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International Journal of Psychology and Educational Studies

Pre-service Teachers' Perceptions of Technology and Multiliteracy Within the Inclusive Classroom

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ARTICLE INFO

Article History:
Received 14.04.2015
Received in revised form 21.04.2015
Accepted 30.04.2015
Available online 01.05.2015

ABSTRACT

The increased use of technology in today's schools has created new possibilities for pre-service teachers and their students. Rather than limiting the use of technology based on student ability, it is now possible for pre-service teachers to develop integrated multiliteracy lessons that integrate technology and enhance student learning. Technology in the form of apps for iPads, iPods, and desktop computers enable teachers to achieve this goal; however, pre-service teacher's perceptions of technology and teacher self-efficacy in relation to technology may influence whether technology is integrated into their lessons. This paper examines 144 primary/junior pre-service teacher's self-efficacy and perceptions of technology before and after developing an app based multiliteracy lesson plan. Findings suggest that new teachers were more comfortable with the idea of integrating technology into their lessons after researching and completing a lesson plan focusing on the use of apps within an inclusive classroom.

Keywords:
literacy, pre-service education, technology

1. Introduction

While the development of students' literacy skills (Sandford & Madill, 2007) has always been a focus of education, the emergence of new technologies has changed both the nature of literacy and its corresponding pedagogy. Research has demonstrated (Garcia & Friedman, 2011) that the integration of technology into the curriculum is beneficial for the development of critical thinking, problem-solving skills and multiliteracies. It is imperative that teacher education programs adjust to meet the changing nature of literacy by providing instruction in multiliteracy and creating opportunities for pre-service teachers to practice new literacy methodologies (Ajayi, 2011). This paper examines how providing pre-service teachers with the opportunity to develop a multiliteracy lesson plan for an inclusive classroom influences their understanding of multiliteracy and their self-efficacy and perceptions of technology.

The inclusive classroom is being embraced globally (Flewitt, Nind, & Payler, 2009) to ensure that all students regardless of exceptionality, socioeconomic status, culture, ethnicity, or any other trait that may influence an individual's ability to access an education is adequately supported in the classroom. As a result, the teaching and learning environment of the regular classroom has evolved to ensure that all students receive a common, quality education (Leyser, Zeiger, & Romi, 2011) particularly in the area of literacy (Flewitt et al., 2009). However, students from diverse populations may encounter difficulties with literacy when it is viewed as simply the act of reading and comprehending printed material.

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DOI: http://dx.doi.org/10.17220/ijpes.2015.02.004

Literacy is not defined by a set of skills learned independently in schools that are then transferrable to the outside world. Learning and teaching are now occurring in new digital landscapes that allow students to represent their ideas and thoughts usingmultimodal formats to a global audience (Lam, 2007). In addition, literacy instruction is being modified to encompass the skills of creativity, innovation, critical thinking, problem solving, communication and collaboration (Potts, Schlichting, Prigden, & Hatch, 2010). These skills are fundamental to a curriculum integrated with technology and encompass many of the essential learning goals deemed necessary for today's learner (Ontario Ministry of Education, 2012).

Lankshear and Knobel (2003) have created the term 'new literacies' in consideration of the fact that, "being literate involves much more than simply knowing how to operate the language system" (p. 12). New literacies involve processes such as judging the value of various Web sites or maneuvering through hypertext (Kulikowich, 2008). For example, today's students are interacting with new literacies on a daily basis, including Web based reading and writing, e-books, participating in social networking spaces, instant messaging, and blogging to name just a few (Lankshear & Knobel, 2003). In this world of new literacies, students are using a number of different technology systems (cell phones to Internet) in order to solve a problem or complete a task (Kulikowich, 2008): "All of these practices impact our conceptions of literacy and, ultimately, influence the definitions of literacies in the classrooms, at home, and at work" (Leu et al., 2004).

Currently there is a disconnect between the traditional view of literacy as a linear, text-based process that can be measured by formal assessments of academic achievement (Giampapa, 2010) and the view of literacy as a multifaceted complex set of skills and resources, which enable the development of meaning from all types and forms of text (Ontario Ministry of Education, 2004). The New London Group (2000) recommended that literacy pedagogy change from the "formalized, monolingual, monocultural, and rule-governed forms of language" to one that is much more expansive (p. 61). As a result, the New London Group introduced the term *multiliteracy* to acknowledge the culturally and linguistically unique interrelationship between print, visual, and audio texts, and communication forms of reading, writing, speaking, and listening. The term multiliteracy, therefore, emphasizes the fact that literacy can no longer be viewed as simply the act of reading and comprehending printed material, but must embrace the multimodal approaches through which the consumption, production, evaluation and distribution of text changes the way individuals interact with text, as well as the nature of the text itself (Borsheim, Merritt, & Reed, 2008; Pianfetti, 2001).

Since it is no longer enough to prepare students for a world of literacy that deals primarily with paper and pencil, it is imperative that pre-service teachers are provided with opportunities to practice using technology as a tool for developing students' multiliteracy skills. According to Barone and Wright (2008), today, effective literacy teaching should include a variety of text formats (e.g., digital and hybrid texts), an adjustment of reader expectations (reading nonlinearly; Warschauer, 2006), and new literacy activities (blogs, wikis, podcasts). However, research has demonstrated that bringing new literacies into the classroom is not always easy for educators especially when the literature has revealed that 66% of teachers believe they are not prepared to use this new, emerging technology (Kajder, 2005). Compounding the situation is the fact that teachers have reported problems with a lack of technology, time, resources, knowledge and skills (Barone & Wright, 2008). As a result teachers may refrain from using technology and the Internet in their daily classroom lessons and experience difficulty connecting standards-based assessment with the use of technology (Davis & McClain, 2003; Friedman, 2006).

A distinguishing factor in whether a teacher will embrace multiliteracy and technology, despite the aforementioned barriers, is their level of teacher self-efficacy. Teacher self-efficacy refers to a teacher's belief that he/she can perform a certain action in order to achieve a given goal (Bandura, 2006; Browne, 2009; Teo, 2009). As a result, teachers who have a high sense of self-efficacy are more open to new ideas and more willing to try new methodologies (Leyser, et al., 2011). Thus, a teacher's level of self-efficacy is an important variable within the classroom environment because it affects the effort teachers will invest in their teaching, which directly impacts student achievement, motivation and the students' own self-efficacy (Tschannen-Moran & Hoy, 2001). In terms of technology, a teacher's self-efficacy refers to a teacher's belief that he/she has the ability to work effectively with technology.If a teacher's self-efficacy is low, the teacher will become easily frustrated and will be less likely to persevere when faced with technological challenges or difficulties (Anderson & Maninger, 2007; Kumar, Rose, & D'Silva, 2008; Teo, 2009). Currently, many teachers are still not prepared to effectively integrate these devices into their teaching and levels of self-efficacy generally remain quite low. As

Graham and Richardson (2012) have stated, "within the current public education schooling experience, there would still appear to be a distinct emphasis on putting the technology well before the pedagogy" (p. 7). Harris and Hofer (2009) refer to the need for a grounded approach to technology integration based on content, pedagogy, and instructional planning.

One promising and popular model that has been developed to address the various levels of technology integration in classrooms is the SAMR model. Developed by Puentedura (2003), SAMR is an acronym for substitution, augmentation, modification, and redefinition. Working through these levels allows teachers to build on their comfort with the integration of technology in their own learning environment and thus their self-efficacy. The goal is to have teachers work towards the higher levels of augmentation and modification, which is reflective of transformative teaching (Puentedura, 2003).

To develop pre-service teachers' self-efficacy for teaching with technology, teacher education programs must integrate the technological skills and perspectives that pre-service teachers currently hold with pedagogical practice (Ajayi, 2011; Puckett, Judge, & Brozo, 2009). In addition, research suggests that pre-service teachers who participate in a technology-enhanced teacher education program are less anxious about computers, their belief in the value of using technology to enhance teaching and learning as well as their self-efficacy toward integrating technology in the classroom significantly improve (Lambert & Gong, 2010). One way to integrate technology into education programs is to encourage pre-service teachers to analyse technology and media to determine how it can support and expand learning opportunities of all students within the inclusive classroom environment. Such an approach would enable pre-service teachers to formulate new and innovative approaches to enhance literacy development through multi-modal learning environments. Multi-modal learning supports the implementation of individualized learning strategies (Brown & Lockyer, 2005/2006) thereby fostering the cognitive processing and critical thinking skills that students need for life long learning.

Ajayi (2011) examined pre-service teachers' attitudes and perceptions towards teaching multi-literacies and found that pre-service teachers are aware that the nature of literacy has evolved to correspond with technological development. In particular, the pre-service teachers acknowledged and accepted that accessing and reading information from multi-media technologies are an important aspect of literacy. Despite this acknowledgement, Ajayi's participants reported that they were concerned about their preparedness to teach in a multiliteracy classroom. Ajayi's findings correspond to other research (i.e., Judge & Simms, 2009; Teo, 2009), which indicates that teacher training is one of the key attributes for the integration of technology into the classroom.

A main limitation of both Ajayi's (2011) and Teo's (2009) research is that the pre-service teachers were not enrolled in a technology-based teacher education program. Therefore, unless pre-service teachers develop confidence in their ability to use and integrate technology in the classroom, they will be unlikely to attempt to use it or will do so with limited effort, perseverance and resiliency (Albion, 1999). Furthermore, pre-service teachers should be introduced to technology during their teacher education program by integrating technology throughout all aspects of their studies (Corkett, Kariuki, Brackenreed, & Waller, 2011). Such an approach may increase the likelihood that pre-service teachers will integrate technology into their future classrooms.

Similarly, Mouza and Karchmer-Klein (2013) have recognized the need for ongoing professional development in learning to teach with technology for educators. The instability of technology requires that teachers need to be made explicitly aware of the constant changes to both the hardware and software applications. In addition, teaching with technology is a complex process and involves the interaction between content, pedagogy and technology (Koehler & Mishra, 2008). This new and distinct knowledge of the integration of technology into teaching has been named the Technological Pedagogical Content Knowledge (TPACK) (Angeli & Valanides, 2009; Mishra & Koheler, 2006; Mouza & Karchmer-Klein, 2013). However, the TPACK model differs from the SAMR model in that it does not distinguish specific stages of technology integration, rather, it provides a more holistic lens for studying the development of technology integration amongst educators (Mouza & Karchmer-Klein, 2013).

Further, Mouza and Karchmer-Klein (2013) found case development that integrated the elements of TPACK was an effective way for pre-service teachers to draw connections between content, pedagogy, and technology and foster retrospective reflection-on-action. It is important that, "In their professional preparation, teachers

need to acquire skills to reflect both in the moment of teaching and retrospectively" (p. 131). Reflection is an important component of teacher preparation programs since it is through the act of reflecting that teachers' can consider why they made the certain choices in their teaching practice and ways of improving their instructional strategies to improve student learning (Lee, 2005).

According to Mouza and Karchmer-Klein (2013), the case study method provides opportunities for per-service teachers to participate in focused reflection that allows them to discern and create relationships with technology, content, and pedagogy. To begin, pre-service teachers are required to create and implement technology-integrated lessons, reflect on the execution of their planned lessons with their students, and finally compose a narrative, which fosters the consideration of their teaching practice in a methodical fashion. "These activities are critical to helping pre-service teachers make insightful shifts in their thinking about technology and its relation to specific content and pedagogy" (p. 131). In their study, Mouza and Karchmer-Klein (2013) found that the case study approach was in fact beneficial for assisting pre-service teachers in understanding the connections between technology, content, and pedagogy, and strengthening their TPACK.

In one northern Ontario University, technology (e.g., Smartboards, computers, iPads, assistive technology programs and devices) is integrated throughout all aspects of its education program. Providing pre-service teachers with the opportunity to explore and use technology both within their courses and while on practicum, may influence their perception and self-efficacy with integrating technology into their lesson plans for the purpose of mulitliteracy instruction. The current study examines whether pre-service teachers who develop a multiliteracy lesson plan that integrates technology report changes in their (a) perceptions of technology, (b) self-efficacy for technology and (c) understanding of multiliteracy.

2. Method

2.1 Participants

The participants consisted of 143 pre-service teachers (female = 122; male = 21; age range 22-44) enrolled in the primary/junior division of a northern Ontario university's Bachelor of Education degree program. The participants were recruited from their mandatory Special Education/Educational Psychology class. All of the participants owned a MacBook Pro computer, 61% owned an iPhone, 77% owned an iPod, and 1% owned an iPad. Participants reported spending an average of 46 hours per week on the computer and an average of 8 hours per week on iTunes. All participants completed an assignment for the course that required the pre-service teachers to create a multiliteracy-based lesson that incorporated one or more special education App with one or more curriculum-based App (e.g., language, geography, science, math, etc.).

2.2 Task

To determine pre-service teachers' preceptions and self-efficacy with integrating technology into lesson planning for the purposes of mulitliterate instruction within an inclusive classroom, the pre-service teachers who participated in the study completed a 63 five-point Likert-scale questionnaire. The five-point Likert scale was broken down into the following categories; (1) not at all; (2) not really; (3) undecided; (4) somewhat; (5) very much. The questionnaire was administered prior to completing the assignment (November, 2011) and upon completion of the assignment (December, 2011).

3. Results

Table 1. Total percentage of responses to 'Very Much' for Self-Efficacy Questions

Questions	Pre-Test	Post-Test
1. I believe that a variety of technologies are important for student learning.	44%	52%
2. I believe that incorporating technology into instruction helps students learn.	43%	50%
3. I believe that student motivation increases when technology is integrated into the curriculum.	42%	46%
4. I believe that technology helps teachers do things with their classes that they would not be able to do without it.	38%	36%
5. I believe that knowledge about technology will improve my teaching.	51%	46%
6. I believe that technology facilitates the use of a wide variety of instructional strategies designed to maximize learning.	31%	34%
7. I believe that students should be required to use a variety of software tools and electronic resources to support learning.	12%	20%
8. How confident are you that you can use technology to focus classroom activities on the needs of each learner.	17%	24%
9. Technology helps me meet the individual needs of students in my classroom.	18%	27%
10. Do you believe you could use technology to address needs of students with exceptionalities?	18%	21%
11. I am aware of a variety of apps that address needs of students	4%	15%
12. I believe that technology might interfere with "human" interactions between teachers and students.	4%	4%
13. I believe that I can integrate computer activities into the curriculum whenever possible.	20%	29%
14. I believe that technology plays an integral role in supporting content learning in my class.	13%	28%

Responses to the pre-test questions pertaining to pre-service teachers' perceptions of technology revealed that more than half of the participants surveyed believed that technology was not important to either student learning (56%) or student motivation (58%). Additionally, slightly more than half of the respondents (51%) believed that an understanding of technology would improve their teaching. Despite the fact that the

participants reported spending an average of 46 hours per week using the computer, the responses to the pre-test questions pertaining to pre-service teachers' technological self-efficacy revealed and a very small percentage of pre-service educators (17%) reported feeling confident about using technology to address the needs of each student. Furthermore, 80% of those surveyed reported a lack of confidence in integrating computer activities into their instruction (see Table 1).

Table 2. Total percentage of 'Very Much' responses to beliefs about multiliteracy

Questions	Pre-test	Post-test
1. I believe that a multiliterate student is one who can read and write on paper.	15%	23%
2. I believe that a multiliterate student is one who can read critically.	23%	30%
3. I believe that a multiliterate student is one who can use computers.	23%	30%
4. I believe that a multiliterate student is one who can work with numbers.	19%	28%
5. I believe that a multiliterate student is one who can understand visual information.	19%	32%
6. I believe that a multiliterate student is one who can understand symbolic information.	19%	31%
7. I believe that a multiliterate student is one who can read music.	15%	28%
8. I believe that a multiliterate student is one who can use the Internet.	21%	32%
9. I believe that a multiliterate student is one who can play video games.	10%	25%
10. I plan to continue searching for resources on the Internet to help me teach a subject matter with technology.	28%	33%

The post-test results revealed a slight decrease in the number of participants who believed that technology was not important to either student learning (48%) or student motivation (54%). Even after the completion of the App assignment, less than half (46%) of the pre-service teachers believed that an understanding of technology would improve their teaching. In relation to pre-service teachers' technological self-efficacy, the post-test results revealed a slight increase in the number of participants (24%) who reported feeling confident using technology to address individual student needs. Finally, results revealed a slight decrease in the number of pre-service teachers (71%) that reported a lack of confidence in integrating computer activities into their instruction (see Table 1).Responses to the pre-test questions pertaining to pre-service teachers' understanding of multiliteracy revealed that only a small percentage of the participants surveyed (close to 20%) understood the concept of a multiliterate student. For example, only 19% of respondents believed that a multiliterate student was one who could understand visual information and only 21% of pre-service teachers believed a

multiliterate student could use the Internet. Additionally, only 10% of the participants considered a multiliterate student to be one who played video games (see Table 2).

Post-test results revealed a slight increase in the number of pre-service educators who understood the concept of a multiliterate student (close to 30%). Specifically, there was an increase in the number (32%) for those who believed that a multiliterate student was one who could understand visual information and a significant increase in the number of pre-service teachers (32%) who believed that a multiliterate student could use the Internet. Post-test results also revealed a significant increase in the number of participants (33%) that considered a multiliterate student to be one who played video games (see Table 2).

Further analysis including paired t-tests revealed a significant increase in the mean Likert scale scores between the pre- and post-questionnaires (see Table 3). Specifically, the questionnaire data showed that pre-service candidates were more aware of subject specific Apps ($t(89)=-6.901$, $p<0.05$) and were able to describe five Apps that they would use in their teaching ($t(141)=-7.023$, $p<0.05$). Additionally, teacher candidates reported a greater ability to identify Apps that would address the needs of students with exceptionalities ($t(142)=-10.588$, $p<0.05$) and the use of these Apps in their teaching ($t(142)=-7.486$, $p<0.05$). Post-test results revealed a significant increase in the number of pre-service educators ($t(142)= -4.136$, $p<0.05$) that believed that they could incorporate computer activities into the curriculum and could effectively use technology to support problem-based learning in their classroom ($t(142)=-3.235$, $p<0.05$). Finally, with respect to the use of technology, teacher candidates reported a significantly greater awareness of a variety of assistive technology devices for students with exceptionalities ($t(142)=-5.784$, $p<0.05$).

Table 3. Summary of mean responses to the Apps questionnaire

Questions	Pre-Test Mean	Post-Test Mean
1. How computer literate do you believe you are?	4.11	4.23
2. I am aware of a variety of subject-specific apps.	2.54	3.38*
3. I feel confident that I could find apps that I can use in my teaching.	3.25	3.70
4. I feel confident that I could describe 5 software programs (apps) that I would use in my teaching.	2.88	3.53*
5. I believe that a variety of technologies are important for student learning.	4.33	4.41
6. I believe that incorporating technology into instruction helps students learn.	4.34	4.39
7. I believe that student motivation increases when technology is integrated into the curriculum.	4.30	4.29
8. I believe that I can integrate computer activities into the curriculum whenever possible.	3.73	4.10
9. How confident are you that you can use technology to focus classroom activities on the needs of each learner?	3.75	4.02

10.Technology helps me meet the individual needs of a variety of students in my classroom.	3.71	4.05
11.How well do you believe you could use technology to address needs of students with exceptionalities?	3.80	3.99
12. I am aware of a variety of apps that address the needs of students with exceptionalities.	2.44	3.77*
13. I am aware of a variety of assistive technology devices for students with exceptionalities.	2.99	3.77*
14. I am aware of how teachers might use technology and particularly Apps in their teaching.	3.13	3.67*
15. I feel confident that I could find Apps on my own that could help me teach a subject matter in an integrated manner with technology.	3.44	3.76
16. I believe that I can integrate computer activities into the curriculum wherever possible.	3.73	4.09*

* represents significantly different $p<0.05$

4. Discussion

The results of this study suggest that requiring pre-service teachers to create a multiliteracy lesson may positively affect their understanding of multiliteracy. However, a single activity in one required course is not sufficient for developing pre-service teachers' understanding of multiliteracy. Interesting, the most significant change in the pre-service teachers understanding of multiliteracy pertained to the use of video games as an aspect of multiliteracy. This is an important finding since it suggests that today's teachers are broadening their definition of literacy to include the literate behaviours demonstrated by the individuals who participate in video games. Further, this will assist in strengthening the literacy connection between in-school and out-of-school literacy practices. Therefore, the results of this study indicate the need for a curriculum that integrates new and traditional literacies and allows new teachers to practice and prepare lessons that embrace the multimodality of multiliteracy.

While completing this assignment resulted in a greater awareness of the technology available to assist students only 52% of the pre-service teachers perceived technology as being important to student learning and student motivation. As stipulated by TAM, if pre-service teachers do not perceive technology as useful, they are unlikely to implement it in their classrooms. "Users do not use technology simply because they perceive it to be easy. Users have to possess a positive attitude towards computer use and perceived technology to be useful at the same time" (Teo, 2009, p. 309). Asking the participants of this study to complete an assignment that focused on multiliteracy integration for the benefit of their future students allowed these future teachers to gain insight into the usefulness of technology to support differentiated instruction in educational settings. In addition, despite the pre-service teachers reporting that they spend more than 46 hours per week using computers, the results of the pre- and post-test indicated that a significant number of pre-service teachers did not feel confident with using or integrating technology into their future practice. While the results of the current study revealed a slight increase in the number of pre-service teachers (9%) who reported confidence in their ability to integrate computer activities in their instruction, the lack of a significant change may be attributed to the fact that the pre-service teachers could not implement their lessons during their practica because many schools do not have the required technology. Thus, while education programs are evolving to

include the integration of technology, this evolution may be irrelevant if the schools do not have the required technology.

The findings of the current study also suggest that teacher education programs cannot assume that just because their pre-service teachers are extensive users of technology, that they will be confident in integrating technology in their lessons. As theorized by Teo (2009), it is clear that behavioural intention is a significant determinant in the use of technology as evidenced by the number of pre-service teachers in this investigation who reported lower computer self-efficacy scores before completing the multimodal assignment. Thus, as Teo (2009) suggests, teacher education programs should provide pre-service teachers with access to all the different types of technology that they will encounter in the schools. This will assist in improving their computer self-efficacy which has been shown to be linked to both prior experience and attitudes toward technology. Taken together, the results of this study and previous research (Yuen, Law, & Chan, 1999) support the recommendation that an essential component of a pre-service education programs should be providing the required experiences and skills with technology in a classroom setting in order that these future teachers can maximize their students' learning.

Although care was taken to ensure proper methodology in this investigation, there are three main limitations in this study that prevent generalizations from being made. First, the participants in this study were not randomly selected. Second, social desirability bias may be present due to the use of a self-reporting questionnaire and from the fact that one of the researchers was the participants' professor. Third, we did not ask our participants to consider if the app they selected would allow for new student learning or was the app simply representative of the substitution level of the SAMR model (Puentedura, 2003). That is, did the app selected simply offer a substitution for something that could have been taught otherwise? This is an important consideration for future studies in this area.

Overall the results of the current research has the potential to inform teacher preparation programs and in particular, suggests that a more advanced technology-focused curriculum paired with opportunity to implement new skills is warranted in order to continue to meet the evolving needs of all students within an inclusive classroom.

5. Conclusion

Teachers can be the leaders of the educational reform that is needed to fully integrate technology into the classroom (Teo, 2009; Lambert & Gong, 2010). As Lambert and Gong (2010) stipulate, it is essential that pre-service teachers be trained in the 21st century reasons for using technology. Technology can no longer be simply viewed as a research tool or a communication device, but must be viewed as an aspect of literacy. In order to meet the mandates outlined by State Educational Technology Directors Association (2007) technology must not only be a part of the general school system it must be incorporated into teacher preparation programs. If pre-service teachers have high self-efficacy in technology integration, they will bring this skill into their classrooms and to their peers. As Chen (2010) states, "Since preservice teachers work very closely with their cooperating teachers during student teaching, teacher education programs can deliberately train cooperating teachers so they can provide necessary support and facilitate technology integration" (p. 40). A symbiotic partnership that allows for the integration of technology throughout all levels of education may be the most effective and efficient method to ensure that students have the necessary literacy skills for the 21st century.

It is clear that there remains a need for continued research in this area so that greater understanding can be developed of the changing skills required for new literacy teachers in contemporary educational settings. As suggested, future research might investigate technology self-efficacy in teacher education programs with respect to new and emerging technologies such as tablets, iPods, and smartphones. In addition, research in technology integration is warranted in all subject areas and should not be limited to literacy and language courses. Finally, there is a need for longitudinal research that would examine the effectiveness of technology integration in pre-service education and the potential outcomes in the classrooms of these future teachers.

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