Application of creative learning principles within blended teacher professional development on integration of computer programming education into elementary and middle school classrooms

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Abstract
Purpose – While it is particularly important that professional programs help teachers become members of a community of practice, especially in crisis situations such as the COVID-19 pandemic, there is a lack of research about strategies to effectively encourage the development of a community of practice and to support teachers’ transformation of their way of teaching. Thus, this paper aims to report on lessons learned from a blended professional development (PD) program for elementary and middle school teachers in Japan focused on computer programming education. In particular, the authors explored how application of the creative learning principles in the blended teacher PD may have helped to nurture a community of practice among teachers in Japan, and how the creative learning principles may be a valuable framework for designing online or blended teacher PD to support teachers’ transition into emergency remote education.

Design/methodology/approach – This paper reports on the lessons learned from two iterations of blended teacher PD situated within a larger design-based research project on applying creative learning pedagogy in teacher PD. Creative learning is a learning approach focused on engagement in personally meaningful projects by tinkering with materials and learning from peers. A total of 26 teachers and coaches participated, all of whom work in elementary or middle schools across Nagano prefecture in Japan. Participant experiences were evaluated based on a pre-survey and a post-survey conducted before and after the in-person kick-off camp; observation notes taken; a final report submitted by each teacher; a debrief meeting at the end of the program; and semi-structured interviews with three selected participants after the program concluded. For this paper, the authors focus on two participants who fully and actively engaged in the program, and they introduce their stories to highlight the outcomes from the PD.

Findings – The results highlight how a blended PD designed to support creative learning of teachers provided teachers with opportunities to gain help from other teachers and cultivate their expertise. The

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results also illustrated that how a community of practice emerged from the PD program, providing teachers with moral support when they tried new lesson designs. This paper offers several recommendations for designing professional learning experiences for instructional designers and professional developers that incorporate remote learning technologies.

**Originality/value** – While an increased number of studies have shown the values of online and blended communities of practice for teacher PD, there are still limited insights on different strategies to support teachers in transforming their teaching practices. They generally do not provide teachers with opportunities to continue learning with and from one another beyond the program itself. This study examined the teachers’ experiences in a unique PD that implemented a creative learning approach into a blended learning environment for teachers.

**Keywords** Online learning, Professional development, Blended learning, Community of practice, Computer programming education, Creative learning

**Paper type** Research paper

1. **Introduction**

   Teachers around the world are facing an urgent need to rapidly adapt their way of teaching to meet the new reality of emergency remote education. They are learning new pedagogical methods and new modes of delivery as they go, “think[ing] outside standard boxes to generate various possible solutions that help meet the new needs for our learners and communities” (Hodges et al., 2020).

   In response to school closures because of the COVID-19 pandemic, a number of online or blended professional development (PD) programs have been created and conducted to support students and their teachers. The term online PD refers to an educational program whose interaction between instructors and participants is mostly through remote communication tools such as emails, online forums and video conferencing tools. On the other hand, blended PD, or sometimes called hybrid PD, includes both remote and in-person interaction. Both types of PD grant teachers a flexibility to fit time and effort to gain new knowledge and skills in their often-overloaded schedules. However, the limitation on social cues in remote communication is historically considered to be challenging for sustaining social interaction between learners (Hara and Kling, 2000). This poses a problem for both online and blended teacher PD because ongoing interaction with instructors, facilitators and other teachers is known to be crucial for the success of these programs (Borko, 2004; Dede, 2004). Furthermore, online learning requires learners to have much greater self-regulation such as time management and help-seeking skills (Lynch and Dembo, 2004), which can place extra burden on teachers who are often dealing with added workload due to the transition into remote teaching.

   In this time of crisis when situations surrounding schools keep changing, it is particularly important that online or blended PD programs help teachers become members of a community of practice (Wenger, 1999), so that they can continue to receive support from one another as they adapt their teaching practices for emergency remote education. In a community of practice, participants with various levels of expertise interact with one another socially over an extended period, addressing issues situated in their contexts (Johnson, 2001). This dynamic social structure facilitates construction of shared authentic knowledge that derives from everyday practices (Brooks, 2010). The shared norms, values, tools emerge from the ongoing knowledge exchange in a community of practice can be a resource that teachers can turn to in times of crisis and critical decision-making. While an increased number of studies have shown the values of online and blended communities of practice for teacher PD (Hur and Brush, 2009; Vaughan and Garrison, 2006), there are still limited insights on different strategies to support teachers in transforming their teaching practices (Dede et al., 2009).
This paper reports on lessons learned about supporting a community of practice by applying the creative learning principles in a blended PD program for elementary and middle school teachers in Japan. The blended PD, called the Shinshu Maker Fellow Program (SMFP), was developed to support teachers who were not specialized in computer science to cultivate their knowledge and skills with regard to implementing computer programming activities in their respective subjects. Integration of computer programming was made compulsory in elementary schools from 2020 in the new curriculum announced by the government of Japan (Shoto-Chuto-Kyouikukyoku-Kyouikuka, 2016). The majority of teachers have been considered to be ill-equipped for this change, with lack of teacher PD and infrastructure to effectively implement computer programming education in their curricula (Kuroda and Moriyama, 2017). The first SMFP began as a sense of urgency for teachers to build a completely new skill set of computer programming became particularly evident across the country. Although the scale of the situation is different, this urgency among Japanese teachers uniquely resembles the current situation surrounding teachers around the world facing sudden demand to transfer their teaching practices into remote or blended environments due to the COVID-19 crisis. The insights we gained from supporting teacher's participation in an online community of practice using creative learning principles during the PD may be a useful resource for instructional designers and teacher educators who support teachers adapting to emergency remote education.

Creative learning is a pedagogical approach proposed by the Massachusetts Institute of Technology (MIT) professor Resnick (2017), who develops and studies technologies that support creativity. Originally inspired by the ways in which children learn through engagement in LOGO, one of the first computer programming language for children (Papert, 1980), the approach emphasizes the four principles of creative learning experiences: Projects (working on an exploratory process to achieve an authentic task), Passion (working on the theme that has personal meaning to the learner), Peers (learning with and from peers) and Play (taking risks and tinkering with materials). These four principles enable learners to construct their knowledge through repeated cycles of imagining, creating, playing, sharing and reflecting, which Resnick calls the creative learning spiral. Resnick posits that learning through the creative learning spiral is indispensable for becoming a “creative thinker”: that is, a person who can think critically and act creatively to navigate a complex, uncertain society. Creative thinking skills are particularly relevant for teachers in a time of crisis, where they need to adapt their practices to the constantly changing needs of students and communities. In this study, we explored how application of the creative learning principles in the blended teacher PD may have helped to nurture a community of practice among teachers in Japan, and how the creative learning principles may be a valuable framework for designing online or blended teacher PD to support teachers’ transition into emergency remote education.

SMFP was a blended learning program for elementary and middle school teachers adapted from a fully open online course at MIT (lcl.media.mit.edu) on creative learning pedagogy. Since 2018, SMFP has been conducted annually, inviting 12–14 new teachers each year from different schools spread across Nagano prefecture, one of the 47 political subdivisions of Japan. Using learning materials (i.e. readings, video clips, activities) from the original online course on creative learning, SMFP was designed to introduce teachers to the potential of computer programming education to support creative thinking while engaging teachers themselves in creative learning experiences. Two iterations of SMFP have shown that the PD program had a positive impact on teachers’ learning experiences and helped them cultivate a community of practice with which they are still involved (Murai and Muramatsu, 2020).
After introducing how SMFP incorporated a creative learning approach in blended learning environments, this paper suggests how application of Resnick’s (2017) creative learning principles in a blended PD context may nurture a community of practice among teachers who face the need to deliver classes under remote teaching and learning conditions. The paper concludes with recommendations for designing similar blended professional learning programs for teachers.

2. Methods
This paper reports on the lessons learned from two iterations of a PD for a larger design-based research (Brown, 1992; Collins, 1992) on creative learning pedagogy (Murai and Muramatsu, 2020). A total of 26 teachers and coaches participated, all of whom work in schools across the Nagano prefecture in Japan. Participants’ experiences were evaluated based on:

- a pre-survey and a post-survey conducted before and after the in-person kick-off camp;
- observation notes taken by the two researchers throughout the program;
- a final report submitted by each teacher;
- a debrief meeting at the end of the program; and
- semi-structured interviews with three selected participants after the program concluded.

Two researchers and two administrative staff met throughout both iterations of the PD to discuss how the design of the PD was working, and how teachers were engaged in the activities and interacting with one another. For this paper, we focus on two participants from SMFP in 2019 who fully and actively engaged in the program, and we introduce their stories to highlight the outcomes from SMFP.

3. Shinshu maker fellow program
SMFP was originally designed as a four-month blended PD program. The participants met in-person at the beginning and at the end of the four months, and participated remotely for the rest of the time (Figure 1). While working remotely, participants regularly checked in with the program facilitators and with other teachers, using synchronous (videoconferencing) and asynchronous (email listserv) remote communication tools. During this period, teachers engaged in project-based learning, which is a practice of learning by engaging in an exploratory task directly connected to an authentic problem or question (Blumenfeld et al., 1991). Each teacher iteratively prepared a lesson plan that involved a

![Figure 1. Schedule of the program](image-url)
computer programming activity, receiving feedback and asking questions using the biweekly check-in opportunities as well as the email listserv. At the end of the remote learning months, each teacher conducted their lesson plan at their school with their students. At the final in-person meeting, the teachers presented the ideas that they tried in their schools and shared lessons learned from their experiences. Building upon feedback from these participants, the second cohort of teachers in 2019 were asked to go through this cycle twice a year.

The whole PD was designed to help teachers develop their knowledge and skills regarding computer programming education as a way to provide their students with creative learning experiences in their classrooms. Rather than simply lecturing on how to support creative learning, the PD modeled the strategies to support creative learning by directly engaging teachers in the four principles of creative learning, Projects, Passion, Peers and Play (Resnick, 2017). The following section describes how these principles guided the design of this PD.

3.1 Project
Resnick (2017) emphasizes the importance of creating an environment where children can learn new ideas, skills and strategies through working on projects that have personal value to them. In SMFP, we enabled teachers to engage in a project about their own classrooms or schools by placing project-based learning at the center of the whole program. The theme of the project was to design a lesson they could implement for any school activity: whether part of their regular classes, electives, clubs or any other time available to them. One of the key design features of the PD were the bi-weekly check-in calls using a videoconferencing tool that enabled the teachers to seek help while conducting the project on their own. Those calls often started with discussions about the learning materials (usually a video clip or a short article about creative learning) assigned prior to the call, and the rest of the time was spent sharing the updates of each teacher’s project. Examples of what teachers shared in these check-ins included materials they created, part of an idea they tried with their students or resources they found. The facilitators encouraged each participant to respond to the updates of other members by asking questions, giving feedback or providing resources that might be helpful for them.

3.2 Passion
The second principle of creative learning, Passion, signifies the powerful motivational potential of interests (Resnick, 2017). To address this principle, we created multiple opportunities in teachers’ learning activities where they could incorporate their questions, their needs and their classes. For instance, at the in-person kick-off camp, we started the first day by asking them to share their expectations, questions and concerns about computer programming education on post-it notes and stick them on one wall in the room. The teachers were prompted to reflect and keep adding more post-it notes on the wall throughout the kick-off camp. We took photos of the questions and perspectives that emerged from this process, shared them digitally in an online repository and frequently referred back to them throughout the four-month program. This activity allowed teachers to articulate their questions and concerns about what they were about to try and helped them to ground the conversation in their own interests.

3.3 Peers
The inspiration for the third principle of creative learning, Peers, is modeled after a Brazilian Samba School, where multigenerational people with different skills levels learn from one
another, creating new songs and dances elaborating on tradition (Resnick, 2017). Promoting peer learning among teachers was one of the main goals of SMFP, particularly as teachers in the region were known to have few opportunities to communicate with one another. After learning that email was the only tool with which all participating teachers were comfortable, we established an email listserv as a main platform for communication. All stakeholders, including facilitators and support staff, joined the listserv to share resources and help teachers as needed. We encouraged teachers to use the listserv as a tool to achieve their projects: sharing any updates, questions, invitations and ideas. The synchronous online check-ins also played an important role by allowing them to give and receive feedback with one another, even though each teacher conducted the project individually. Once peer feedback was established within the culture of SMFP, teachers also started to invite one another to visit their classrooms in-person to exchange feedback about course design.

3.4 Play

While play is often associated with activities that trigger laughter and fun experiences, Resnick (2017) posits that play for creative learning represents “experimenting, taking risks, and testing the boundaries” (p. 128). To embed the aspect of Play in SMFP, we provided several activities at the very beginning of the PD where teachers could engage in playful experimentation in a low-risk environment. For example, one of the activities asked teachers to create a survival tool for a school built on Mars. By staging an imaginary situation, the activities allowed teachers to articulate their ideas even when they were unpolished and try things with the materials at hand. By providing this experience at the early phase of the PD, we tried to encourage teachers to practice playful engagement in learning. While these playful experimentations were done in an in-person environment during the two iterations of SMFP, having such playful shared experience at the beginning of the program seemed to have helped teachers establish relationships and a sense of trust that they could keep relying on after they started to work remotely. In addition, the synchronous online regular check-in calls were also designed to support teachers to engage in the experience of play. By holding several mid-point check-ins instead of having one final share-out, we created opportunities for teachers to share their work in-progress, asking questions and receiving feedback from other teachers on failed attempts. In addition, hosting these check-in calls online provided many teachers flexibility to join from the locations they needed to be, which enabled them to engage in playful conversation regularly.

4. Participant experiences

For the purpose and scope of this paper, two participants’ stories are highlighted. The two were chosen because of their active and full engagement in the program and their contrasting prior experiences with the content of the PD (computer programming education): one, Yutaka, had no experience with computer programming education; the other, Natsuko, had some previous experience.

Yutaka, a teacher in a rural public elementary school, applied to participate in SMFP when he saw the name of his prior college supervisor among the list of organizers. Being an elementary school teacher covering almost all subject areas, he had never tried computer programming before but took the chance to learn something new, even though he was nervous about his lack of experience. The turning point came early when he was participating in the kick-off camp. The experience participating in the playful activities with other teachers left him with a powerful first-hand experience of the joy of making something through exchanging ideas and cooperating with others. Driven by the desire to share a similar experience with his students, he later actively implemented several ideas into his
classroom. While he was not sure where to start at first, the opportunities he sought to learn from other teachers gave him many ideas: he called one of the SMFP alumni to ask about the computer programming tool he was going to use; he tried out other tools recommended by teachers at the check-in call; and he visited another teacher’s class to observe how the teacher taught computer programming and then modified what he observed for his school. He gained a great deal of inspiration and encouragement from other teachers as he worked on a project implementing computer programming in his school.

In contrast to Yutaka, Natsuko had worked as an information and communication technology (ICT) coordinator at her school in the city of Nagano and was actively trying out computer programming herself to help other teachers use it in their classrooms prior to participating in SMFP. For her, the most important take-away from the kick-off camp was the realization of her own tendency to overcontrol her classroom. Participating in playful activities and observing how other participants exchanged ideas made her reflect on her own practices and opened up her perspectives to a more exploratory learning approach. Furthermore, before being connected with other teachers in SMFP, she had no one in her school with whom she could discuss how she should approach computer programming education. Being the only person who was familiar with the topic at her school, she was worried that her ideas influenced other teachers too much, because they tended to mindlessly trust what she suggested they do. By contrast, in the SMFP community, she could receive honest feedback. For example, she sent an email to the email listserv to share a lesson idea that she designed and immediately received responses from five teachers and facilitators in the community. Such interactions provided invaluable support for her as she tried out new lesson designs.

Both teachers described their willingness to continue using the community as a source of PD, learning from lesson plans designed by other teachers and using the email listserv to ask questions or request feedback.

These stories highlight how a blended PD designed to support creative learning provided teachers with opportunities to cultivate their expertise while participating in a community of practice. In particular, the two teachers’ experiences exemplify three ways in which a community of practice supported them as they tried the new lesson in their classrooms. First, the community in SMFP provided the teachers an opportunity to test new practices in a low-risk environment. Natsuko was able to allow herself be exploratory in her own practice after working with others on playful activities during SMFP. By engaging in playful activities with other teachers, she could reflect on and modify her usual way of approaching teaching. Second, the community provided ongoing practical support while the two teachers prepared and conducted a new lesson in their schools. Inputs from multiple other teachers connected through SMFP helped Yutaka construct the tryout session idea. The community provided him timely support when he did not know how to start the project. Finally, and perhaps most importantly, the community provided moral support and fostered confidence in the teachers. Both teachers were encouraged directly or indirectly by other teachers in SMFP. Particularly because both teachers had limited local networks of teachers who were interested in computer programming education, the opportunity for them to gain encouragement was indispensable. These teachers, who had to rapidly learn and implement new computer programming education in their schools share a challenge with teachers affected by the COVID-19 crisis who have to transform their teaching into online or blended learning environments in a short amount of time. The benefits of communities of practice observed above are relevant for today’s teachers facing emergency remote teaching requirements.
5. Recommendations

Based on the researchers’ experiences organizing SMFP, this section shares several recommendations based on creative learning principles for instructional designers and teacher educators who seek to foster a community of practice in online or blended PD experiences for teachers.

5.1 Embed playful shared experiences in the early phase of the program

A playful but challenging group activity at the first stage of the learning community helps to cultivate trust between the participants, enabling them to take risks and be experimental. This is particularly important in remote learning environments because participants tend to struggle building a trusting relationship with one another due to limited social cues (Hara and Kling, 2000). An activity or problem without an apparent solution creates a space for diverse ideas and enables participants to work beyond otherwise-present social dynamics and power (such as age and work experiences). While the playful activities in SMFP were performed in-person, they can easily be applied to remote environments by using commonly available household items and creating breakout discussion opportunities.

5.2 Establish clear milestones with abundant open-ended exploration

It is important that teachers have autonomy in working on projects tailored to their passions. However, it is also important that teachers share milestones to support each other and make progress, especially in remote learning environments that require more self-regulation and discipline (Lynch and Dembo, 2004). In SMFP, teachers were asked to share small updates during the bi-weekly online check-ins as they worked toward final presentations. The teachers were given freedom to decide what to work on and how, but they were asked to try at least one activity at their schools, making it easier to share and exchange feedback with other teachers. This balance between structure and open-endedness is particularly important for a blended learning environment, where participants often need to work according to their own schedules.

5.3 Offer low-risk regular check-ins

While remote communication technologies such as videoconferencing tools, chat platforms and email listservs provide fewer social cues, which could negatively affect social relationships, these tools are useful in inviting participants to share their updates with other members on a regular basis. Regular interaction creates more opportunities for each participant to learn from one another. In addition, having multiple chances to share their progress makes it easier for teachers to take small risks when trying something new. During the regular check-ins for SMFP, each participant was given at least a few minutes to present even when they did not have concrete news to share. As a result, they started talking about small ideas and reflections they had in mind. It is important to select a communication platform that most participants feel comfortable to use. In addition, in case of introducing a new tool, an extra scaffolding should be provided in advance of participation. We conducted a survey to confirm that email was the most comfortable tool for all participants, and hosted a practice session to walk them through how to use the videoconference tool. During the regular check-ins, the key to success is to allocate a time for every participant to encourage them to share any type of update. By lowering the stakes and reducing the risk, the regular check-in becomes a space for participants to adopt a playful attitude to their manner of working.
5.4 Model multiple ways to share
Social participation plays a critical role in inciting knowledge sharing and strengthening community ties (Tseng and Kuo, 2014). One of the challenges of building a community in a remote environment is that social participation is less likely to happen spontaneously. On the other hand, remote communication that enables people to communicate both synchronously and asynchronously opens up new opportunities for people to participate in a community through sharing. For example, asynchronous communication tools such as emails are useful to share lesson materials that teachers created that would take too much time to share if it were in in-person settings. Synchronous communication tools such as video conferencing tools are useful to invite larger number of people for regular updates. During SMFP, facilitators took turns to post an email to the email listserv once per few days to lower the hurdle for teachers to share. Those posts included their reflection on the PD, an event report that was relevant to the theme of the PD, a question they were inspired to ask the teachers and an invitation to a presentation they were hosting. When facilitating a community of practice in a remote environment, it is important to model different ways of sharing knowledge in the community and acknowledge various ways of contributing that are welcomed in the environment.

5.5 Mobilize and distribute resources for remote project activities
Lack of access to materials and equipment is often an obstacle to conducting project-based learning in remote environments. Facilitators can support participants by introducing alternate resources accessible digitally or playing the role of librarian – finding and lending resources for remote-learning participants. For example, in SMFP, we prepared a physical guide to computer programming techniques as well as some microcontrollers that teachers can borrow and use in their classrooms. Many teachers used these rental materials and equipment when their workplace did not own those materials.

5.6 Keep the community open
For a community of practice to remain a valuable learning environment, it requires members’ active and constant social participation (Wenger, 1999). Asynchronous online communication environments are uniquely capable of supporting this process by allowing a greater number of people to take part in the community at relatively low cost. To inspire more social participation in SMFP, for example, we invited the new cohort of teachers to the same email listserv used by teachers who participated in the previous year, instead of creating a separate communication channel. We also invited all facilitators and visitors to the program to participate in the listserv. Each time new members joined the listserv, several interactions occurred within the community. Keeping an online community open to all members, former as well as new, may help a community of practice maintain social participation.

6. Conclusion
This paper has described a blended PD program for elementary and middle school teachers, specifically focusing on how creative learning approaches were used to overcome the challenges of blended learning environments. While the PD program was hosted prior to the COVID-19 crisis, the lessons learned from applying creative learning principles in blended learning environments provide valuable insights for those who support teachers transitioning to remote or blended teaching. Several recommendations have been proposed for designing professional learning experiences to better foster a community of practice that can offer ongoing support for teachers transitioning to online or blended teaching.
This year, in response to the COVID-19 crisis, SMFP will be hosted entirely online with 14 new teachers from different schools across Nagano. To provide an experience as powerful as that of the past two blended iterations, participants will receive a mail delivery of minimal materials and resources to engage in the same playful experience as in the physical kick-off while separated from one another. The lesson design project assignment must also be altered due to reduced school days. Instead of prototyping and testing with students in school, the teachers will be encouraged to develop video materials for students and other teachers.

Future research should investigate the extent to which the fully online environment of the third iteration of SMFP may change participants’ experiences with learning as well as support a community of practice.

References


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