

# 농촌 초등학교에서 디지털격차 해소를 위한 테크놀로지 활용 수업 사례 연구

## A Case Study of Equitable Access to Quality Technology Uses in a Low-Resourced Rural Elementary School

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### 요약

본 연구의 목적은 농촌 지역의 자원과 테크놀로지가 부족한 초등학교 1인 학급 환경에서 교사의 테크놀로지 활용이 학습의 향상에 어떤 도움을 주는지에 관한 질적 연구를 통해 수업 설계를 위한 시사점을 도출하는 데 있다. 연구 참여자는 초등학교 5학년 학생 1인과 교사 1인이었으며 교사 및 학생 인터뷰와 교실 수업 관찰, 학생 일지 등의 자료를 수집하고 분석하였다. 연구 결과 자원과 테크놀로지가 부족할 뿐 아니라 1인 학급 상황의 한계에도 불구하고, 기존 도구의 창의적 활용과 다양한 온라인 테크놀로지를 활용함으로써, 개별 학습자의 요구와 수준에 맞는 적응적 학습의 제공, 다른 지역 학생과의 협력학습, 교육과정의 재설계 등 학습향상을 위한 다양한 교수전략을 통해 디지털격차를 극복하고 있음을 확인할 수 있었다. 본 연구의 결과는 자원과 예산 부족, 학생 수 경감에 따른 농촌 지역 학교의 위기에서 새로운 대안과 효과적 학습경험 제공의 가능성을 제시하고 있다.

■ 중심어 : | 디지털격차 | 1인 학급 | 교사의 테크놀로지 활용 | 농촌 학교 | TPACK |

### Abstract

The aim of this study was to describe how a teacher used technologies to improve underserved student's learning in a low-resourced rural elementary classroom and provide implications for teachers' use of technology. The in-depth case study was conducted in a one-student classroom setting that isolated the fifth grader from social and collaborative learning opportunities. The qualitative data was collected in forms of classroom observation field notes, teacher interviews, student interviews and student's reflection journals. Findings are as follows: First, technology partakes an import role in a one-student classroom to support student's collaborative learning. Second, to overcome a digital divide, the teacher created a technology-enhanced environment with alternative methods of her own and supplemented teacher-created resources. Third, the teacher used technologies to support adaptive instruction based on student's needs.

■ keyword : | Digital Divide | One-student Classroom | Teachers Use's of Technology | Rural School | TPACK |

## I. Introduction

The advent of educational technology has created new possibilities for teachers to bring meaningful and transformative learning experiences in K-12 classrooms. Even though technology has increased access to resources, expanded communication opportunities, and enhanced collaborative capacity, not every class fully benefits from the new technology[1-3]. Rather, it has produced disparities in potential benefits from those technologies in each classroom. Initially, the lack of access to digital technologies, such as the Internet, was the primary concern of the “digital divide” that excludes disadvantaged teachers and students from accessing learning opportunities[4]. However, this digital divide has grown by the degree to which people productively or unsuccessfully use technology[5], in particular with differing quality of using them in classrooms depending on school’s socioeconomic status[6]. While the recent development of affordable devices and free or low-cost options for accessing digital materials have gradually alleviated some concerns regarding the ‘access’ itself, a gap of effective technology uses among teachers still exists[7].

Even in South Korea, a country regarded as highly advanced regarding equipping technological infrastructure, there is a noticeable disparity in the use of educational technology due to the digital divide between schools with high equipped technologies and those with a lack of access as well as teachers with varying competency of using them. Also, remote geographic locations and decreased number of populations in the rural area create a unique context for rural education in South Korea. In

contrast to many previous studies and educational policy documents that examined and described the exemplary use of innovative technologies in K-12 classrooms as a proving ground for new initiatives (e.g., Smartboard, cloud computing system, 1:1 tablet initiative, or digital textbooks)[8], there is little research focusing on how teachers in low-resourced schools use technologies for the underserved students’ equitable access to devices, resources and quality learning. Given that teachers play a key role in deciding how and when to use technology in their classrooms[9], research producing lessons for teachers to use technology in a low-resourced setting is critical to provide underserved students with an equal opportunity to learn. Therefore, the purpose of this study was to describe how a teacher used technologies to improve underserved student’s learning in a one-student elementary classroom and provide implications for the design and implementation of instruction that overcomes geographical limitations and disparities in digital resources.

This research explores following research questions: How does an exemplary teacher use technology to support student’s learning in a one-student classroom at low-resourced rural elementary school? and what role does teacher’s TPACK play in developing technology-enhanced lessons?

## II. Literature review

### 1. Digital divide in rural schools

The OECD defined the digital divide as “the gap between individuals, households, businesses and geographic areas at different

socioeconomic levels with regard both to their opportunities to access information and communication technologies (ICTs) and to their use of the Internet for a wide variety of activities”[10]. Unlike the initial expectation that technological development may expand the learning opportunities, a review research concluded that unequal access to computers rather maintained or exaggerated existing inequalities without bringing education closer to equal educational opportunity[11]. The lack of access to ICTs, including Internet, has been one of the primary concerns among educational researchers because it excludes disadvantaged teachers and students from accessing learning opportunities[4]. The gap between those with and without access has been well documented in previous studies that examined the digital divide between rural and non-rural districts and schools. It is our consistent understanding that rural districts and schools are lower-funded and lower resourced than their non-rural counterparts regardless of the national contexts, such as in United Kingdom[12], Australia[13], United States[14], South Korea[15] or China[16]. This disparity may cause problems for students’ learning in rural schools because fewer opportunities to access ICTs are correlated to rural students’ lower self-efficacy of using Internet and lower academic performance[16].

## 2. Teachers’ use of technology in rural schools

In addition to unequal access to technological infrastructure, a teacher factor also influences the way technology is being used in a classroom [9], which may escalate the digital divide. Previous studies provide evidence of the potential inflation of digital divide by stating

that digital divide has grown by the degree to which people successfully use technology[5]. In particular, technology use differs in its quality of being used in classrooms depending on school’s socioeconomic status (SES): students’ use of computers for drill and practice or remedial work in low-SES schools versus students’ use of software for student-centered deep learning in high-SES schools such as producing with or collaborating through technology[6]. The gap in accessing quality technology use is partly due to the result of rural teachers’ being less knowledgeable about effective technology-enhanced instruction[17]. In fact, rural teachers indicated that they have continued to not only be limited in accessing classroom technology but also inadequately prepared to engage students in using technology in a meaningful way[19]. In addition to teachers’ knowledge, their attitudes towards technology also affect the use of technology and how much students get benefit from technology integration[14][18]. Considering the result showing that it is teacher variables that have significant associations with technology integration rather than schools’ SES and remoteness[14], providing instructional guidelines for rural teachers to model exemplary practices is necessary.

## 3. Conceptual frameworks

By acknowledging the lack of previous studies, this research explores how an exemplary teacher uses classroom technologies in a low-resourced rural school and describes the teacher’s instructional practices designed and implemented for facilitating student’s equitable access to quality education. To achieve the research goal, two conceptual

frameworks will guide our qualitative inquiry process. First, the framework for technological pedagogical content knowledge (TPACK) will be adopted to identify the exemplary teacher's knowledge used for designing technology-integrated lessons. TPACK framework was proposed to identify three primary knowledge areas that teachers should possess for successful integration of technology in teaching: technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK), and four intersections of each knowledge area, technological pedagogical knowledge (TPK), technological content knowledge (TCK), pedagogical content knowledge (PCK), and technological, pedagogical content knowledge (TPACK)[19].

Also, the teacher's use of technology identified in the study will be interpreted by three categories of technology implementation highlighted by Hughes [21]: technology functioning as replacement, amplification, and transformation. Teachers can use technology for replacing traditional means of instructional delivery without changing instructional goals, practices and student learning processes. Also, technology can be used as amplification by enabling more efficient and effective instructional practices without changing tasks themselves. Ultimately, technology used for transformation can significantly change students' learning processes and teacher's instructional practices in a classroom.

### III. Method

An in-depth single case study was conducted in a low-resourced rural elementary school in

South Korea. Compared to multiple case studies that examine the differences and similarities between cases [22], a single case study allows researchers to get a deeper understanding of one particular context[23]. Therefore, we adopted this particular approach to understand teacher's use of technology in a unique one-student rural classroom setting.

The school was a branch of one elementary school located in Gangwon province. While this school was situated in a particular national context, South Korea, the school confronted common challenges as other rural schools in different countries are facing. For example, the school had limited budgets and funding [3], lack of technological access and educational opportunities available to students[21]. The one-student classroom was equipped with teacher's computer, student's laptop, flat TV, and dry eraser sheet as a substitute for a whiteboard. More importantly, the school's unique geographic location exaggerated the difficulties of providing quality education to its students. Since the school was physically isolated from surrounding rural towns that have experienced significant decrease in populations, there were only fourteen students and three teachers in total including a single fifth grader and one female teacher, Ms. A whom we observed in class.

The one-student classroom setting isolated the fifth grader from social and collaborative learning opportunities, which was a particular challenge for the teacher. Unlike teachers in rural schools usually perceived as lower quality compared to those in suburban schools[21], Ms. A was an exemplary teacher who was acknowledged for her innovative teaching practices with technology in an elementary

classroom. She has sixteen years of elementary school teaching experiences and it was her first year in this branch school. She was assigned to the ICT department in her first year of teaching and then she learned educational use of ICT expand teaching and learning experience and bring real world into classroom. Ms. A volunteered to work in this branch school with a belief of achieving more meaningful teaching experience and dealing with different opportunities and challenges. The teacher also initiated a research project that could inform her the best practices in a small-scaled school context. As part of this research project, Ms. A was planning to investigate the unique challenges that a small school has (e.g., a small number of students and classes) further with a researcher in school district the following year. She would collaborate with a team of teachers in other small school branches to create an alternative program or content that could support small schools and help students not being isolated. Ms. A's significant amount of teaching experiences, education, her position at the school, as well as research experiences are altogether related to the use of classroom technologies, which makes this case an exemplary.

During and after four 45-minute lessons in two weeks, qualitative data was collected in forms of classroom observation field notes, teacher interviews, student interviews and student's reflection journals. An inductive analysis method was employed to identify themes and categories from teacher interviews [24]. Interviews with Ms. A were first open-coded, wherein the lead author developed several themes relating to the teacher's use of technology. While developing themes, the lead

author also deductively coded the data using the TPACK framework and Hughes's three levels of technology uses. For triangulation, emerging themes and categories were constantly compared with evidence from field notes, student interviews and reflection journals.

## IV. Findings

The result of this study showed that teacher's efforts of using technology provided her student with a collaborative learning opportunity, equitable access to technologies and resources, and adaptive learning experiences in a unique one-student classroom culture and context. Across three themes emerged, we observed Ms. A's use of the TPACK for designing technology-enhanced lessons and three categories of technology uses.

### 1. Technology functioning as replacement

Teachers can use technology for replacing traditional means of instructional delivery without changing instructional goals, practices and student learning processes[20]. The teacher created a technology-enhanced environment with alternative methods of her own despite the lacked technological devices and resources at the school. One example of substituting a technological device was attaching dry erase sheets on a classroom wall to create a similar experience of having a whiteboard and a screen for projecting a computer. Since the school was low-resourced and did not equip appropriate technological devices to deliver digital instructional materials, Ms. A used her technological knowledge of using a whiteboard from previous teaching experiences to create

an equally effective technology-enhanced learning environment. Such alternative method enabled more efficient and effective instructional practices of using digital materials in the classroom, which can be considered amplification based on the categorization by Hughes[20].

Ms. A also supplemented learning opportunities that were previously restricted with teacher-created digital resources. The school's physical location and limited financial support prevented the teacher and the student from visiting famous field trip sites, which creates a gap in accessing quality learning opportunities between rural students and their counterparts. Also, many online instructional resources requiring costs for purchase hindered the teacher's use of supplementary digital materials in a resource-challenged rural school with budgetary limitation. To overcome these challenges and provide the student equal access to diverse learning experiences, the teacher actively created her own multimedia resources and support student's authentic learning. For example, the teacher took photos or videos of places that she visited during vacations and developed virtual field trips to historic places for a social studies lesson, such as old palaces in a metropolitan area. She also used free instructional animations presenting historical events that occurred in those places during 19th century. Developing virtual field trips was attributed to the teachers' technological knowledge, pedagogical knowledge, content knowledge as well as the combination of three areas because Ms. A needed to know when to use virtual field trips for which subject area, and how to develop them. Unlike physical field trips that often have significant budgetary

limitations, virtual field trips have been advocated as alternatives that enable teachers to take their students to places that are far away, in the past, or inaccessible[25]. Considering the result of previous studies that found virtual field trips were equally effective to traditional ones[26], using teacher-created field trips could expand learning opportunities for students in a school with limited resources. This type of technology use can transform student's learning experiences.

## 2. Technology functioning as amplification

Technology can be used as amplification by enabling more efficient and effective instructional practices without changing tasks themselves[20]. Technology seemed to partake an important role in this one-student classroom to support student's collaborative learning. Ms. A acknowledged the importance of collaboration in learning and was also familiar with online tools that facilitate the collaborative processes. For a social studies lesson, she used free online tools to overcome the lack of communication and collaboration among students, which represents her pedagogical and technological knowledge as well as the integration of two areas. The advantage of using these collaborative learning tools was maximized in this classroom where a student rarely had a chance to interact with other students in the same grade level due to the school's isolated location. In order to provide a student with a group work experience, Ms. A collaborated with two other teachers in neighboring schools located in the same province but separated by mountains, and developed a project together, which reflects teacher's pedagogical content knowledge. In

this social studies lesson, each student conducted research about domestic animals and created a Power Point presentation. When presenting the product, teachers used Google Hangout, a free online conference tool, to connect all three classrooms so that students could see each other and present their works online. They also set up an online community in Classting®, an online community service platform for K-12 teachers and students, where students could share their product and provide comments to each other. This collaborative project was regarded as an example of transforming teaching and learning by using technology because the use of online tools transformed the one student's learning and teacher's instructional practice by providing a collaborative opportunity that would not be otherwise possible in a one-student classroom.

Furthermore, in all three classrooms, the increased interaction seemed to amplify students' satisfaction, which was portrayed in their answers from their reflection journals and interviews: "It is interesting to study by using the internet to discuss and do activities with the other students / I like how we can share our ideas to our peers in class / I liked how we used social media to provide feedback by stating positive, negative, and improvement points that helps one fix and change necessary areas / I liked how I was able to know everyone's thoughts and ideas/ I felt more friendly towards my teacher by using the web to ask and answer questions / I was happy to share my presentation by using screen sharing. In Classting®, it was really helpful to see other students' feedback".

Also, the teacher recognized that an online discussion topic organizer could be used as a

tool to support her student who cannot pair work or group work in class. Using visual ranking tool provided Intel® the student could present her idea during in-class discussion by providing a step for preparing and visually organizing her thoughts and opinions. Then she can compare different point of views from her teacher and other students in different schools. Despite asynchronous interaction, she could still share and reflect her own thought as if she was involved in normal classroom with multiple colleagues. More benefit was mentioned, "I could be more prepared for discussion during organizing my own idea with the tools" by the student, "I encourage her more actively analyze or compare other's perspective using these tools than real time interaction in class" by the teacher.

### 3. Technology functioning as transformation

Technology used for transformation can significantly change students' learning processes and teacher's instructional practices in a classroom[21]. Throughout the lesson, the teacher used classroom technologies to support adaptive instruction based on student's needs. The unique context of the one-student classroom setting allowed one-on-one instruction, which was further supported by the teacher's technology use. For example, the teacher taught the student how to search information from the web, critically evaluate and also present them. Information searched and evaluated by the student was then used to guide her to set personal learning goals. Helping students to have an ownership for their learning and meet individual needs cultivate learners to be empowered for their own learning, one of the critical criteria for successful technology

uses[27]. Especially, Ms. A let her student to take a lead in learning and the student perceived it as nurturing and motivating in her interview: "My teacher always says that it is important to ask myself to what extent I will study by making an agreement between my teacher and myself. So, I asked my teacher to give me more time for harder assignments so that it allows me to finish the easier homework first and save some time to work on harder ones."

In addition to supporting the student to become an independent learner, the teacher also used an online tool to be flexible in modifying curriculum and creating learning activities to accommodate her students' learning needs. For example, in a regular classroom with many students, a teacher cannot easily change the pace of teaching or modify curriculum across different grades. However, in one-student classroom that we observed, when the student presented her interest in learning more about history that was beyond the current curriculum, the teacher modified the 5th grade social studies curriculum and reorganized lessons and activities to be aligned with the 6th grade curriculum. Furthermore, Ms. A arranged the online discussions with nearby school's 5th grade and 6th grade classrooms so that her student could participate in real time online discussions. This adaptive instruction with the modification and rearrangement of the curriculum could be attributed to the teacher's pedagogical content knowledge, which was further enhanced by incorporating technological knowledge. The teacher's TPACK transformed the classroom instruction and student's learning to reach the full potential of using technology in one-student classroom.

## V. Conclusion

The technology uses by the exemplary teacher described in this study provided a new opportunity for a traditionally underserved student to have equitable access to high-quality educational experiences. Equitable access does not only mean providing devices and connectivity. More importantly, a teacher should be an advocate for equal access to educational technology and quality learning opportunities for all students[27]. The case described in this study can contribute to this end by deepening our understanding of how a teacher can transform learning opportunities available to all students with the equitable use of technology in underserved rural educational settings. First, even in a school that is geographically isolated and low-resourced, the optimal use of minimally equipped classroom technology can overcome digital divide and provide quality learning opportunities to students. Second, teacher's knowledge and skills of using technology is a critical factor for overcoming that limitation. Considering the previous studies that a human-factor in technology implementation can inflate the digital divide and exaggerate the gap of accessing quality education[5][6], professional development for teacher's successful use of technology and development of TPACK is necessary to minimize digital divide accounted by a teacher factor. Lastly, successful use of technology can maximize the potential of collaboration among students in remote one-student classrooms where a unique challenge develops with a dramatic decrease in rural school-aged populations. These findings provide important implications for the design



and implementation of instruction that overcomes geographical limitations and disparities in digital resources.

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