THE EFFECTS OF BICHRONOUS PROFESSIONAL DEVELOPMENT ON TEACHERS: PERCEIVED BARRIERS TO TEACH ONLINE

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ABSTRACT

This qualitative, multicase study examined the perceived effect on teachers of an online professional development (PD) program supported by facilitators who provided extensive feedback to them. Our goal was to identify the barriers to teachers implementing their learning in their diverse contexts. Using inductive and deductive thematic analysis and cross-case analysis of interviews and reflections, we found that positive results are much more likely if the design of PD is contextual and facilitation is in place. However, for this external PD to be effective, barriers to implementation, such as administration or support, school policies, and context need to be considered. The nature of PD does not guarantee the implementation of what was learned in the classroom. Suggestions for improvements in terms of PD design and barriers are also discussed.

Keywords: *online professional development, teacher professional learning, barriers to implementation, understanding by design, quality matters*

INTRODUCTION

During the pandemic, educators were pushed to adapt to emergency remote and online teaching (Hodges et al., 2020). The studies during this period showed that teachers familiar with face-to-face teaching methods before the pandemic had difficulties in online or remote teaching due to the need for adequate knowledge of digital tools, apps, or platforms (Gao & Zhang, 2020). Without structured professional development (PD) offerings, sufficient time, and sustained professional support, they were expected to teach in online environments (Evmenova et al., 2021).

Teachers had to explore resources to make their classes more effective (Mustangin & Riswanto, 2020) and they looked for ongoing PD to use technology in their classrooms (Brown et al., 2021). Universities and nonprofit organizations have done their best to provide PD opportunities for teachers. For instance, during the pandemic Boutilier et al. (2020) used online work labs enhanced with an online learning community and feedback to support educators. However, national and international reports have identified issues in teaching remotely (or at a distance) despite PD opportunities provided to teachers. For example, Bond et al. (2021) showed that the lack of student engagement in isolation and poor class attendance was frequently observed in K–12 classes. It was common that there were no student interactions with live, synchronous lessons; text-based sharing tools; or recorded videos.

Remote and distance teaching in the K–12 setting is here to stay, and even though there are examples of PD efforts during the pandemic, it is clear

that the traditional ways of delivering PD may only sometimes be feasible and possible even after the pandemic. Teachers should design and teach courses blended with technology and in-person components (Greener, 2021) while not letting students learn in isolation and as passive recipients of knowledge. Teachers need to create courses that support active learning and interaction among learners (Kaden, 2020). Studies also showed that students asked for more teacher involvement and a socially present teacher, which are, in fact, the characteristics of effective design and instruction in general and not specific to the pandemic or the postpandemic environment (e.g., Andriessen & Baker, 2014).

The pandemic has shifted educators' attention to essential training for teachers to teach with technology in various formats (Foulger et al., 2020; Gao & Zhang, 2020). However, the question is how to help teachers address their continuing needs of support fully. Giving access to content (videos, reading materials, etc.) is not designing a learning activity for teachers. The shift toward more digitalized PD in teacher professional learning will likely happen (Mouza et al., 2022). Well-planned online PD programs would differ from other activities offered in response to emergency remote or online teaching. Empirical evidence also suggests that there has been an increased interest and need for quality online PD during the pandemic, which will have long-lasting effects on teachers and their practice (Bergdahl, 2022). The goal of an effective PD must be to equip teachers with essential skills and knowledge to design learning environments for students' needs (i.e., technology-mediated environments) (Darling-Hammond et al., 2017; Desimone, 2009) and to provide resources to teach effectively regardless of the format of the courses and classes they teach (Can, 2020). As online, hybrid, and blended formats are becoming more common in K–12 schools, there is still a need for high-quality online professional experiences that teachers learn at their own pace without sacrificing interactivity to create meaningful learning environments for students using various modalities based on pedagogic principles and online learning models.

Although several studies have evaluated teachers' PD efforts during and after the pandemic (Evmenova et al., 2021; Mouza et al., 2022), few examined the barriers to implementing in their classrooms what teachers learned. Looking at the intended effects of PD programs provides a greater understanding of why enacting professional learning is impeded (Tawfik et al. 2021). The massive switch to online instruction grows, which provides a unique opportunity to explore the potential barriers teachers encounter as they try to teach online in K–12 settings. There is a need to focus on this issue in the PD arena to identify teachers' challenges and find potential mechanisms to support teachers in need.

More importantly, it is not known if this is still the case after teachers participated in a PD program that featured effective practices and was supported by a facilitator during the program. Even though the general challenges teachers face as they teach online are known, there is still a need for more evidence (McChesney & Aldridge, 2021). What barriers do teachers have that are related to the high-quality PD they attended? What factors interrupt teachers from implementing their learning even though facilitator support is available? Does the design of a PD program help teachers overcome barriers to implementation? The answers to these questions are essential to know since PD providers need to consider them as a design consideration to obtain the desired outcomes of their PD efforts. Highlighting barriers to implementation helps save time, money, and effort, considering that teachers do not implement their learning after they participate in a PD program. Understanding the barriers also helps address teachers' concerns to provide them with a better professional learning environment within schools so that barriers do not impede successful classroom use of what they learn in PD. Therefore, this study intends to identify what the effects of PD are for teachers and what barriers to implementation teachers encounter and/or perceive. In line with this purpose, our specific research questions are as follows:

1. What were the perceived effects of online professional development regarding teachers' knowledge and perspective changes?
2. To what extent did teachers implement what they learned in their own classrooms?
3. What barriers did teachers encounter when they tried to implement what they learned?

CONCEPTUAL FRAMEWORK

The conceptual framework to evaluate our PD program was based on the literature on barriers to change in teachers (Ertmer, 1999; McChesney,

2017) and the theoretical and empirical evidence on effective PD features (Bragg et al., 2021; Dede et al., 2009; Desimone, 2009)

Barriers to Implementation

There are numerous reasons teachers do not implement or cannot integrate their new learning into their classroom after successfully participating in PD; these are known as barriers to implementation. Leary et al.'s (2020) review of extensive online PD studies reported that the setting, context of implementation (school and classroom), institutional support, and administrative roles were often overlooked and became barriers. A heavy workload also hampers teachers' professional actions in the classroom (OECD, 2009). Moreover, teachers can experience barriers to implementation regarding school climate, context, and technology (Johnson, 2006). Specifically, teachers avoid teaching with what they learn (the targeted content) because they are not comfortable and confident with their learning (knowledge of the content), or they do not think the targeted content is relevant to their curriculum (Ennes et al., 2021; Wise, 2010). Some researchers even argue that there are contextual factors in teachers' professional learning process, but there is a need for greater clarification on these factors and how they influence teachers' efforts to implement (Boylan et al., 2018).

Various models or perspectives have been proposed to detect the barriers teachers face during and after PD. For example, Ertmer's (1999) first- and second-order barriers to change explain external and internal barriers to integrating technology into teachers' classrooms. First-order barriers are external and include a lack of access to technology or materials, not enough time to plan lessons, and insufficient support from school leaders or technicians. Second-order barriers are intrinsic and about teachers' beliefs and views about teaching, technology, and professional classroom practices. These barriers hinder teachers' technology implementation efforts and bring more challenges (Ertmer et al., 2012). This and similar frameworks have been extensively used to examine and identify reasons not to integrate technology in the classroom (i.e., Kelly, 2015). In one study, Tawfik et al. (2021) used these barriers to explore teachers' online learning behaviors and found time, accountability, communication with administrators, and no time for feedback as potential barriers to implementation. However, for this study, we believe Ertmer's perspective is practical and in-depth in nature and will help us deal with barriers to implementation after teachers attend a PD program.

Another perspective when evaluating barriers to classroom implementation is McChesney and Aldridge's (2021) model of PD-to-impact trajectory (also in McChesney, 2017). This model provides a lens to approach potential barriers to implementation. In their model, they identified four barriers that intersect with the PD process:

(1) Structural barriers are school-related factors (timetables, location etc.) and language issues (different spoken languages) that prevent teachers from taking PD.

(2) Acceptance barriers are related to cognitive access, perceived fit, and teacher agency. The cognitive access barrier is the gap between teachers' professional knowledge and practices including their perspectives on teaching and learning. The fit barrier is teachers' thoughts if a PD activity is suitable for their students and school. Teacher agency is the value teachers feel and perceive as shown in a PD program.

(3) Implementation barriers prevent teachers from implementing in class what they acquire from a PD event.

(4) Student impact barriers are the barriers teachers think are associated with student achievement.

McChesney and Aldridge assert that these barriers hamper the development of teachers' learning trajectories. In simple language, not all planned PD activities make it into the classroom (McChesney, 2017). Thus, to examine whether or how our PD program was used in the teachers' classroom settings, we adopted McChesney and Aldridge's (2021) model of PD-to-impact trajectory. Also, this model is more structured, and the distinction between different barriers is more apparent than in Ertmer's model. Thus, this model facilitated our qualitative analysis efforts and provided us with a framework to investigate teachers' experiences more thoroughly.

Professional Development Program

PD21 was a three-week online PD program that included both synchronous sessions and asynchronous activities designed based on the Doğan & Yurtseven's (2021) model including effective features of professional learning for teachers

(Darling-Hammong et al., 2017; Desimone, 2009) and successful design considerations of online PD (Bragg et al., 2021; Dede et al., 2009). This model is contextualized and is a suggested PD framework for teachers working in Türkiye (Doğan & Yurtseven, 2021). We incorporated eight key elements derived from adult learning theories and social constructivism (also suggested by Powell & Bodur, 2019):

(1) **Content focus**: technology knowledge (TK), pedagogical knowledge (PK), technological pedagogical knowledge (TPK), and knowledge of effective design with Quality Matters standards (Shattuck, 2015) and Understanding by Design (McTighe & Wigging, 2015).

(2–4) **Engagement, collaboration, and reflection**: Hands-on, interactive, and active learning experiences in which teachers work together, share, and reflect on their expertise and cooperate as they design modules.

(5–6) **Sufficient duration and exposure time**: Activities are spread over three-weeks and provide more than 20 hours of time to learn and interact.

(7) **Facilitation and support**: An expert with teaching and design experience supports teacher groups throughout the program via both asynchronous and synchronous interactions.

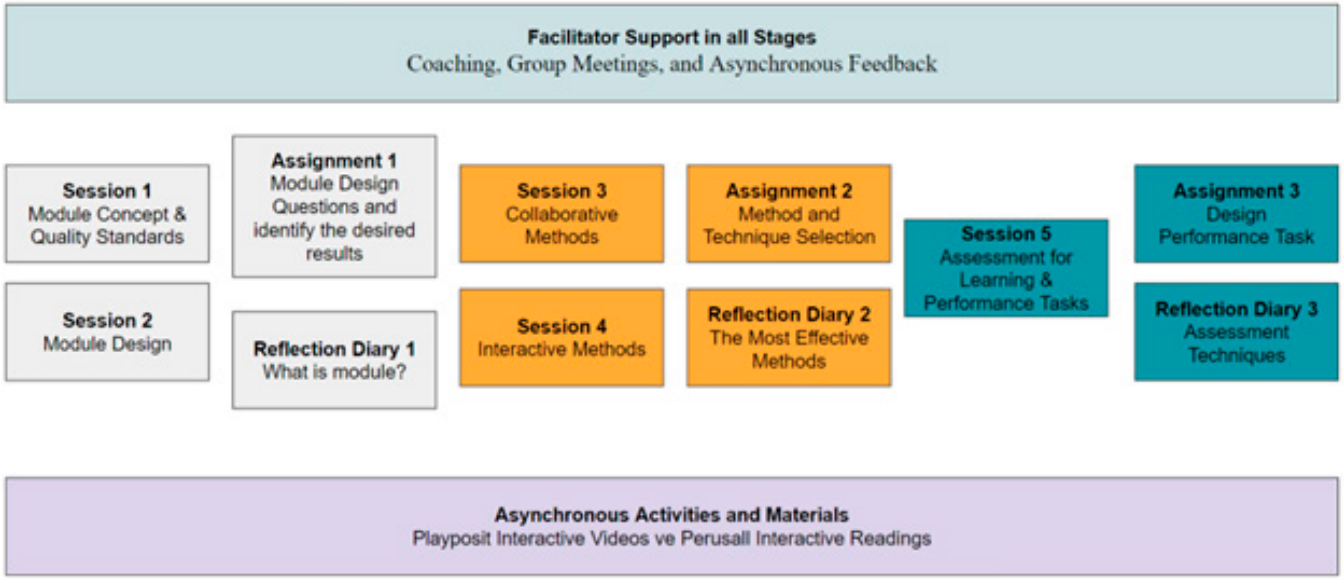
(8) **Best examples of module design**: The program provides and analyzes model designs and instructional materials.

Lastly, coherency and relevance were explored in activities that were aligned with teachers' needs and the environment during the pandemic. Teachers were asked and expected to implement their designs in their classrooms or schools.

The primary goal of PD 21 was to equip teachers with the skills and essential knowledge needed to design a weekly online module (in any format) enhanced with effective practices. The main activities were five, 2-hour (10 hours total) live sessions enhanced with synchronous engagement (e.g., group work, reflection time, formative assessment, and discussions) and at least 11 hours of asynchronous activities (e.g., interactive videos, social readings, discussion forums, assignments, and formative assessment) housed in a learning management system (LMS). After each live session, we assigned the teachers a task and reflection diary. We also provided curated materials, expert-made module examples, and video tutorials as resources. Unique to this program, one facilitator supported groups of four-five teachers using varying scaffolding techniques, such as one-on-one coaching, group meetings, and asynchronous feedback (see Figure 1 for an overview).

All participants working in a group designed and developed a weekly module to be taught in their classroom. Based on the systematic review by Bragg et al. (2021) on the design elements,

Figure 1.
Overview of PD21 Program



these key activities corresponded to the evidence of teachers improving their knowledge, skills, and instructional practices. Therefore, after participating in the program, we expected teachers to improve their PK, TK, TPK, and design skills.

METHOD

Design and Study Context

We adopted a multiple case study (Yin, 2011) to address the research questions of what the perceived effectiveness of PD was, which perceived barriers influenced the implementation of professional learning in natural classroom settings, and how the barriers impeded PD implementation. The study's multiple-case design, involving teachers in very different school contexts, allowed us to triangulate the data collected (Lincoln & Guba, 1985), and, ultimately, employ a cross-case comparison through an interpretive approach (Merriam, 1998).

We conducted this research with K–12 teachers from both public and private schools who chose to participate in PD21 to improve their online teaching and design skills in Türkiye. There was a need to set up the infrastructure, develop course contents, and actively use presentations in distance education practices in Türkiye (Can, 2020; Özdoğan & Berkant, 2020). More specifically, teachers have experienced problems with designing courses for distance learning and they have not been able to compensate for the insufficiency of the existing designs. They failed to do efficient planning due to the shortness of online lesson times (Demir & Özdaş, 2020). Believing that the source of these problems was the lack of PD, we decided to offer PD21, which provided and analyzed model designs and instructional materials to improve teachers' online teaching and design skills.

A total of 41 teachers participated in PD21. After the PD21 program ended, we decided to pursue this research and considered the participation of teachers in the framework of volunteerism first. Then, we selected the participants based on maximum diversity (Creswell, 2014) by having teachers working in both public and private schools with different seniority, online course experience, and subject expertise. In total, seven teachers participated in this study (Table 1).

Data Collection

Individual interviews served as the primary data collection method and underscored this study's qualitative methodology and purpose. We also used teachers' reflections (prompts to express their feelings, perceptions, and experience) that were completed during the PD to support the interviews and data-collection exploration of individual teachers' professional learning (Guskey, 2002).

Table 1.
Information Regarding Participants of the Research

Teachers	Type of School	Subject matter	Seniority (Year)	Online course design experience before COVID-19
T1	Private School	Classroom Teacher	25	Designing online materials for the school's virtual portal
T2	Public School	Classroom Teacher	7	No experiences in online course design
T3	Public School	Math Teacher	11	No experiences in online course design
T4	Private School	Preschool Teacher (Assistant Principal)	22	No experiences in online course design
T5	Private School	Turkish Language and Literature Teacher	29	No experiences in online course design
T6	Public School	Math Teacher	16	No experiences in online course design
T7	Private School	Turkish Language and Literature Teacher	30	Tutoring via Skype

The teacher interviews explored teachers' experiences of PD21, including their perceptions of PD effects. We used a set of open-ended, predetermined questions, yet as Patton (2002) suggested, we also provided opportunities to ask new, follow-up questions. After some introductory questions, all participants were asked 12 questions under three main categories: (1) the challenges during online teaching before PD21, (2) the perceived effects and experiences of PD21 and what the teachers learned (their TK, TPK, TP, module design, and implementation, such as what they like and suggestions for improvements), and (3) the implementation process of what teachers learned and barriers they faced.

Data Analysis

We transcribed all the interviews manually to promote insight into and understanding of participants' responses, which fostered accuracy, analysis, and participant anonymity. We analyzed the transcripts using deductive and inductive coding within Braun and Clarke's (2006) thematic analysis framework. To answer the research questions, we developed a coding list integrating the definitions and examples of possible effects (changes in knowledge and design skills) and barriers of PD in the literature (Borup & Evmenova, 2019; Bragg et al., 2021; Darling-Hammond et al. 2020; Desimone, 2009; Ertmer, 1999; Guskey, 2022; Leary et al., 2020; McChesney & Aldridge, 2021; Means et al., 2010). First, we coded the data deductively, as were searched for the possible effects of PD such as changes in knowledge and design skills during the analysis of the interviews and reflections. For instance, if the teachers stated that they learned a new digital tool, it was coded as TK. Similarly, if the teachers stated that they learned how to design their instruction by balancing asynchronous and synchronous lessons, we coded them as PK. When we captured different codes from the initial code list, we used inductive coding and returned to the literature to identify their categories. For the last research question, categories were combined into larger themes guided by McChesney & Aldridge's (2021) conceptual model of barriers.

To provide reliability, we used an intercoder process. In the first round, we achieved 65% agreement. After the first level of coding, we came together and discussed the initial codes and citations we disagreed with. We updated our code list, constructed the themes by the codes determined, and formed patterns. This discussion regarding coding and themes served as a peer debriefing. After independently coding the data of another teacher over the draft code list we agreed on, the intercoder reliability was calculated as 89.6%. Intercoder agreement in the second round was found to be close to the 90% range suggested by Miles and Huberman (1994), and the coding process proceeded with other transcripts. We created a matrix in Microsoft Excel, displaying the codes, themes, data sources, and participants before the data interpretation phase.

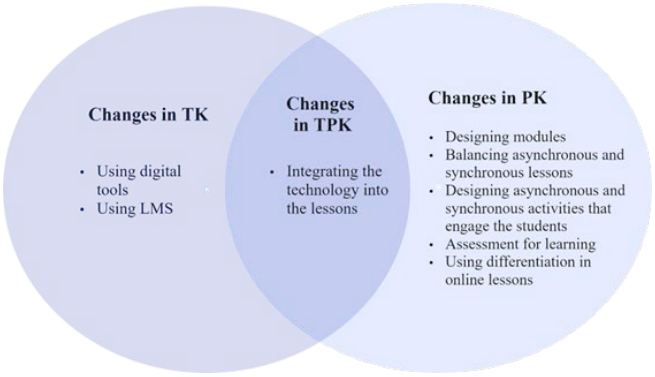
We also used cross-case analysis (Miles & Huberman, 1994) to reveal similarities and differences among teachers who worked in different school types. The cross-case analysis method involved all data for seven participants outlined above and distilled pertinent themes concerning knowledge and design skills changes, implementation stage after PD, and barriers. We iteratively analyzed each case, with data themes emerging. Data sources were analyzed and cross-checked in terms of the school type by the team to establish consistency of the concepts of interest in the study. We also used both interview and reflection data to triangulate and confirm results within cases, and we repeated observation of the main effects across multiple cases, which strengthened the validity of the study's findings. Conceptual themes appearing in each case were schematized to facilitate a cross-case comparison. Primary themes emerged, representing those observed across at least two cases.

FINDINGS

Perceived Effects

We merged two categories related to the perceived effects of PD21: (1) improving instructional design skills and (2) changes in perspective toward instructional design. As teachers gained instructional design skills and solved instructional issues they had been facing (e.g., lack of student interaction), their perspectives on instructional design also changed. Teachers developed their instructional design skills in terms of improving PK, TK, and TPK. Figure 2 represents the knowledge types and their intersections with examples from the teachers.

Figure 2.
What Changed in Teachers' Knowledge after PD21



After they participated in PD21, the teachers' skills in designing modules, including identifying big ideas for their module and creating learning goals based on big ideas, were improved. Furthermore, we found that teachers also improved in designing modules or uncovering the learning objectives and in assessment for learning. T7 and T3 reported positive changes in their PK and their practices toward "assessments for learning." These teachers often underlined the necessity of focusing on enduring understanding and interaction with their students, especially in online education. They stated that learning different methods for formative assessment in PD was extremely important. In addition, T6 explained that:

> I didn't know how to integrate the assessments for learning. One of the most impressive aspects [in PD] was the assessment of the learning process. Because I'm lecturing, but I'm not sure what is and isn't understood. You can catch up with children face to face [education], but since I had some engagement problems and was unable to interact with anyone online either, the assessment for the learning part was effective for me (Interview, Public School).

Moreover, teachers learned not only how to assess the learning process but also how to develop authentic performance assessments that work well with assessment for learning. Especially, teachers who learned how to design performance tasks and use them in online education stated that authentic assessment is essential for enduring understanding. Findings obtained from teachers' reflections showed that they learned the importance of measuring students' ability to transfer their understanding: "While students are learning something, they often ask where it will be useful or effective for them. I learned that the performance task should be able to answer these questions and be designed" (T4, Reflection, Private School).

We also found that there were changes in teachers' TK and TPK. Teachers extended their TK by learning various digital tools, such as Kahoot, Nearpod, and Flipgrid. In terms of TPK, teachers stated that before PD, they merely utilized digital tools in their lessons without considering their purpose, however after PD, they learned how to incorporate digital tools into their lessons. T1 said about their lessons: "For example, I regarded Kahoot as a game. It's not an assessment… You play, it finishes, but I learned that it is a good assessment and evaluation tool and an enjoyable educational tool." T5 explained in their reflection diary that they gained knowledge about using technology according to its purpose and integrating it into lessons: "We learned where, how and for what purpose they [digital tools] will be used. We learned what it means to use them in the right place and to collect feedback from them."

As for changes in perspective toward instructional design, teachers were aware that live sessions and asynchronous activities are a part of the design when they work in collaboration. T7 mentioned:

> The main theme of my gains from this PD is "design." My design potential has reached a completely different level, it has become more organized. The idea of the module was excellent for this, otherwise, we had to load things somewhere, but it flew away, and there was no interaction, no control, and no monitoring of learning (Interview, Private School).

Before PD, some teachers believed that online education consisted of only synchronous activities/lessons in which the teacher is primarily active; however, this belief was dispelled with PD and teachers learned to design asynchronous activities. Moreover, thanks to PD, they learned how to design synchronous and asynchronous activities and how to balance these activities within a module. For example, public school teacher T3 mentioned that synchronous live sessions alone did not improve the quality of their teaching with the reflection that "I learned that not every lesson has

to be synchronous, some things can happen asynchronously, loading everything synchronously is unqualified or inefficient."

Another change in teachers' design perspective was that they learned how to approach design comprehensively. Before PD, teachers perceived teaching as just lecturing and delivering information to their students. After PD, they learned that designing lessons holistically using a big idea is necessary to provide active learning opportunities for their students. Teacher T1 pointed out:

> It [PD] changed my perspective. When I designed a lesson plan with a holistic view of teaching, the lesson flow ran quite smoothly, and I only steered it; I saw that the children also took an active role. (Interview, Private School)

It is important to mention that we have yet to find a salient difference in the instructional design skills between private school and public school teachers. However, private school teachers talked more about how they focus on student interaction in their classrooms. For example, T5 learned tips and techniques on how to make students active online, and T5 believe they can design fewer engaging lessons with the strategies they learned in PD. On the other hand, statements from public school teachers focused more on assessment in online education.

Implementation in the Classroom

The findings indicated that after participating in the PD21 program, teachers practiced instructional design and online learning principles in their classrooms. These practices were (a) opening a virtual classroom using LMS, (b) designing and implementing modules based on Quality Matters and other standards, (c) enacting key elements in teaching, (d) integrating technology into the lesson, and (e) maintaining a balance between synchronous and asynchronous activities.

The teachers who created a virtual classroom through an LMS during online education and enacted their lessons were private school teachers. Whether in an LMS or not, each teacher (regardless of private or public school) stated that they designed and enacted the module. For example, T1 said, "I went through step by step thinking about the module in my mind while designing"; T4 said, "I designed and implemented a module using the 5E Model"; and T6 said, "I designed my modules by thinking of the big idea," indicating that the teachers enacted their module design skills after PD.

Teachers reported that they used vital elements such as warming up, cooperative and/or differentiated tasks, and authentic assessment in both synchronous and asynchronous activities by using digital tools. For example, public school teacher T3 explained that they used various digital tools in their synchronous and asynchronous lessons and implemented assessment activities. Otherwise, private school teacher T4 mentioned that they established learning centers and designed online education activities that aim to develop both inquiry and creativity of students.

When we compared the public school and private school teachers in terms of implementation of what they learned from PD21, public school teachers could not use an LMS and focused more on formative assessment techniques than the other key elements of teaching in their mostly live sessions. On the other hand, private school teachers used an LMS and focused more on collaborative synchronous and asynchronous activities. Furthermore, unlike public school teachers, private school teachers used what they learned from PD to become the providers of digital transformation in their schools. T7, T4, and T5 claimed they intended to initiate an institutional transformation in online education in their schools before PD. Their responses related to the implementation process revealed that they achieved this goal through PD. For example, T7 stated that in their school, they adapted a module design template and structure, decided on the number of asynchronous tasks in order not to overwhelm the students with tasks, and built a structure in which both asynchronous tasks and the content of synchronous lessons presented in advance via an LMS. T7 also emphasized that while in-person education continues, they have established a system for students who were in quarantine due to the pandemic and that they implemented the knowledge of creating virtual classrooms learned from PD.

Barriers to Implementation

The participating teachers were asked to implement their PD learning (the modules and activities) in their classroom settings. In our analysis, according to McChesney and Aldridge's (2021) conceptual framework, we discovered both acceptance and

implementation barriers. We encountered no structural barriers, as all teachers voluntarily participated in PD21. Among the acceptance barriers, we found only cognitive access barriers in PD21. The findings revealed that the factors constituting the cognitive access barrier were the intensity of PD and the structure of group dynamics. Some teachers expressed their concerns about whether they could use what they learned due to the intensity of PD. For instance, T4 (from a private school) stated in their reflection diaries about struggling with all the knowledge applicable in their lessons, "At the end of this PD, I am a little anxious to combine and apply all of what I have learned." On the other hand, the teachers particularly struggled to make sense of the new strategies when the examples were not directly aligned with their teaching subject. Therefore, they stated that they preferred subject-specific strategy examples. For example, T3 (from public school) expressed their concerns in the interview about how the strategies or digital tools they learned in PD could be implemented in their subject matter:

> Strategies really challenged me, thinking of translating them into math, thinking about how I can use [them]... The trainers taught all of them, but they [the given examples] did not suit me [my subject] at all...I needed more information on how to implement them into mathematics. (T3, Interview, Public School)

Teachers' responses included references to the critical implementation barriers that affected the enactment process. We revealed that all implementation barriers could be focused on three different sections: (1) student-related barriers, (2) colleagues and department leader-related barriers, and (3) national/school policy-related barriers (see Figure 3 below). All the public-school teachers failed to make acceptable practices with students due to a lack of technological tools (computer, tablet, etc.) or unstable internet connection because of the low socioeconomic status of the students. We called these barriers student-related barriers. For example, T3 stated that they could not get efficiency from asynchronous activities due to limited student attendance. Likewise, T6 explained that they could not implement collaborative activities in their asynchronous and synchronous lessons because of limited access to the technology of students:

> I couldn't do the collaborative tasks very well. In the public schools, the students had limited Internet connection and tablets/phones, most of the students didn't have computers, and they were using their phones or parents' phones. For us, it was more challenging. I wanted to conduct collaborative activities, but I couldn't use them efficiently (Interview, Public School).

Moreover, even if public school teachers wanted to teach using an LMS, they stated they could not successfully maintain the virtual classroom practice because of students' insufficient internet access and technological devices. Therefore, limited technology access has been one of the barriers faced by public school teachers. On the other hand, some private school teachers hit a brick wall with their colleagues' unwelcoming perspectives. As teachers implemented what they had learned in their own classrooms, students expressed differences in practice among teachers, and this caused tension among colleagues. T7 described the resistance they encountered while describing their own implementations in the interview as "disturbing the other teachers' comfort."

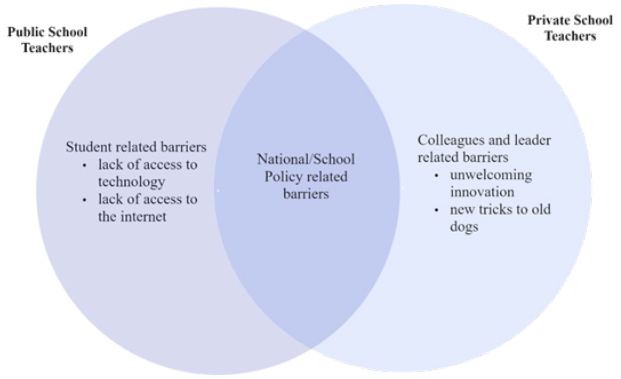
Lastly, we found that national or school policies commonly affected teachers' implementations of what they learned from PD. For example, public school teachers noted that students' attendance in online lessons was limited due to the national policies of the Ministry of National Education during online education. Because, during online education in Türkiye, if parents declared that their children followed the lectures on TV, their children were not obliged to attend the online lessons and were exempt from attendance. This resulted in limited student participation in the lessons and was an implementation barrier. T3 stated that the asynchronous tasks they designed in response to this issue did not achieve their goal.

The school policies were an implementation barrier for public school and private school teachers who had the same issue after PD. T1 claimed they were more flexible and autonomous in distance education and could implement what they learned from PD. However, T1 stated that they could not implement the module design, collaborative activities, and authentic assessments they learned due to the textbook-based instruction policy adopted by their school for in-person education. This finding indicated that not only

national policies, but also private school policies, might change and affect teachers' practices.

The analysis based on implementation barriers showed us that there was a clear difference in terms of barrier types. Our cross-case analysis revealed that the common implementation barrier in private and public schools was only due to national or school policies. The barriers related to students were just seen in public schools, while the ones related to colleagues only belonged to private schools (see Figure 3).

Figure 3.
Comparison of School Types in Terms of the Implementation Barriers after PD21



DISCUSSION

This present study responds to two research questions on the effects of an online PD program through a cross-case analysis of teacher interviews and reflection diaries working with different types of schools in Türkiye. The study also responds to the third research question on the barriers the teachers faced while implementing what they learned. Notably, this study adds to McChesney and Aldridge's (2021) PD-to-impact trajectory model by deepening the understanding of the barriers faced in practice. In this section, we first discuss the effects of our PD program, then outline the differences between school types in terms of implementation, and finally, we examine the teachers' barriers using our conceptual framework.

Improvements in Design Skills and Perspective Led to the Implementation

Concerning the first and second research questions, this study found a positive perceived effect of PD on teachers' skills and knowledge and in changes in teachers' classroom design and implementation practices. The teachers learned something new, aligned it with their practice, and were engaged enough to motivate themselves to implement their learning in their classroom. One reason for this significant change might be the effective features of PD. Synchronous collaborative group sessions, expert facilitation, asynchronous hands-on experiences, and immediate and ongoing feedback are deemed as useful, which is supported by the PD literature (Bergdahl, 2022; Bragg et al., 2021; Desimone, 2009; Leary et al., 2020) and by the contextual PD studies (Doğan & Yurtseven, 2021).

Another reason for the perceived changes is that PD21 was not assigned in a top-down fashion. The teachers in this study were motivated and voluntarily attended for 21 days and agreed to teach their own design, if possible. Conducting an online PD in a bottom-up manner is more likely to produce positive outcomes than a top-down approach (Darling-Hammond et al., 2017). Moreover, given that all seven teachers reported they did not have any PD support for online design during and after the pandemic, the value of the PD21 experience for them was about validating their practices and learning something new based on their needs.

Furthermore, why this kind of PD worked might be of relevance (Darling-Hammond et al., 2017; Desimone, 2009). Teachers learned how to create engaging activities and to promote meaningful interaction with students through various online media that reflected the value of the teachers' professional learning and had practicality for their classrooms. Since a structured PD opportunity (with sufficient time, sustained expert support, and feedback) on online, blended, and asynchronous design during a global crisis was what was needed by teachers (Evmenova et al., 2021, Mouza et al., 2022), we think we have achieved this. Moreover, based on the findings for research question two, teachers had a chance to use an LMS, design new lessons for their students, and integrate technology into their classrooms. In general, these enacted practices are perfectly aligned with the content and scope of PD21. The teachers tend to use their improved knowledge and act on it.

Disparity in Implementation in Terms of School Type

Based on the findings, there needs to be more clarity between the PD content and the existing realities of K–12 schools and policies. The

participants were trained to teach online using flexible design considerations, but the context of some schools was not conducive for testing innovative ways of teaching at a distance. Notably, the findings regarding the context of public school teachers surprisingly showed they were prevented from implementing their learnings from PD in the classroom setting. This echo previous studies emphasizing the importance of local context, such as school affluence for shaping classroom instruction after PD (e.g., Garet et al., 2008; Supovitz & Turner, 2000). Using effective features, we did our best to align PD21 to the needs and expectations of schools and teachers. Regardless, this might still make our PD poorly connected to differing school climates and conditions, a challenge frequently addressed in PD policy studies (Burns & Darling-Hammond, 2014) and online PD research (Duffy et al., 2006). We need to think thoroughly about the value of external PD opportunities (i.e., those not organized by the school for the teachers in that school) before we design effective professional learning. Matching teachers with the formats, topics, or technology resources is important (Borup & Evmenova, 2019) but more effort is needed to impact the real classroom.

An unexpected finding of the current research is that there were differences in private school teachers in terms of implementing what they learned after PD. We interpret these results with caution because when teachers are supported by their institutions to participate in PD, it becomes easier and more feasible for them to implement what is learned from PD in their classrooms. However, in line with individual wishes and needs—without institutional support—private school teachers participating in PD are limited in implementing what they learned from PD. Based on the finding of Opfer and Pepper (2011) that engagement of school leaders and external expertise is necessary for a PD program, it was no surprise that one of the participants (T1) could not transfer their new knowledge and skills when they began face-to-face instruction. Given the importance of school leadership and organizational support for PD participants (Burns & Darling-Hammond, 2014; Garet et al. 2001; Kragler et al., 2014), organizational characteristics and school leaders' support are crucial for influencing what and how teachers later implement PD in their classrooms. Lastly, this finding can be interpreted with mesosystems from an ecological perspective in PD (Ehrenfeld, 2022). The mesosystem represents the relationships between the settings within which people are active. It adopts a standard description of the mesolevel as the institutional context of schools. In our study, subtle differences between school contexts (private and public) impacted teacher implementation of what they learned in PD in their classroom settings. In PD contexts with strong mesosystems, teachers' institutional tracking practices and their commitment to diminishing the mesosystem's harm can effectively implement what they learned from PD. Therefore, we were not surprised that two private school participants (T7 and T4) could make the transformation real with what they learned from PD.

Some Barriers Impeded Implementation

From our data, we found out that the participating teachers partially implemented what they learned. Module design, using innovative and authentic assessments, and effective teaching strategies were the ones that were tested out by the majority of teachers. However, school- and student-related barriers were in play for other practices and blocked teachers' implementation efforts. This is also true in terms of where teachers work. Public school teachers need technical resources, while private school teachers ask for more administrative support and flexibility in their teaching style (Ünsal & Çetin, 2019). Previous studies provided similar results on this finding (Ertmer et al., 2012). Public school teachers face first-order barriers in Ertmer's (1999) model: They need resources and equipment. Indeed, these barriers are relatively easier to handle with financial support and budget planning. Therefore, we need to go one step further and consider Ertmer's assumption that "once adequate resources were obtained, [integration] would follow" (p. 50). For the participants of this study, we can safely accept this assumption because they already implemented their modules and used new assessment and teaching methods (discussed above). They could not use apps and technology tools because of the lack of access to the internet during the pandemic.

There were also acceptance barriers, which are similar to Ermer's (1999) second-order barriers. The second-order barriers are internal to a teacher, including beliefs about teaching and learning, attitudes toward change, and self-efficacy. In our study, the teachers who were confused about

how to implement all the knowledge they learned in their classroom context provided us with some concrete evidence. They reflected their beliefs towards change or self-efficacy. These second-order barriers can be overcome. As Borup and Evmenova (2019) suggested, instead of focusing on what is taught it would be better to focus on how it is taught. In PD designs, teachers need to try out and reflect on their experience because teachers' beliefs and attitudes are the safest way to succeed in implementation (Ertmer et al., 2012). A mindset change is also needed because "student-centered beliefs undergirded student-centered practices (authenticity, student choice, collaboration)" (p. 423).

Using our conceptual model based on McChesney and Aldridge (2021), we can say that teachers did not struggle with structural barriers such as school-related factors or language issues. In previous studies that used the same model with teachers from different backgrounds, structural barriers had been identified (i.e., Kewalramani et al., 2022). This means the intended PD was converted to the received PD (McChesney, 2017). We also found that the teachers (regardless of school type) encountered some challenges between the received and accepted PD due to the intensity and complexity of their professional learning experience. This is closely aligned with our conceptual model revealing that teachers felt overwhelmed or exhausted as a result of the pace and theory-heavy content of PD (McChesney & Aldridge, 2021).

As for private school teachers, what they need from their administrators is open communication and recommendations (Barbour et al., 2020). The unique contribution of this study is that administrative support is warranted more for teachers working in private schools. This is one area for future research, as well. We do not know the other (administrative) side of the coin because school policies bind most leaders. Regulations in a school cannot be changed just to support teachers. For PD programs after the pandemic, it is not possible to predict the number or type of barriers a teacher will face (whether in public or private), but they will surely experience a differing range of barriers. By identifying these barriers and being knowledgeable about them, teachers can be supported when developing new skills and implementing them in their classrooms (Ertmer, 1999).

On the other hand, this study's most significant strength is extending McChesney and Aldridge's (2021) framework in terms of implementation barriers by elaborating on those barriers that influence teachers' transformation of accepted PD into implemented PD. Through our findings on barriers, we might claim that it is not sufficient to have effective components in PD design to have an effect on teachers' learning. In other words, although we designed PD21 considering high-quality criteria (Darling-Hammond et al., 2017; Desimone, 2009), barriers encountered at the contextual or political level affected the impact of PD on teacher learning. In the present study, by discovering the barriers related to students and policies that affect the relationship between impact and design, we are echoing McChesney (2022). McChesney found the assumption of optimizing just the design of PD problematic and might not be enough to ensure impact. As a result, while we believe that the difference between acceptance and applied PD will never be eliminated, follow-up studies should focus on this to reduce this difference. Due to this, we found Darling-Hammond et al.'s (2017) follow-up support valuable and their suggestions for future PD studies that teachers be provided with support on how they can use what they learned through experts in classroom settings.

IMPLICATIONS

For Research on Professional Development

The literature on PD is replete with PD effectiveness studies examining the effects of professional learning activities on various teacher outcomes (e.g., Boutilier et al., 2020; Can, 2020) using several frameworks, such as Desimone's (2009) path model. In this study, we used Desimone's framework and added a new focus to explore what happened after teachers left the PD program. Several outcomes, variables, or factors must be studied for the post-PD period (Boylan et al., 2018). Barriers to implementation are of crucial importance to understand more deeply. Even though PD is designed with effective and high-quality features, a closer look at teachers' working environment and the policies governing their teaching practices is essential since these might hamper the effects of PD (Evmenova et al., 2021; OECD, 2009).

McChesney (2017) provided a lens with the PD-to-impact trajectory to examine the barriers

teachers encounter as they try to develop new skills (although the last two steps in the framework are still being developed and further research is needed). Qualitative studies would provide a deeper understanding of why teachers cannot use what they learn for online learning and other PD activities such as learning communities, lesson studies, and informal learning opportunities. Addressing potential barriers through research studies is also important for the large-scale effects of PD programs. Quantitative studies documenting actual and perceived barriers and challenges to implementing learning from PD might shed some light on this trajectory posed by McChesney (2017).

Finally, our study has value for contextual PD studies because it examines teachers from different backgrounds. Barriers can exist even when comparing teachers from private and public schools. More comparative studies should be explored, especially on how the barriers to teachers implementing what they learned appear in different contexts. Metasynthesis studies on barriers after PD can be done, along with more qualitative studies on this subject.

For Practice and Policy

Significant suggestions for improvements for other PD efforts also emerged. The most relevant of these suggestions is follow-up support during and after PD, also seen in previous studies (Opfer & Pedder, 2011), and meta-synthesis and metareview studies (Dunst et al., 2015; Sims & Fletcher-Wood, 2021). PD providers leverage technology-enabled platforms in online PD events (e.g., asynchronous tools and an LMS) to assist with assessment and lesson delivery. Moreover, just focusing on TK is not conducive to effective learning. PK and TPK should also be focused on in PD activities, and teachers should be encouraged to have hands-on experience with the design and development of apps and technology tools.

We believe that PD policies should be developed so that teachers can implement more of their learnings from PD in real classroom settings because "more teacher learning takes place when online PD content can be transferred easily to a class testing setting" (Reeves & Pedulla, 2013, p. 62). Admittedly, this requires a paradigm shift that needs to be done nationwide and is not open for discussion now. However, what we can do is encourage teachers to attend PD that have effective features. Our study shows that with support, teachers feel better about PD. PD providers can also focus more on effective PD design, including follow-up studies, rather than signing up more teachers to make more money. Thus, they can decide under which conditions they should support the teachers and organize their follow-up studies accordingly. Our online PD mechanisms are cost effective and provide time and place independence when designed carefully.

Concerning barriers to implementation, more than just PD design is needed for a reform movement in classrooms. Yes, in terms of teacher outcomes, it is effective. However, considering school and classroom climate and student-related outcomes, potential barriers impede implementation, as also evidenced in Ertmer (1999) and McChesney (2017). Our study revealed some barriers such as cognitive access and others that are leader-related. Notably, a PD program's intensity (i.e., complexity level) must be carefully decided on so that participants can get the most out of it. Designating levels of PD can be helpful, such as beginner, intermediate, or advanced, so that teachers have a chance to choose and decide which PD they want.

Based on our findings, school type is also a decisive factor in whether there are barriers or not. Identifying the potential challenges for private school and public school teachers would be a benefit when designing new PD programs. For example, most public school teachers need access to technology (such as an LMS or apps) or the internet. Also, new strategies need to be developed for that particular need so that barriers to implementation can be eliminated before teachers attend PD activities. Moreover, PD designs and applications are also crucial, especially in countries with a central education system such as Türkiye. However, there can be many differences even in the two school contexts. Therefore, considering the teachers' settings when developing PD policies will reduce the difference between accepted and applied PD (McChesney & Aldridge, 2021).

LIMITATIONS

First, although we provided a window into online PD and its effects on teachers teaching online during the pandemic, it only represents some public school and private school teachers. Our PD

was designed with high-quality features so more research is needed to see if other PD opportunities (e.g., webinars, district-mandated training, or informal PD) bring about similar results. Quantitative methods would be helpful to get a general picture of barriers to implementing.

Second, while barriers to implementation are abundant, there might be other important factors to understanding why there is a gap between accepted PD and enacted PD. In addition, our data on the implementation barriers were limited to teachers' self-reports. In order to explore these barriers in depth, we recommend conducting case studies with in-class observations. More research in the context of educational policy is needed to see if the national curriculum and/or the Ministry of National Education is a genuine pressure for not implementing new knowledge teachers gain in PD.

Third, PD21 used some apps and technology tools. However, some other tools and apps might result in different consequences in terms of PD effects and barriers to implementation. The last limitation concerns how we analyzed our PD effect, which was using a linear path model. There are also other models (e.g., Clarke & Hollingsworth, 2002) to examine the change in teachers in a nonlinear way. Researchers who try to establish the relationship between PD design and impact can analyze the barriers more profoundly and extend existing models by analyzing teacher change.

In conclusion, our findings encourage us to take a critical stance against external or district-provided PD efforts, given that teachers do not always have the chance to implement what they have learned in their classrooms. We also underline the importance of facilitator support and feedback as necessary in PD design. We argue that PD design with online mechanisms is what is needed, but we also consider barriers and challenges in school and national policies that govern all teacher learning efforts.

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