. 286). The primary goal of this research was to fully understand Instructional Technology Coaches' perception of which design elements were effective for learning in an online PD program called Pathways. Therefore, this research was conducted in the virtual real world for Instructional Technology Coaches. The approach used to collect and analyze data involved primarily qualitative data supported by quantitative data. This research was a single-case study since the research was "organized around a single-case; the case might have been chosen because it was a critical, common, unusual, revelatory, or longitudinal case" ([41], p. 288). Pathways is a series of PD sessions; therefore, it is a single experimental event over a duration of time. The overarching research question that guided this research is as follows: According to Instructional Technology Coaches, how did the online PD program affect their learning? Three sub-questions were answered through this single-case study. The first question is as follows: What design elements do Instructional Technology Coaches perceive as beneficial during the online PD

program in order to learn the content? The second question is as follows: What design elements do Instructional Technology Coaches perceive as a barrier to their learning during the online PD program? The third question is as follows: How is Instructional Technology Coaches' TPACK impacted by the design elements utilized in the online PD program? Data were collected primarily through qualitative methods, including interviews and surveys, and supplemented by quantitative data, such as Likert-scale surveys and rubric scores. This study sought to understand how online PD influenced the coaches' learning, the effectiveness of various design elements, and the impact on the coaches' TPACK.

3.1. Research Context

The participants for this study were contracted by the school district for the 2023–2024 school year to work as Instructional Technology Coaches in a school within a large school district located in the southeast region of the United States of America. Convenience sampling was used in this single-case study to determine which Instructional Technology Coaches participated. Instructional Technology Coaches had the opportunity to register and choose which Pathway to participate in throughout the summer according to their availability. A total of 30 Instructional Technology Coaches registered for the Instructional Technology Strategies Pathway over the summer. These 30 participants had the option to participate in this research (see Table 1). The following characteristics described the participants: male and female; different grade levels (elementary, middle, or high school); and different levels of TPACK. The levels of TPACK were determined on the asynchronous assignments using a rubric.

Table 1. Number of participants in this research and how they participated.

Grade Levels	Completed Interviews, Feedback, and Asynchronous Assignments	Completed Only Feedback and Asynchronous Assignments
Elementary school (K-5)	2	11
Middle school (6–8)	3	3
Traditional high school (9–12)	1	6
Non-traditional high school (9–12)	1	0
Special entity school (6–12)	1	0

The Pathways program comprised four synchronous sessions and three asynchronous lessons while utilizing Microsoft Class Teams for online PD. Pathways was conducted by the first author and a co-worker. The designers ensured that the seven-part framework of Darling-Hammond et al. [4] was incorporated, as described in Table 2. The design elements that were utilized during Pathways were collaboration, content focused on instructional technology strategies, active learning, modeling effective practices, coaching and expert support, feedback, sustained duration and time, reflection, resources, and the format of Microsoft Class Teams. Data were collected through interviews, surveys, and classwork artifacts to understand learning outcomes. Each synchronous session focused on a specific theme based on district-identified instructional strategies, with the emphasis on coaching varying per session. Participants also completed asynchronous assignments, creating a one-page document on an instructional strategy using a technology tool.

Table 2. Darling-Hammond characteristics implemented in Pathways.

Darling-Hammond Characteristics	Implementation of Design Elements during Pathways
Content focus	Instructional technology strategies as determined by Instructional Technology Coach leaders.Beginning to create an Instructional Technology Coaches playbook of instructional technology strategies,
Active learning	Engaging learning activities in asynchronous and synchronous lessons.
Collaboration	Collaboration time among Instructional Technology Coaches during synchronous session. OneNote was used for collaboration during asynchronous lessons. Teams Chat was available for collaboration at all times.
Modeling	Modeling the use of online professional development through Pathways.Integrating instructional technology strategies in the classrooms at the local school buildings.
Coaching Support	Participants were able to schedule 1-on-1 time with leaders at any time during Pathways. Coaching support was also provided during synchronous sessions to assist in answering questions. Support was provided for technical and content-focused instructional questions.
Feedback and Support	Feedback was provided during synchronous sessions during whole-group and breakout rooms when needed. Feedback was also provided on asynchronous assignments that were submitted. Support was provided for technical and content-focused instructional questions.
Sustained Duration	Summer Pathways was held for at least 4 weeks. Semester Pathways was held over the course of an 18-week semester.
Reflection	Participants were provided with time for reflection at the end of each session.
Resources	Resources were available all the time through Microsoft Class Teams.
Format of Microsoft Class Teams	Organization and format of information and resources within Microsoft Class Teams (channels, tabs, resources, assignments, etc.).

Before the Pathways program began, leaders deliberated and decided on the program's content, with a focus on instructional technology strategies. The creation of design elements for the synchronous and asynchronous Pathway sessions occurred prior to the first synchronous session by the co-presenters. Participants were able to attend all synchronous sessions via Microsoft Teams meetings and submit all asynchronous classwork to "Assignments" within the Class Team. Table 2 provides details on how the design elements were implemented throughout Pathways. Virtual pre-interviews were conducted to gauge participants' prior knowledge and attitudes toward online PD.

During each synchronous session, a theme was chosen based on instructional strategies that were identified by the school district. The first synchronous session focused on building prior knowledge and questioning instructional strategies with a coaching strategy focused on building relationships through conversation starters. The second synchronous session focused on vocabulary and active learning instructional strategies with a coaching strategy focused on active listening. The third synchronous session focused on collaboration and communication instructional strategies with a coaching strategy focused on asking good questions. The final synchronous session focused on feedback and reflection instructional strategies with a coaching strategy focused on building trust.

Each session's structure included a review, an introduction to an instructional strategy, small group discussions, a presentation on coaching strategies, and a reflection period (see Table 3). Participants provided the following five key pieces of information: technical details, alignment with instructional strategies, teacher and student use case examples, and additional resources for other coaches.

Table 3. Generalized structure of synchronous sessions.

Approximate Amount of Time	Activity
5 min	Introduction and summary of previous synchronous session
10–15 min	Introduction of instructional strategy with the modeling of a technology tool(s)
10–15 min	Collaboration in breakout rooms and summary provided to the whole group
10 min	Coaching strategy information
5–10 min	Collaborate in a large or small group regarding coaching strategy
5–10 min	Reflection, preview upcoming asynchronous and synchronous sessions, complete feedback form, and answer questions

This information aligned with the TPACK rubric for asynchronous assignments, and the score determined if TPACK was impacted. Feedback was provided by the co-presenters on the classwork artifacts and was completed by the co-presenters before the following synchronous session. Interviews were conducted throughout the case study virtually through Microsoft Teams, and interviews were completed by the presenter/researcher so that knowledge was gained throughout the process. Figure 1 provides a basic timeline for when the various sessions occurred with the gathering of data throughout the single case study.

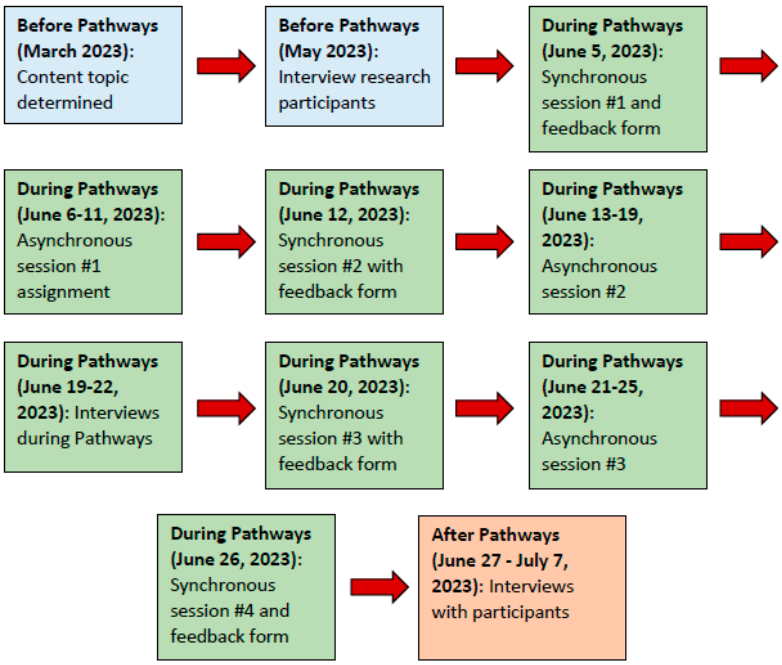

Figure 1. Timeline of Pathways and research design.

3.2. Data Collection and Analysis

Data were collected in the form of interviews, feedback forms, and asynchronous assignments to determine which design elements were effective for learning based on

participant opinion and to measure how various domains of TPACK impacted learning. All participants were Instructional Technology Coaches during the 2023–2024 school year within one school district (see Table 1). Eight participants were willing to complete all three forms of data collection. Six of these participants completed all portions of the data collection. An additional twenty participants completed either all or a portion of the feedback forms and asynchronous assignments.

Participants answered questions regarding their demographics and background information about their previous experience with design elements in online PD. The pre-interviews included questions regarding the Instructional Technology Coaches' perception of online PD, learning style preference, and previous experiences with design elements in online PD sessions. The questions required open-ended responses (see Appendix A).

Feedback surveys were conducted during Pathways (see Appendix B) to analyze how Instructional Technology Coaches' perspectives of the design elements changed, if at all, over the course of the online PD program. Participants were also asked to complete assignments to demonstrate how the TPACK of Instructional Technology Coaches was applied to what they learned in PD. The Likert-scale questions on the feedback form were analyzed for trends in each session. For each of these questions, the average was taken each week along with an overall average for each of the design elements. Each design element was analyzed each week to determine its effectiveness for the content being delivered. The higher the numerical average, the higher the effectiveness of a design element. Tracking the scores for each design element provided by each participant also determined design elements that were effective for that individual. Survey answers were analyzed for common themes after each session in order to finalize any changes needed for the following synchronous sessions and/or asynchronous lessons. The open-ended questions were analyzed for common codes.

The asynchronous assignment (see Appendix C) required the participants to demonstrate their TK, PCK, TCK, and TPK by utilizing a tech tool with an instructional technology strategy. The assignments and rubrics were created based on the content of Pathways. Following the completion of the assignments, participants were questioned on how the implementation of the design elements impacted their learning through interviews. Classwork artifacts completed during the asynchronous lesson by the participants were analyzed based on how well they completed their assignments and the quality of work using a rubric (see Appendix D). These data helped determine the effectiveness of the feedback provided by the presenters and TPACK gained during the sessions. Participants' rubric scores were tracked through the three assignments to determine how TPACK was impacted. The scores for each rubric category were recorded to determine if there was an increase or decrease in each of the TPACK categories for each participant.

Interviews with the participants were recorded and conducted through online Teams meetings. Additional interviews were completed prior to the start of the semester, midway through Pathways, and after completing the online PD program (see Appendix A). For interviews conducted prior to and following the Pathways series, a structured list of questions was asked to each participant. These interviews and the interviews conducted during Pathways were semi-structured in order to ask follow-up and probing questions that may differ between the participants. The answers from the interviews were analyzed for common themes.

The interviews and surveys were analyzed for common themes among the participants. ATLAS.ti is classified as computer-assisted qualitative data analysis software (CAQDAS version Windows 23.2.2) and is used to analyze text documents, multimedia files, surveys, and social media data. This program was used to analyze and synthesize various qualitative artifacts during this research. This software was also used to code the transcripts from the interviews.

Feedback forms (see Appendix A) were analyzed by co-presenters to identify misconceptions and adjust future content. Optional coaching sessions were offered to participants. Post-interviews were conducted upon completion of the program to assess changes in par-

ticipant perspectives (see Figure 1). A feedback survey gathered insights on the advantages and challenges of the design elements used during the series.

The triangulation of data provided data for the overall question and three sub-questions. Data that were analyzed to determine the benefits and barriers of design elements came from the surveys and interviews. Analyzing the common themes from two different data sources assisted in providing accurate results. TPACK data were gathered by analyzing the results of surveys and rubric scores. Rubric scores were analyzed for each participant over the course of the online PD program in order to determine if TPACK knowledge changed throughout Pathways. TPACK data were also analyzed in answers from the interviews and surveys in the common themes.

4. Results

This single-case study aimed to identify effective design elements in an online PD program for Instructional Technology Coaches. The TPACK rubric was used to assess participants' knowledge development, as demonstrated by classwork artifacts. This study adopted Darling-Hammond et al.'s [4] seven characteristics of effective PD to design the online program.

4.1. Research Question #1

This study sought to answer the following question: What design elements do Instructional Technology Coaches perceive as beneficial during the online PD program to learn the content? Feedback forms and interviews were used to measure the perceived effectiveness of the design elements. Each week, the participants completed a feedback form to measure the perception of effectiveness for each of the design elements including collaboration, content focused on instructional technology strategies, active learning, modeling effective practices, coaching and expert support, sustained duration and time, feedback, reflection, resources, and the format of Class Teams. Table 4 shows the weekly averages for each design element on the feedback forms of the participants who were able to complete them each week.

Table 4. Likert-scale averages of design element ratings during synchronous sessions per week.

Design Element	Week 1 (n = 21)	Week 2 (n = 22)	Week 3 (n = 17)	Week 4 (n = 26)
Active learning	4.75	4.95	4.69	4.80
Coaching and expert support	4.62	4.95	4.73	4.88
Collaboration	4.95	4.95	4.88	4.88
Content focus	4.86	5.00	4.88	5.00
Feedback	4.58	4.85	4.67	4.87
Format of Class Teams	4.90	4.86	4.65	5.00
Modeling effective practices	4.05	4.95	4.53	4.80
Reflection	4.42	4.91	4.81	4.96
Resources	4.67	4.90	4.75	4.96

After the first synchronous session, collaboration was perceived as the most effectively implemented design element, with an average rating of 4.95 out of 5 on the Likert scale. Other design elements were also rated highly, including the format of Class Teams (4.90), content focus (4.86), and active learning (4.75).

These results suggest that collaboration, a well-structured format of Class Teams, focused content, and active learning are key design elements in effective online PD for Instructional Technology Coaches. Further research could explore the impact of these elements on durable teacher change within school buildings.

In addition to the quantitative data, qualitative feedback was also collected. Participants were given the opportunity to explain which design elements were most impactful on their learning. Collaboration was frequently mentioned, with 15 participants highlighting its importance. For example, Victoria found idea sharing with peers useful, while Scarlett appreciated the small group breakout sessions that allowed for preparation before whole group discussions.

Three participants highlighted the importance of coaching and expert support. Aria, for instance, appreciated the detailed explanation of the Teams folders, which she had not used extensively before.

Reflection and resources were also mentioned as beneficial by two participants each. Claire and Layla found reflection helpful, while Claire and Grace found the resources beneficial.

Three participants mentioned additional design elements. Leah found the content focus beneficial, Ava appreciated the modeling of effective practices, and Charlotte noted the format of Class Teams as beneficial.

These insights provide a deeper understanding of the perceived effectiveness of different design elements in online PD. They highlight the importance of collaboration, coaching, reflection, and the provision of resources, among other factors. This feedback can be used to refine and improve the design of online PD programs further for Instructional Technology Coaches.

Following the second synchronous session, the design element "content focus" received the highest average rating of 5 out of 5 on the Likert scale. Four other design elements, including collaboration, active learning, modeling effective practices, and coaching and expert support, also received high ratings of 4.95 out of 5. Participants identified modeling effective practices as the most impactful on their learning, with 14 participants referencing it. Collaboration was also frequently mentioned as beneficial.

After the third synchronous session, collaboration and content focus were again perceived as the most effectively implemented design elements, with an average rating of 4.88 out of 5. Participants continued to highlight the importance of collaboration, with 14 out of 17 participants mentioning it as impactful on their learning. Coaching and expert support were also noted as beneficial.

These results suggest that content focus, collaboration, active learning, modeling effective practices, and coaching and expert support are key design elements in effective online PD. The feedback from participants provides valuable insights into the design of future PD programs for Instructional Technology Coaches. The high ratings and positive feedback for these design elements indicate their effectiveness in facilitating learning and engagement in the online PD context. These findings can guide the refinement and improvement of future online PD programs.

In the subsequent sessions, participants continued to provide feedback on the design elements. After the fourth synchronous session, "content focus" and the "format of Class Teams" were perceived as the most effectively implemented design elements, both receiving an average rating of 5 out of 5. The other design elements that also received high ratings included reflection (4.96), resources (4.96), collaboration (4.88), coaching and expert support (4.88), feedback (4.87), active learning (4.80), and modeling effective practices (4.80).

Participants identified several design elements as impactful on their learning. Collaboration was again highlighted, with 11 participants mentioning it. Modeling effective practices was also frequently mentioned, with seven participants referencing it. Resources were mentioned by three participants as beneficial, particularly the Playbook. Coaching and expert support were also noted as beneficial by two participants. Reflection was mentioned by two participants as a benefit to their learning. Three additional design elements were mentioned by participants including active learning, content focus, and the format of Class Teams.

These results further reinforce the importance of content focus, collaboration, active learning, modeling effective practices, and coaching and expert support in effective online PD. The feedback from participants provides valuable insights into the design of future PD

programs for Instructional Technology Coaches. The high ratings and positive feedback for these design elements indicate their effectiveness in facilitating learning and engagement in the online PD context. These findings can guide the refinement and improvement of future online PD programs. This study also highlights the importance of providing resources and opportunities for reflection and the potential benefits of using specific formats such as Class Teams. These insights can inform the design of future PD programs that better meet the needs of Instructional Technology Coaches.

4.2. Research Question #2

The second research question of this study aimed to identify design elements that Instructional Technology Coaches perceived as hindrances during online PD. Feedback forms and interviews were used to collect these data after each synchronous session.

During the first week, three participants indicated that they would have preferred more modeling of effective practices. Collaboration was also identified as a challenge by two participants, with issues arising from quiet group members and off-topic discussions in breakout rooms. The format of Class Teams was viewed as a hindrance by two participants. One participant expressed concern about locating resources at a later date, while another found the format new and unfamiliar.

These findings suggest that while certain design elements such as content focus and collaboration are perceived as beneficial, their implementation can also present challenges. This feedback provides valuable insights into potential areas for improvement in the design of online PD programs. For instance, more effective practices could be modeled, collaboration could be facilitated to ensure active participation from all members, and the format of Class Teams could be made more user-friendly or familiar to participants. These adjustments could enhance the learning experience and effectiveness of online PD for Instructional Technology Coaches.

In the second week, participants identified several design elements that hindered their learning. Collaboration was a challenge for two participants because of excessive talking or difficulty maintaining focus during breakout sessions. One participant suggested that having multiple screens would make the session easier. Time was another hindrance, with three participants indicating they needed more time to complete activities or assimilate what they had learned.

In the third week, eight out of seventeen participants identified hindrances to their learning. Technical difficulties with Teams meetings led to three participants missing the last 15 min of the session. Collaboration continued to be a challenge, with two participants expressing difficulty in breakout sessions because of off-topic discussions or the need to lead the conversation. One participant was still struggling with the format of Class Teams, while another found it hard to contribute because of being new to the role of Instructional Technology Coach.

These findings highlight the importance of addressing potential hindrances in the design and implementation of online PD. Ensuring smooth technical operations, facilitating effective collaboration, providing adequate time for activities and learning assimilation, and supporting new Instructional Technology Coaches are key considerations for improving the learning experience. This feedback can guide the refinement of future online PD programs that better meet the needs of Instructional Technology Coaches.

In the third and fourth weeks of the Pathways synchronous sessions, the Instructional Technology Coaches identified several design elements that hindered their learning. Time was a common issue, with several participants expressing a desire for more time to collaborate and discuss in their groups. Technical difficulties with Teams and varying levels of participation in breakout rooms also posed challenges. Some participants struggled with the format of Class Teams, while others found it difficult to contribute because they were new to the role of Instructional Technology Coach or because of their location, which limited their ability to use their microphone.

Active learning, specifically the competitive aspect of Nearpod's Time to Climb, was identified as a hindrance by one participant, Lucas, who expressed discomfort with competitiveness. Other participants noted hindrances related to collaboration, feedback, sustained duration and time, and the format of Class Teams.

These findings highlight the importance of considering individual learning preferences and technical challenges when designing online PD programs. They suggest that providing adequate time for collaboration, ensuring smooth technical operations, and accommodating different learning styles and levels of experience are key considerations for improving the learning experience in online PD for Instructional Technology Coaches. These insights can guide the refinement of future online PD programs that better meet the needs of Instructional Technology Coaches.

Through feedback forms and interviews, Instructional Technology Coaches were able to pinpoint design elements that obstructed their learning during the Pathways program. These obstacles included insufficient modeling of effective practices, difficulties with collaboration because of reticent group members and digressive discussions, and excessive dialogue in breakout rooms. The structure of Class Teams also posed a recurring challenge, with some participants finding it novel and unfamiliar and others expressing concerns about future resource retrieval. In the third session, technical issues with Teams prevented some participants from rejoining the main room after breakout sessions. Across all synchronous sessions, time was cited as a constraint, with participants indicating a need for more time to complete activities, exploration, and collaboration. One participant noted that being at home and being distracted by her family was a hindrance. These hindrances underscore the importance of effective collaboration, sufficient time allocation, and technical competence in the design elements of online PD.

4.3. Research Question #3

The third research question of this study aimed to understand how the TPACK (Technological Pedagogical Content Knowledge) of Instructional Technology Coaches was impacted by the design elements used in the online PD program. To answer this, classwork artifacts and interviews were conducted. After each synchronous session, participants completed an asynchronous assignment to demonstrate their TPACK. They were required to select a tech tool that they could recommend to a teacher during a coaching session to assist with technology integration in the classroom.

Over the course of three assignments, the cohort showed an increase in all evaluated areas of TPACK including Technical Knowledge (TK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), and Technological Pedagogical Knowledge (TPK). Table 5 shows the weekly average in the four TPACK areas that were measured during the asynchronous assignments. The assignment required the coaches to create a document on an instructional technology tool that includes the following five elements: technical information (TK), alignment with content and instructional strategies (PCK), teacher use cases (TCK), student use cases (TPK), and tips for other Instructional Technology Coaches. The largest increase was observed in TK, with a 0.42 increase from the first to the third assignment. PCK, TCK, and TPK also showed increases of 0.32, 0.31, and 0.35, respectively.

Table 5. Average TPACK scores on asynchronous assignments.

Asynchronous Assignment	TK	PCK	TCK	TPK	Tips	# Of Assignments Completed
Assignment #1	3.18	3.32	3.29	3.25	3.04	28
Assignment #2	3.39	3.54	3.50	3.50	3.11	28
Assignment #3	3.60	3.64	3.60	3.60	3.36	25

Interviews conducted before, during, and after the Pathway program provided further insights into how participants' knowledge was impacted. Participants not only referenced the design elements that influenced their learning but also acknowledged how their knowledge was impacted. For instance, Abigail described how her contextual knowledge was impacted throughout the Pathway program, stating that she was able to understand the role of the Instructional Technology Coach and build relationships with others in the same position. This feedback provides valuable insights into the effectiveness of the design elements used in online PD and their impact on the TPACK of Instructional Technology Coaches.

The Pathways program had a significant impact on the contextual knowledge of its participants. Abigail, an Instructional Technology Coach, found that her understanding of her role was enhanced through the program, and she valued the opportunity to build relationships with others in the same position. Lucas, another coach, noted how the program's design elements expanded his knowledge of integrating instructional technology. The research-based resources provided during the Pathway program allowed him to explore various frameworks for technology integration and focus on increasing technology pedagogy. Mia, a newer coach, found the entire program beneficial in expanding her contextual knowledge. She appreciated learning about various technology tools that could be used in teaching. Leah found that the Pathway program not only reinforced her existing knowledge but also introduced her to effective teaching strategies that could be used in her instructional technology sessions. These experiences highlight the impact of resources, content-focused learning, and modeling effective practices on the contextual knowledge of Instructional Technology Coaches.

The Pathways program significantly impacted the Technological Pedagogical Content Knowledge (TPACK) of its participants. Lucas, an Instructional Technology Coach, found the resources and content provided during the Pathway program beneficial for his focus on technology integration. He gained insights into TPACK and the Technology Integration Matrix (TIM), which he plans to use in his future training sessions.

The Pathways program significantly impacted the Pedagogical Content Knowledge (PCK) of its participants. Lucas found the resources and assignments beneficial, allowing him to combine his pedagogical and content knowledge. Claire highlighted the value of the collaborative final product, which expanded her PCK and helped her learn about various tools. Hazel appreciated the opportunity to delve deeper into the content and discuss challenges. Chloe found that her PCK was enhanced, prompting her to consider how to transfer the knowledge to her school staff. The design elements in Pathways have proven effective in enhancing PCK, fostering a collaborative environment, and facilitating the transfer of knowledge to the role of the Instructional Technology Coach.

The Pathways program significantly impacted the participants' Technological Pedagogical Content Knowledge (TPACK). Aurora, an Instructional Technology Coach, found the resources and content provided during the Pathway program beneficial for her focus on technology integration. She appreciated the insights into TPACK and the Technology Integration Matrix (TIM), which she plans to use in her future training sessions for teachers. Claire, another coach, appreciated the organization and structure provided by Teams. She found the combination of direct instruction, collaboration, and practical application of learning extremely helpful for her TPACK learning. The Pathways program's design elements effectively enhanced participants' TPACK, facilitating a deeper understanding of technology integration and its practical applications. This not only enriched the participants' teaching practices but also equipped them with valuable knowledge to share with other educators.

5. Discussion

This research study delved into the potential of online PD for Instructional Technology Coaches with the aim of enhancing their TPACK. The results revealed that the integration of two theoretical frameworks, TPACK and adult learning theory, can effectively

bolster the outcomes of the design elements employed in online PD tailored specifically for Instructional Technology Coaches.

This study identified ten design elements that were deemed beneficial to the learning of the participants. These elements include content-focused learning, active learning, collaboration, modeling, coaching support, feedback, sustained duration, reflection, resources, and the format of Microsoft Class Teams. However, this study also highlighted areas where the implementation of some design elements could be refined. For instance, in the case of active learning, providing participants with the autonomy to choose their learning methods could enhance their engagement and comprehension. Similarly, in the realm of collaboration, allowing participants to select their group members or providing discussion protocols could foster more effective teamwork and communication.

This study also found that the consistency and acknowledgment of modeling effective instructional technology practices throughout the sessions could be improved. In terms of feedback, it was suggested that providing participants with opportunities to delve deeper into their answers could enhance their understanding and application of the learned concepts.

Time management was another crucial aspect that this study touched upon. It suggested that various factors such as the day of the week, time of day, and time of the year should be taken into consideration when scheduling sessions. By being mindful of external factors, instructors could potentially eliminate many external barriers for the participants, thereby enhancing their learning experiences. By implementing these improvements to the design elements in Pathways, the learning experiences of the participants could be significantly enhanced.

The Pathways program, an online PD program for Instructional Technology Coaches, incorporated several key design elements to enhance learning. These elements, while generally beneficial, were identified by some participants as needing improvement.

Reflection was a significant design element, allowing participants to consider changes in their practice [4]. This reflective practice was facilitated by a range of resources, including session recordings, presentations, research-based articles, and a playbook, all of which supported problem-centered learning [27,28].

The program utilized Microsoft Class Teams as its primary platform. Despite a technical glitch in week 3, the platform was generally beneficial, providing a consistent and structured environment for delivering content. Participants appreciated the consistency in the platform's use, although some faced challenges because of unfamiliarity with the platform and technical difficulties. This suggests a need for more robust technical support and device compatibility checks.

Active learning was another key design element of the program. However, some participants found aspects of it, such as gamified competition, to be hindrances rather than aids to learning [42]. This feedback indicates that future iterations of the program could offer more choices in learning activities to cater to different learner preferences.

Collaboration was a highly rated design element, fostering a learning environment where participants could share insights and learn from each other. However, the dynamics within small groups posed challenges for some participants, suggesting a need for more flexible group formation strategies and structured conversation protocols [43,44].

Inconsistent modeling of effective strategies during synchronous sessions was noted, suggesting a need for more explicit and consistent modeling [45]. Feedback, while beneficial, was sometimes seen as vague, indicating a preference for more specific and direct feedback [46].

External factors, such as location and time management, affected the perceived benefit of the time design element. This feedback suggests a need for careful scheduling and consideration of participants' individual circumstances to optimize engagement.

The findings of this research have important implications for the design and delivery of online professional development for Instructional Technology Coaches (see Table 6). Future research could explore the long-term impact of these design elements on learning outcomes,

the effectiveness of reflection and resources in enhancing learning, and the influence of the platform on participant engagement. Comparing the impact of design elements on TPACK among novice and veteran Instructional Technology Coaches and exploring how these elements affect learning in different settings (e.g., summer versus school year) could provide valuable insights. As instructional technology continues to permeate classrooms, ongoing research is needed to optimize PD for Instructional Technology Coaches. This research underscores the importance of continuous improvement and adaptation in the design and implementation of PD programs to meet the evolving needs of educators in the digital age.

Table 6. Design elements and suggested best practices based on this single case study.

Design Element	Suggested Best Practices for Implementation
Content focus	Content is applicable and able to implement immediately.
Active learning	Engaging activities that provide options to the participants.
Collaboration	Provide participants the choice of who is in their breakout rooms or provide protocols; provide opportunities for both small and large group to share ideas.
Modeling	Consistently model the content; state when the modeling is taking place.
Coaching support	Experts provide support in the Pathway program. Support can be provided in one-to-one meetings with the instructor, email, chat, and discussions.
Feedback	Provide feedback that provokes deeper thinking to extend the learning of the participants.
Sustained duration and time	Consider time of day and time of year and how they interact with district and school events. Provide time between synchronous sessions for participants to reflect on what they have learned by completing asynchronous assignments that also demonstrate what has been learned.
Reflection	Provide opportunities during synchronous sessions for self-reflection.
Resources	Record and present synchronous session. Additional research-based resources that could help extend learning. Participants create resources that can be shared with other participants.
Format of Microsoft Class Teams	Organize content into modules. Organize resources. Explain organization to participants.

6. Conclusions

This single case study aimed to provide online PD to Instructional Technology Coaches to develop their TPACK. Guided by adult learning theory, TPACK, and Darling-Hammond et al.'s [4] framework, this study designed "Pathways", a series of online sessions. Data were collected through surveys, interviews, and classwork artifact rubrics, and analyzed to identify effective design elements. This research addressed a gap in understanding online PD design, a field that has gained relevance after the pandemic [3]. This study found that ten design elements were beneficial to participants' learning, but suggested improvements in areas such as active learning, collaboration, modeling, and feedback to enhance the learning experience.

Despite these findings, this study's limitations include potential bias in participant feedback and the unique context of the participants, who were all from the same district. These limitations should be considered when interpreting the results and planning future research.

The findings of this single case study underscore the need for further research on how to design online PD experiences optimally for Instructional Technology Coaches. It also highlights the importance of differentiating instruction based on the needs of participants. This research is pivotal in ensuring that Instructional Technology Coaches are equipped with the necessary knowledge and skills to support teachers in effectively integrating technology into the classroom. As such, this study serves as a valuable resource for those involved in the design and implementation of PD programs for Instructional Technology Coaches.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in this study.

Data Availability Statement: The original data presented in the study are openly available in Digital Commons at Kennesaw State University at https://digitalcommons.kennesaw.edu/instruceddoc_etd/21/.

Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A. Interview Questions

The interviews were semi-structured. The structured questions are listed below. Based on the answers provided by the participant, the interviewer used the semi-structured prompts typed in red below.

BEFORE PATHWAYS Interview Questions

Interview Questions:

For the purpose of these interview questions, we will define professional development as a series of courses diving deeper into the content. This is not referring to sessions that cover the content in one session.

1. Over the course of your career, explain your experience as a participant in professional development.
   a. What did you learn about?
   b. Can you provide more details?
   c. Did you feel that you learned anything during these experiences?
2. What elements of the professional development did you feel were effective? (If needed: Some examples could include: duration of time, collaboration opportunities, organization of materials, access to materials afterwards, etc.)
   a. Which did you feel were the most effective?
   b. What made these elements effective for your learning?

From this point on, we will be referring to your experiences with only online professional development experiences - not in-person professional development.

3. When thinking about your online professional development experience, how was the learning environment organized?
   a. Can you provide more details about. . .
4. Keeping a learner's engagement during professional development is a goal of every leader. Can you describe your engagement level during an online professional development session?
   a. Can you provide more details about. . .

5. Tell me more about your experience with online professional development. What aspects did you enjoy or find beneficial to you as a participant?
   a. Can you provide more details about. . .
6. What aspects did you find frustrating or challenging as a participant?
   a. Can you provide more details about. . .
7. How has your viewpoint developed, especially during the pandemic, in regard to online professional development?
   a. Can you provide more details about. . .
8. Are there any specific design elements of online professional development that you believe cannot be ignored? Design elements can include the time of day, coaching, Q&A sessions, synchronous sessions, asynchronous work to be completed by participants, etc.
   a. Can you provide more details about. . .
9. Would you like to share any additional thoughts regarding online professional development?
   a. Can you provide more details about. . .

DURING PATHWAYS Interview Questions
Interview Questions:
For the purpose of these interview questions, we will focus on Pathways so far. This is not referring to previous Pathways you have attended in the past.

1. Over the course of Pathways so far, explain your experience as a participant in Pathways.
   a. Can you provide more details about. . .
2. What design elements of online professional development do you feel are benefiting you to learn the content so far? (*Note: List of design elements will be provided for this question once content has been determined.)
   a. Can you provide more details about. . .
3. How are these design elements benefiting your learning?
   a. Can you provide more details about. . .
4. What design elements of online professional development do you feel are hindering your learning of the content so far? (*Note: List of design elements will be provided for this question once content has been determined.)
   a. Can you provide more details about. . .
5. How are these design elements hindering your learning?
   a. Can you provide more details about. . .
6. Keeping a learner's engagement during professional development is a goal of every leader. Can you describe your engagement level during Pathways so far?
   a. Can you provide more details about. . .
7. Has your viewpoint of online professional development changed since attending these Pathways sessions?
   a. Can you provide more details about. . .
8. Have you utilized any individual coaching sessions with the presenters so far?
   a. If so, did you find this design element support your learning?
   b. If not, explain why you have not needed to utilize the coaching sessions?
   c. Can you provide more details about. . .

9. Would you like to share any additional thoughts regarding your experience in Pathways so far?

    a. Can you provide more details about. . .

AFTER PATHWAYS Interview Questions

Interview Questions:

For the purpose of these interview questions, we will focus only on your experience during this Pathway course.

1. Over the course of this Pathways, explain your experience as a participant in online professional development.

    a. Can you provide more details about. . .

2. When thinking about this Pathways experience, how was the learning environment organized?

    a. Was this beneficial to your learning? Why or why not?
    b. Can you provide more details about. . .

3. Keeping a learner's engagement during professional development is a goal of every leader. Can you describe your engagement level during these Pathways sessions?

    a. Can you provide more details about. . .

4. Is there a particular session that you found to be the most beneficial to your learning? Describe why you feel this way about this session. Was there any particular reason it was beneficial?

    a. Can you provide more details about. . .

5. Is there a particular session that you found to be the least beneficial to your learning? Describe why you feel this way about this session. Was there any particular reason it was not beneficial?

    a. Can you provide more details about. . .

6. What elements of the professional development did you feel benefitted you learning the content throughout the entire Pathway? (*Note: List of design elements will be provided for this question once content has been determined.)

    a. Can you provide more details about. . .

7. What design elements did you find frustrating or challenging as a participant? (*Note: List of design elements will be provided for this question once content has been determined.)

    a. Can you provide more details about. . .

8. Did you utilize any individual coaching sessions with the presenters?

    a. If so, did you find this design element support your learning?
    b. If not, explain why you have not needed to utilize the coaching sessions?
    c. Can you provide more details about. . .

9. How has your viewpoint developed from this experience, in regard to online professional development?

    a. Can you provide more details about. . .

10. Explain how you might or might not be able to transfer this experience to your job as an Instructional Technology Coach?

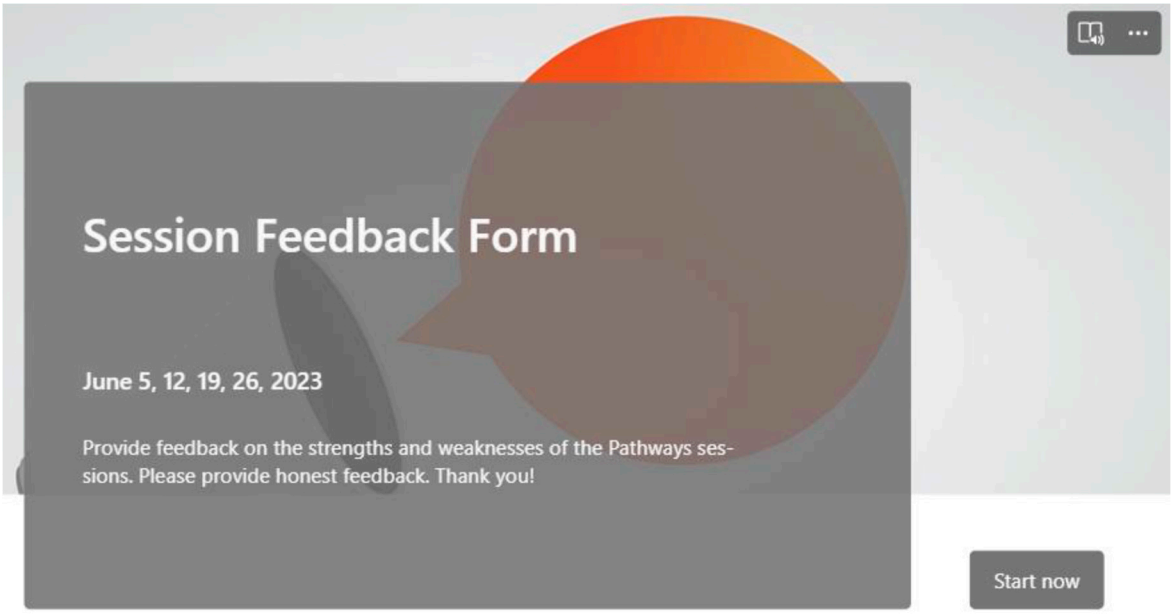
    a. Can you provide more details about. . .

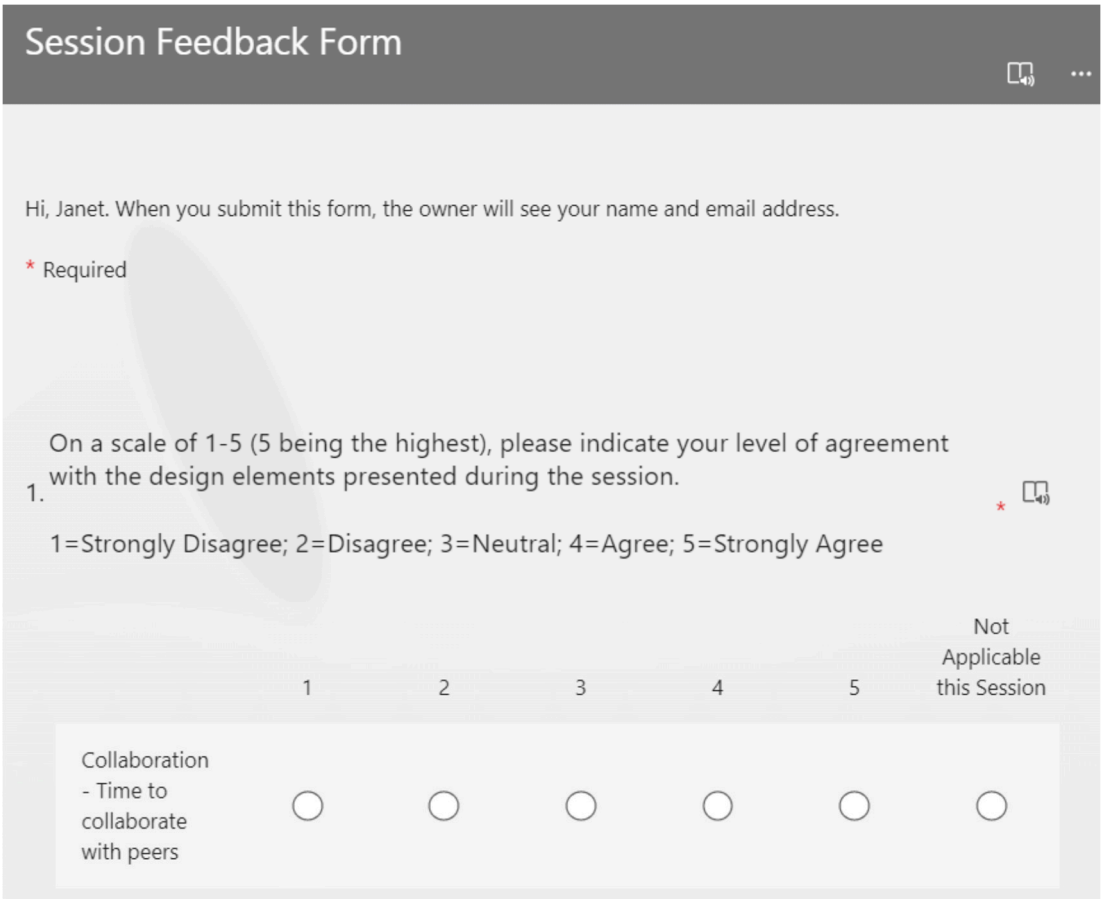
11. Would you like to share any additional thoughts regarding Pathways?

    a. Can you provide more details about. . .

Appendix B. Training Session Feedback Form

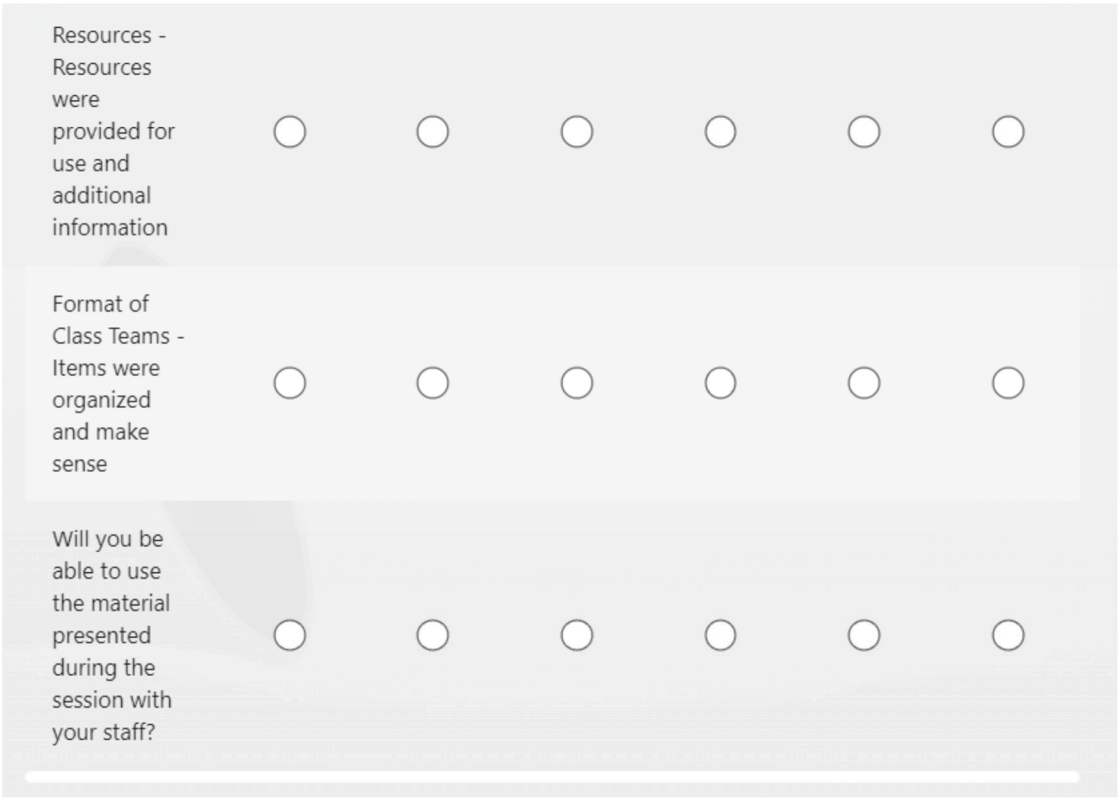
Note: Some questions might change based on the previous week's feedback in order to gather more qualitative and/or quantitative information for the research.





Content Focused - Content was focused on Integrating Instructional Technology Strategies	○	○	○	○	○	○
Active Learning - Instructional Strategies used during the session	○	○	○	○	○	○
Modeling Effective Practices - Modeling how to Integrate Instructional Technology Strategies	○	○	○	○	○	○

Coaching and Expert Support - Leaders of the session provided coaching and expert support when needed during the session	○	○	○	○	○	○
Feedback - Feedback was provided by the leaders of the session	○	○	○	○	○	○
Reflection - Time was provided for individual reflection during the session	○	○	○	○	○	○

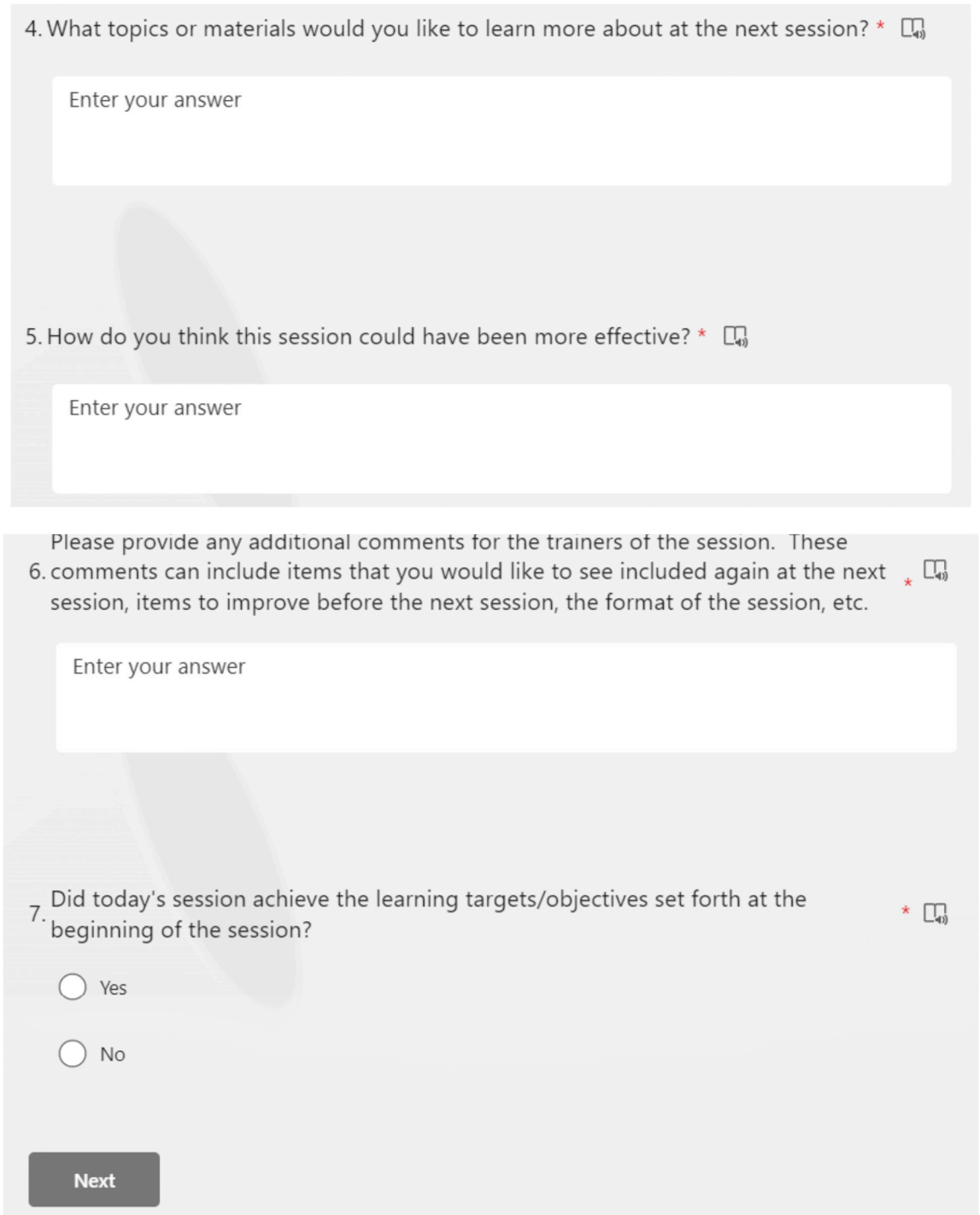


2. What design elements (using the list above) did you find the most impactful to your learning today? *

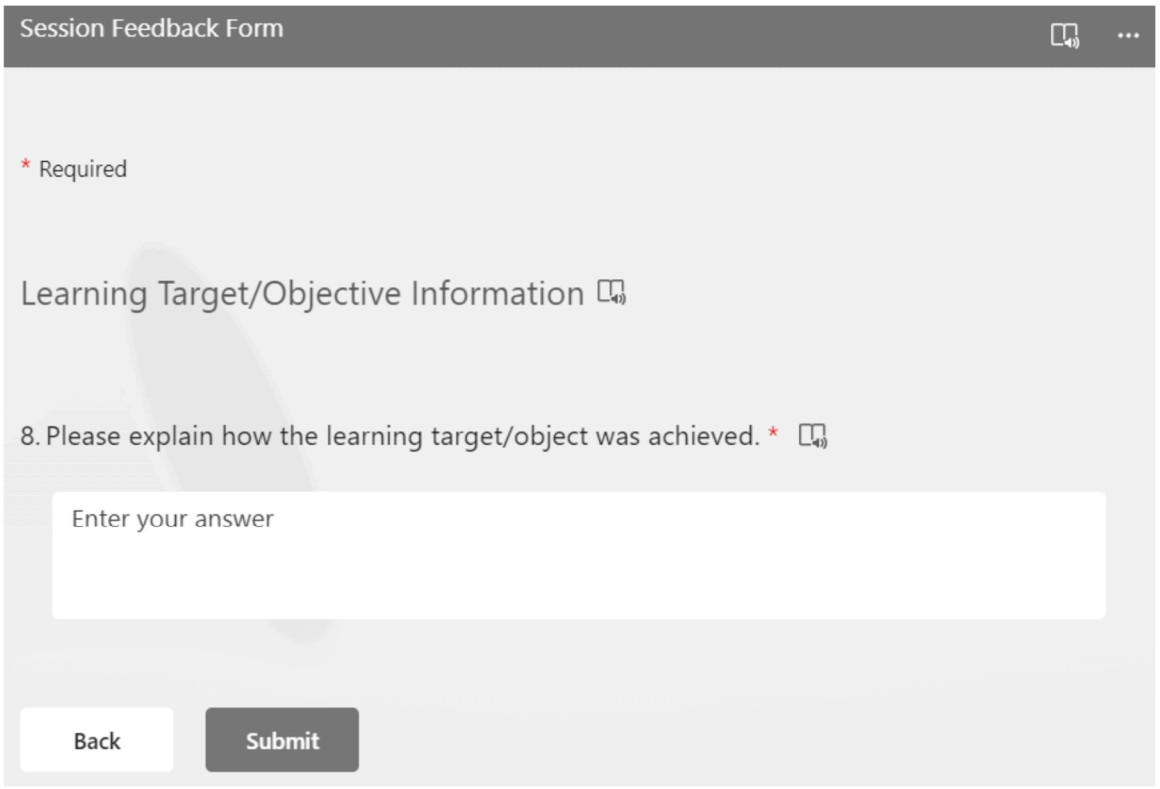
Enter your answer

3. What design elements (using the list above in #1) did you find hinder your learning during the session today? *

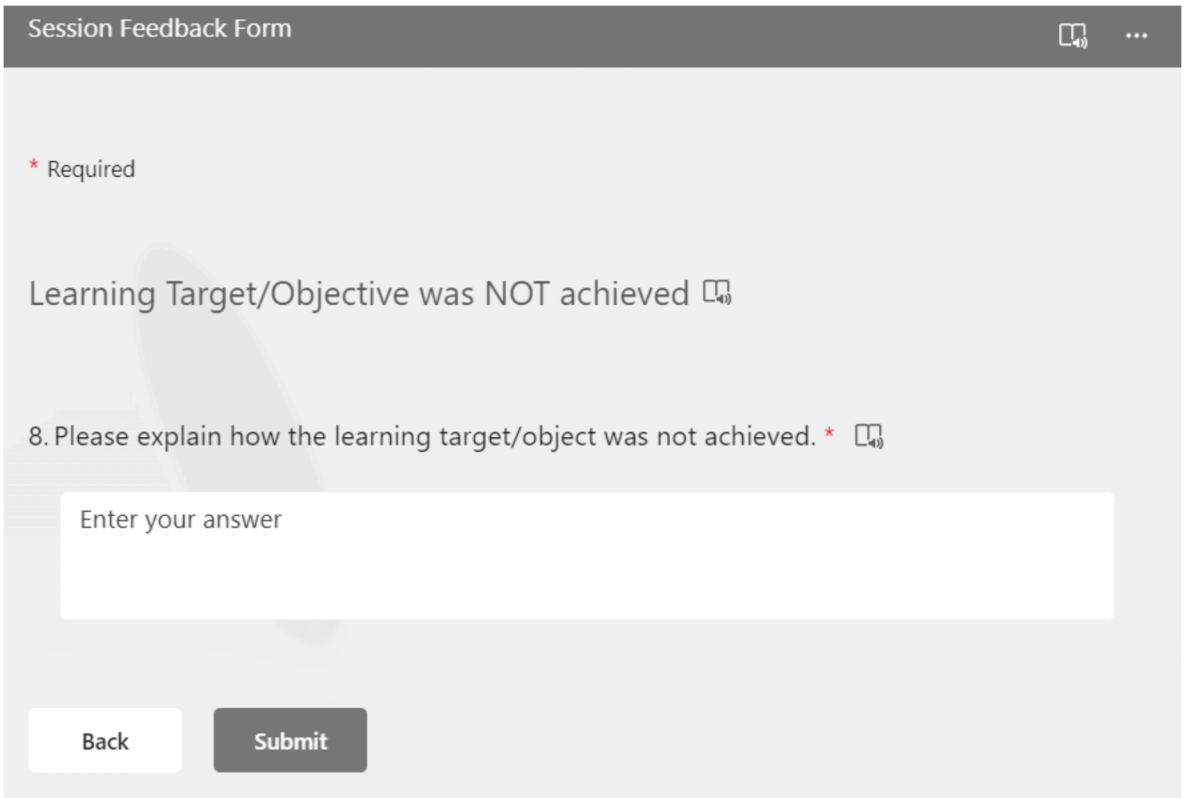
Enter your answer



Next question appears based on answer to #7.


Session Feedback Form
* Required
Learning Target/Objective Information
8. Please explain how the learning target/object was achieved. *
Enter your answer
Back
Submit

OR


Session Feedback Form
* Required
Learning Target/Objective was NOT achieved
8. Please explain how the learning target/object was not achieved. *
Enter your answer
Back
Submit

Appendix C. Playbook Template

TEMPLATE for One-Pager: Title

Tech Tool Name (website linked to name):

Technical Information

GMPS login information for TEACHERS: Teacher/Student Login Information
GMPS login information for STUDENTS: Teacher/Student Login Information
Other technical information needed:

Purpose to use tech tool:

Teaching Strategy: Yes or No Modeling & Practice Yes or No Questioning Yes or No Problem-solving Yes or No Background and Prior Knowledge Yes or No Collaboration Yes or No Vocabulary Yes or No Summarizing Yes or No Non-verbal representation Yes or No Comparison and Contrast

Teacher use case examples:

-

Student use case examples:

-

Additional Resources for Instructional Technology Coach
(examples: important notes, articles, other handouts already created, research, etc.):

-

Appendix D. Rubric for Asynchronous Work

Participants were asked to complete asynchronous work that demonstrates the TPACK gained. Asynchronous classwork was focused on creating one-page documents that demonstrated what they learned during the previous synchronous session.

Name of Activity Chosen by Participant	Did not meet expectation 1	Somewhat met expectations 2	Met expectations 3	Above meeting expectations 4	Above and beyond meeting expectations 5
One-pager Information: Technological Knowledge (TK)	Did not choose a piece of technology that supports the learning of the content	Chose a piece of technology that somewhat supports the learning of the content	Chose a piece of technology that supports the learning of the content	Chose 2 pieces of technology that supports the learning of the content	Chose 3 or more pieces of technology that supports the learning of the content
One-pager Purpose of the Instructional Technology strategy/ Ultimate Goal Achieved: PCK	Artifact does not demonstrate PCK	Artifact somewhat demonstrates PCK	Artifact demonstrates PCK	Artifact thoroughly demonstrates PCK	Artifact demonstrates PCK in multiple ways

One-pager How can this tool impact student learning in the classroom? TCK	Artifact does not demonstrate TCK	Artifact somewhat demonstrates TCK	Artifact demonstrates TCK	Artifact thoroughly demonstrates TCK	Artifact demonstrates TCK in multiple ways
One-pager What does the teacher need to know? TPK	Artifact does not demonstrate TPK	Artifact somewhat demonstrates TPK	Artifact demonstrates TPK	Artifact thoroughly demonstrates TPK	Artifact demonstrates TPK in multiple ways
One-pager What are some tips and tricks for the IT Coach to remember?	Artifact does not demonstrate _____	Artifact somewhat demonstrates _____	Artifact demonstrates _____	Artifact thoroughly demonstrates _____	Artifact demonstrates in multiple ways
Overall					
TPACK Information					

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