PREPARING SPECIAL EDUCATION TEACHERS TO DIFFERENTIATE
INSTRUCTION BY INTEGRATING TECHNOLOGY

by

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As the inclusive movement continues to gain momentum, preparing prospective special education teachers to successfully meet the needs of a diverse student population is an essential mission. Integrating technology to differentiate instruction (DI) can be an effective method to support each student’s individual learning. This cross-sectional mixed-methods study utilized surveys and multiple case studies (focus groups discussions, interviews, and observations) to collect data from both teacher educators and prospective special education teachers to investigate whether prospective special education teachers receive ample preparation and develop sufficient capability to differentiate instruction by integrating technology. The findings showed that the instructors and pre-service teachers recognize the importance of differentiated instruction and acknowledge that integrating technology can be a potentially effective method to DI, but improvement in preparation of pre-service special education teachers to differentiate instruction with technology is needed. The findings of this study are intended to assist teacher educators as they re-evaluate how to better prepare preservice special education teachers to address the learning needs of all students in an inclusive environment.

Keywords: inclusion, teacher education, pre-service special education teachers, technology, differentiated instruction, TPACK, DITPACK
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PREPARING SPECIAL EDUCATION TEACHERS

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Chapter 1: Introduction

Approximately 6.4 million children ages 3 to 21 or about 13 percent of all students were served under the Individuals with Disabilities Education Act and provided with special educational in 2011-12 (U.S. Department of Education, National Center for Education Statistics, 2013). Most students with special needs are no longer educated in segregated schools or classrooms, and instead are included in general education classes. Inclusion is an evolving and complicated concept, based on the principle that all students, regardless of their differences and abilities, deserve a high quality education. The goal of inclusion is to provide a meaningful education for all students within a regular classroom setting by offering an appropriately challenging and supportive curriculum. However, it also presents many challenges for current and future educators as well as for higher education programs preparing them for effective teaching.

One major challenge is ensuring that differentiation of instructions addresses the full range of students’ skill levels. With the increasing need to provide a meaningful education for all students within an inclusive setting, differentiation of instruction is critical. Differentiated instruction is a philosophy of teaching stating that students learn best when their teachers effectively address variance in students’ readiness levels, interests, and learning profile preferences. A key goal of differentiated instruction is maximizing the learning potential of each student. (Tomlinson, 2001, 2003, 2005)

Many educators use technology to adapt instruction to the needs of individual students.

The use of educational technology continues to provide opportunities to enrich learning environments, tailor materials to individual needs, and engage students in the learning process. Integrating technology into instruction can be an effective method of
teaching, as “technology can improve meaningfulness by building upon students' experiences and providing a relevant learning environment” (Hooper and Rieber, 1995). Educational technology refers to a wide range of computer-based teaching and learning resources, applications, and devices. If technology is used to differentiate instruction successfully, it provides a platform for scaffolding and improving students’ success.

It is essential that prospective teachers receive appropriate training and be able to combine technology competence with effective teaching practices. Ludlow (2001) brings to attention, that standards published in 2000 by the Council for Exceptional Children (CEC) also “include competencies in assistive technologies and computer applications that represents essential knowledge for teachers and therapist who work with individuals with special needs.” Using educational technology to differentiate instruction to meet the needs of a diverse student population is not a new concept. While many educators in the field already use technology to adapt instruction to the needs of individual students, it was not clear if prospective special education teachers are being adequately prepared to meet this challenge. Teacher preparation programs must focus on ensuring that new teachers are ready to differentiate instruction and address the full range of students’ skill levels.

The purpose of this cross-sectional study was to investigate whether prospective special education teachers receive ample preparation and develop sufficient capability to differentiate instruction by integrating technology. The study subjects were students and instructors in the two–year teaching program at the Graduate School of Education (GSE) of Rutgers University. This teaching program seeks to provide necessary pedagogical knowledge and develop instructional skills, including proficiency in integrating
technology into instruction. While using educational technology to meet the needs of a diverse student population is not a new concept, it is essential that prospective teachers receive appropriate training to enable them to combine technology competence with effective teaching practices, such as differentiated instruction.

During the two-year teaching program at GSE, students complete a sequence of methods courses during the first year, and receive practical training during their teaching internship in the second year. Forty-six students participated in this research during their first and the second years in the program. Additionally, 41 faculty members involved in preparing future teachers at GSE also participated in this research. This study explored the effectiveness of teacher preparation, with an emphasis on the development of technological skills and acquisition of knowledge enabling teachers to successfully differentiate instruction to raise student achievement.

My study was guided by the following research questions:

• How and to what extent do GSE instructors prepare prospective special education teachers to differentiate instruction by integrating technology knowledge, pedagogical knowledge, and content knowledge (DITPACK)?

• To what extent do prospective SPED teachers feel that they are prepared to differentiate instruction by integrating technology knowledge, pedagogical knowledge and content knowledge (DITPACK)?

• What are the similarities and differences between GSE instructors and special education preservice teachers’ perceptions regarding DITPACK, and what can be done to improve the preparation to DITPACK?
This dissertation is comprised of three distinct artifacts to respond to these research questions: a scholarly journal article, a research presentation to GSE faculty, and modules “Differentiating Instructions by Integrating Technology” designed for pre-service special education teachers, which can be used by instructors involved in preparing special education teachers.

By creating these three products, I was able to achieve multiple goals. Preparing an article for publication allowed me to condense my findings and communicate them to a broader research audience. I prepared my presentation for the faculty members and anticipate that presenting my findings will provide them with formative feedback on integrating technology that can lead to a positive change in preparing teachers at Rutgers GSE. Finally, the development of the modules for pre-service teachers combined both my findings, current practice in the GSE program, and the research literature in preparing future teachers. This artifact allows for integration of my findings into the future work of preparing teachers at the GSE, but also more broadly in other teacher preparation programs as well.

I detail each dissertation artifact in the following:

I. **Scholarly journal article prepared for publication.**

Using technology to support special needs students’ learning is a concept that many educators explore, debate, and implement. As technology is constantly evolving, the search for strategies and solutions also remains strong in the field of special education. I intend to contribute to this discussion by publishing my research article in a peer-reviewed journal. The article is prepared for Teacher Education and Special Education. In the article I explored the issue of preparing special education teachers to
address individual learning needs by integrating technology. In this article, I focused mostly on my first research question “How and to what extent do GSE instructors prepare prospective special education teachers to differentiate instruction by integrating technology knowledge, pedagogical knowledge and content knowledge?” My findings are based on multiple data sources (a faculty survey, class observations, and faculty interviews). Three key findings emerged from the quantitative and qualitative analyses. Instructors involved in the preparation of special education teachers recognized the importance of differentiated instruction, acknowledged that while integrating technology can be a potentially effective method, they do not currently prepare pre-service teachers well to differentiate instruction with technology, and identified the main reasons for the shortfall in this area, such as lack of coordination, lack of technology available, and varying levels of instructors’ proficiency to integrate technology effectively. I hope that these results will be valuable to teacher educators aiming to improve the preparation of special education teachers.

II. Research presentation to interested GSE faculty members

The second component of my portfolio is a presentation prepared for GSE faculty members. I was kindly provided with the opportunity to conduct this research using the GSE teacher preparation program. The evaluative nature of my study allowed me to examine the range of opinions regarding this topic among instructors and students and focus on the third research question “What are the similarities and differences between GSE instructors and special education prospective teachers’ perceptions of: the importance of DI, the value of using technology to DI, the extent to which the teacher
preparation program at the GSE prepares prospective SPED teachers differentiate instruction with technology, and what can be done to improve the teacher preparation in this area?" Over 40 GSE instructors involved in special education teacher preparation responded to the survey and many of them also shared class materials with me and allowed me to observe their classes. In addition, I interviewed almost 25% of participating instructors. They shared their thoughts on the important topics of differentiating instruction, integrating technology, and preparing pre-service teachers for working with a diverse population of students. Key findings regarding students’ perspective on DITPACK preparation are: students recognized the importance of differentiated instruction, students in the second year of the program felt more confident and capable to DI by using technology, but overall students agreed that they do not currently get ample preparation to differentiate instruction with technology and would like to see instructors modeling more and receive additional learning opportunities for practicing differentiating instructions with technology.

I will be presenting the findings from my research to faculty in the fall. I hope that this presentation will provide an opportunity for focusing on differentiating instruction with technology and lead to the coordination of the efforts in this area and improving the practice of preparing special education teachers at the GSE.

III. A set of ready-to-use modules “Differentiating Instructions by Integrating Technology” designed for pre-service special education teachers

Findings from my research indicated that special education teachers would greatly benefit from intentional opportunities to develop and retain skills of using technology for teaching students with special needs. One of the major findings from my dissertation was
that a lack of connections across courses did not provide students with a cohesive framework to know how DI using technology. Knowledge learned in the Ed.D. Program and my prior experience as a computer programmer, special education teacher, and teacher of technology enabled me to develop modules around this need. This set of modules addressed the issue of preparing special education teachers to differentiate instruction to suit learners’ special needs by effectively using technology.

The objectives of this set of modules are based on learning from current research, exploring evidence-based teaching practices in Special Education, and project based learning that provide prospective teachers opportunities to create and learn how to use digital tools for differentiating instruction. Many educators object to using technology in their classrooms either because of lack of skills or out of fear that technology will interfere with pedagogy. By using this set of modules, prospective special education teachers will learn how to make pedagogically sound decisions and implement them for the improvement of learning opportunities for every student by utilizing technology within a consistent conceptual framework. Students will have an opportunity to combine skills of differentiating instructional planning and delivery, modifying assessment and learning activities, and incorporating technology tools to accomplish these tasks effectively and efficiently. I developed a set of modules that instructors can use as a unit or they can select individual components for integration into their courses. These modules offer instructors the convenience of preselected technology resources, learning activities, and assessments that they can add into their courses with ease. Additionally, instructors can see the broader DI framework that organizes the conceptual framework within the modules to place their coursework within broader program goals.
While very different, all three of the above described products for my dissertation portfolio were designed to expand on what I have learned as a student in the Ed. D program at the GSE and apply my knowledge and the findings from my research study. Each of the components is aimed at creating positive change. I summarized my research about instructors’ perspectives findings in the article, intending to add to the knowledge base of special education. Preparing my research results for presenting and discussing these findings with faculty is focused on making practical improvements in the GSE teaching program. Development of the set of modules will add to educational technology coursework and therefore make a positive change for preservice teacher training, helping prospective teachers to be better prepared for teaching with technology. I hope that these three products demonstrate my skills and passion to make positive changes in the field of education.
Chapter 2: Article

Preparing Special Education Teachers To Differentiate Instruction By Integrating Technology

Approximately 6.4 million children ages 3 to 21 or about 13 percent of all students were served under the Individuals with Disabilities Education Act and provided with special educational in 2011-12 (U.S. Department of Education, National Center for Education Statistics, 2013). Most students with special needs are no longer educated in segregated schools or classrooms, and instead are included in general education classes.

Inclusion is based on the principle that all students, regardless of their differences and abilities, deserve a high quality education. The goal of inclusion is to provide a quality education for all students within a regular classroom setting by offering an appropriately challenging and supportive curriculum. With the increasing need to not only provide a meaningful education for all students within an inclusive setting, but also to ensure better educational outcomes, teachers’ ability to differentiate instruction is essential.

Therefore, Differentiated Instruction (DI) is critical in making inclusion work. One of the leading specialists of differentiated instruction, Carol Ann Tomlinson (as cited in Kara-Soteriou, 2009) explains, “Differentiated instruction is based on the premise that instruction should be adapted to the students' different learning styles, interests, and ability levels”. She also suggests” that differentiated instruction is designed with content, process, and product in mind. Teachers develop different activities (content) for different students, allow students to learn through different methods (process), and encourage students to show their understanding through different means (product)” (as cited in Kara-Soteriou, 2009). In addition to content, process, and product, instructional methods can also be differentiated by considering affect and learning
environment (Salend, 2011). While teachers differentiate instruction and assessment, they must consider many aspects of students they teach, such as students’ learning styles and preferences, sensory abilities, cultural and linguistic backgrounds, impact of disabilities, levels of mastery, effort and motivation, etc. The continuum of DI includes a variety of methods that can be categorized as access differentiation techniques, such as Braille and dictionaries, low-impact differentiation techniques, such as content enrichment and learning strategies instructions, and high-impact differentiation techniques, sometimes called modifications, that are designed to adjust content and curriculum, such as multilevel teaching and curriculum overlapping (Sallend, 2011). There are numerous strategies that teachers could use to provide effective differentiated instruction that would be beneficial for all learners in classes with diverse student population.

While the concept of differentiated instruction may not be fully embraced by general education teachers, special educators find that it is an absolutely, necessary practice that must be implemented in inclusion classrooms. Individualized learning needs of children must be at the center of instruction. Special educators have always recognized this and differentiated for the learners. (The Council for Exceptional Children's Position on Special Education Teacher Evaluation, 2013). Many researchers recognize that there is a gap between research and classroom practice, but “differentiated instruction is viewed as the keystone to promoting access to the general education curriculum and appropriate instruction for students with disabilities in successful full inclusion models” (Zigmond, Kloo, and Volonino, 2009). Edyburn (2013) agrees.

Effectively using technology is one way that may help teachers to differentiate instruction and also manage a variety of learning goals in a classroom. “Technology can have a positive impact on student achievement if certain factors are present, including extensive teacher training and a clear purpose” (Fouts, 2000).
New teachers must learn how to respond to variations in students’ readiness levels, interests, and learning preferences and how to select and integrate appropriate technology-based resources to support students’ achievement. Differentiated instruction using technology-based resources has proven to be effective in increasing students achievement (Cobb, 2010), however, it is one of the main challenges for new teachers. Using technology can help new teachers to adapt instruction to the needs of individual students, as “technology can improve meaningfulness by building upon students' experiences and providing a relevant learning environment” (Hooper and Rieber, 1995). Using technology to support students with special needs is not a new concept. “In recent years technology has become an integral component of best practice in special education and disability service for individuals with disabilities of all ages” (Ludlow, 2001). When technology is used to differentiate instruction within an inclusive environment, it provides a better opportunity to support all learners.

However, using technology to differentiate instruction is a complex task. Studies have shown that teaching with technology alone is a complex process that requires teachers to combine a variety of skills and knowledge. Koehler, Mishra, and Cain (2013) describe a teacher knowledge framework for technology integration called technological pedagogical content knowledge (TPACK). This framework “builds on Lee Shulman's (1986, 1987) work of pedagogical content knowledge (PCK) to include technology knowledge” (Koehler et al, 2013). The authors of the paper discuss the growing popularity of the TPACK framework around the world, the challenges of teaching with technology, and the social and contextual factors that affect educators in developing and combining technology skills with pedagogy and content knowledge. They also point out that preparing new teachers and providing professional development to experienced teachers to use TPACK successfully is also a very difficult task,
especially considering that teachers operate in very diverse contexts of teaching and learning and a “one-size-fits-all” approach cannot be used. Koehler and colleagues believe that there is no one best way to integrate technology into instruction; instead teachers must be creative and flexible when thinking about their particular contexts, specific class audiences, and technological resources available.

Preservice special education teachers in particular need to learn how to use technology to support various students’ learning needs. “Thus, it is essential that we provide our future teachers with solid evidence that technology-based, student-centered instruction can have a positive impact on students’ learning and their achievement on standardized tests” (Ertmer & Ottenbreit-Leftwich, 2010). Although there is a sizeable body of literature about preparing special education teachers (Brownell, Ross, Colon and McCallum, 2001) and the evolving role of technology in the classroom (Stanford, Crowe, and Flice, 2010; Cobb, 2010), not as much is known about how prospective special education teachers are being prepared to differentiate instruction during their preservice training despite the increasing number of inclusion classrooms. We know even less about how teaching programs are supporting new teachers in using technology for differentiation. It is essential that prospective teachers receive appropriate training to enable them to combine technology competence with effective teaching practices, such as differentiated instruction. Evaluating how teaching programs addressing this issue and establishing successful practices will help teacher educators to modify programs to support preservice teachers.

The purpose of this case study was to investigate how instructors involved in a teacher education program prepare prospective special education teachers to develop sufficient capability to differentiate instruction by integrating technology. Since the TPACK framework is
extensively used to examine skills, knowledge and attitudes of teacher educators in context of integrating technology into instruction, the TPACK framework was adapted and expanded to suit the needs of this study. The component of differentiating instruction (DI) was added to TPACK, resulting in the DITPACK framework.

Figure 1 – DITPACK – Differentiated Instruction with Technological Pedagogical Content Knowledge

This study focused on exploring the effectiveness of teacher preparation, with an emphasis on the development of technological, pedagogical, and content knowledge enabling teachers to successfully differentiate instruction in seeking to respond to the following research questions:
How and to what extent do teacher education programs prepare prospective special education teachers to differentiate instruction by integrating technology knowledge, pedagogical knowledge and content knowledge (DITPACK)?

a. What are the instructors’ confidence, perception, and implementation of DITPACK?

b. In what ways are students prepared similarly or differently across various coursework?

c. How do instructors evaluate the current state of teachers’ preparation to DITPACK and what are their recommendations for improvement?

Methods

A sequential explanatory mixed methods design was used for this study, which involves a procedure for “collection of both quantitative and qualitative data sequentially” (Creswell, 2009, p.18) and mixes data analyses to broaden the understanding of a research problem. Data collection and analyses were performed in two distinct phases using multiple measures. In the first phase, responses to survey were collected from the larger number of participants providing primary mostly quantitative data. The second phase, which consisted of interviews and class observations, produced rich primary qualitative data that added to reliability, helped to triangulate and explain the findings from the first phase. This design made it possible to study the issue from broader point of view first, and then explore it deeper using data from observation and individual interviews. Quantitative and qualitative data were used to answer the main research question and subsequent questions.

Participants

This study was conducted in the two–year teaching program at a large northeastern
university. This graduate level teaching program seeks to provide necessary pedagogical knowledge and develop instructional skills, including proficiency in integrating technology into instruction. The primary reason for selecting the two-year teaching program at this large northeastern university is the fact that this school is one of the leading graduate schools of education. According to the March 2013 U.S. News and World Report, this school of education was included in America’s top fifty best schools of education. Studying current teaching practices in one of the best schools of education provides a meaningful illustration and beneficial research to educators in the field to better understand the relationship between classroom technology use and teacher preparation training. During the two-year teaching program, students complete a sequence of methods courses during the first year, and receive practical training during their teaching internship in the second year.

A total of 41 (62%) instructors (i.e., 34 females and 7 males) from the 66 possible instructors who teach in the 2-year special education certification program participated in the survey. Additionally, 10 instructors (i.e., 6 females and 4 males) participated in observations and follow up interviews to better understand the ways in which they were supporting preservice teachers to understand and practice differentiated instruction. The 10 instructors were chosen to cut across the four program areas: special education (5), core education (1), methods (2), and technology (2).

**Procedure**

In the first (quantitative) phase of the study, sixty-six instructors involved in the preparation of prospective special education teachers received an email invitation to respond to the on-line survey. Forty-one surveys were returned, representing an overall response rate of 62%. Based on courses taught by participating instructors, survey responses were divided into
the four program areas mentioned above: special education (13), core education (18), content methods (6), and educational technology (4). This approach permitted analysis about when and how students received instruction about differentiating instruction across different instructional areas.

The survey was adapted from the work on TPACK with preservice teachers (Schmidt et al, 2009). Seven questions about Teaching General Differentiated Instruction and seven questions about Differentiated Instruction with Technology Knowledge were added to the survey. In addition, seven general demographic and three open-ended questions were added to suit the purpose of this study. The final survey consisted of 57 items divided into seven sections. Items based on the original TPACK model focused on technology and pedagogy skills. Instructors were asked to use a five-point Likert scale (from 1-no skills to 5-expert) to respond to items such as, “I teach prospective teachers to appropriately combine literacy, technology, and teaching approaches” and “I teach prospective teachers to choose technologies that enhance students' learning for a lesson” (see appendix A). Two additional sections assessed teaching skills necessary for differentiating instruction, emphasizing integration of DI with TPACK skills. For example, survey items, such as “I teach a variety of specific technology resources, applications and tools to use for differentiated instruction” and “In courses I teach as part of the teaching program, I provide prospective teachers with many opportunities to teach using technology for differentiating instruction” were added. Instructors’ responses ranged from 1 – strongly disagree to 5 – strongly agree. In addition to multiple-choice questions, the open-ended questions were included asking instructors to describe in-class activities and out-of-class projects that helped preservice teachers to learn how to differentiate instruction.

The sequential design of this study supported selecting participants for the second
(qualitative) phase based on results from the first phase. A purposeful sample was used for the second phase. Therefore, based on the results of the surveys, samples of cases representing the different characteristics of the population of instructors were selected. Ten instructors were selected for the 30-40 minute interviews and class observations. Interview questions focused on areas of teaching with technology included in their courses, unique aspects of their specific teaching methods with regard to diversity of students, differentiation of instruction, and integrating technology. All instructors who participated in interviews had prior K-12 teaching experience (from 2 years to 40 years) and had taught at the college level (from 3 years to 20 years). Instructors articulated their thinking about differentiated instruction, the role of technology in the process and how they teach preservice SPED teachers to differentiate instruction through class activities, projects, and by modeling or using technology in their own teaching. Faculty members also shared concerns and difficulties they have while integrating technology into their teaching, and made suggestions about what would help them to overcome these challenges.

**Measures and Data Analysis**

Data analyses included a variety of methods. Quantitative data was analyzed with statistical software, Stata, by using basic descriptive statistics (arithmetic means and standard deviation). One-way ANOVA (ANalysis Of VAriance) with post-hoc Tukey were used to determine significant differences among instructors’ groups. The significance level in analyses was considered $p < .05$.

Dedoose software was used to conduct the interpretation and analyses of data from interviews and responses to open-ended items. First level analysis of the interviews and open-ended items entailed coding for broad categories. Examples of the codes were: instructors’
perception of DI, instructors’ methods of teaching DI (modeling, class discussions, activities and assignments), technology tools for DI (content specific, learning management, learning style preferences), availability of technology resources, instructors’ needs and instructors’ suggestions. After this first layer of analysis, codes were refined to look for themes within the data such as limited technology access in university classrooms and lack of common language when referring to DI. Finally, the third layer of coding included looking for confirming and disconfirming evidence of these themes and led to further refinement.

Observational notes were used to guide discussion during the interviews, clarify instructors’ perspectives and validate findings from the survey and interviews. The validity of this study was strengthened by the results of the analyses of qualitative data from class observations and interviews, in addition to triangulating these findings with the quantitative results from the survey data.

Results

This section describes how this teaching program perceives its readiness to prepare preservice special education teachers to integrate technology, pedagogy, and content knowledge to differentiate instruction. Data from a survey, interviews and observations is synthesized by themes. First general perception of all instructors is presented, and then more specific outcomes divided by instructors group by their teaching areas.

Overall Instructors’ Confidence, Perception, and Implementation of DITPACK.

To examine the general Technology and Teaching Confidence Scores, descriptive statistics were used to compare instructors’ survey responses. The number of items in each scale was used to calculate the average item score for each scale. As noted in Figure 1, average item
scores for each scale vary from the lowest average score of 2.84 in Teaching Technological Content Knowledge to the highest average score of 4.34 in Teaching General Pedagogical Knowledge. Instructors from all four groups teach general principles of pedagogy, which explains the highest average score of 4.34 in Teaching General Pedagogical Knowledge. The average item score of 3.82 in Technology Knowledge and Attitude demonstrates that overall, instructors are knowledgeable and comfortable using technology and have a positive attitude toward technology integration. Similarly, the average item score of 3.85 in Teaching General Differentiated Instruction shows that all instructors highly value differentiation of instruction. However, while both the scores representing general technology knowledge and teaching differentiated instructions are above 75%, the scores representing integration of technological knowledge with particular content and pedagogy are below 60%, as demonstrated by the score of 2.84 for Teaching Technological Content Knowledge and 2.93 for Teaching Technology, Pedagogy, and Content Knowledge.

Table 1. Average Technology and Teaching Confidence Scores by Scales

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<th>Scales of Technology and Teaching Confidence</th>
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<th>M &amp; SD</th>
<th>No. of Items per Scale</th>
<th>Average Item Score for each Scale</th>
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<tr>
<td>1</td>
<td>Technology Knowledge and Attitude (TKA)</td>
<td>41</td>
<td>34.41 (5.89)</td>
<td>9</td>
<td>3.82*</td>
</tr>
<tr>
<td>2</td>
<td>Teaching General Pedagogical Knowledge (TGPK)</td>
<td>41</td>
<td>30.44 (4.45)</td>
<td>7</td>
<td>4.34</td>
</tr>
<tr>
<td>3</td>
<td>Teaching General Pedagogical Content Knowledge (TGPCK)</td>
<td>41</td>
<td>13.17 (3.95)</td>
<td>4</td>
<td>3.29</td>
</tr>
<tr>
<td>4</td>
<td>Teaching Technological Content Knowledge (TTCK)</td>
<td>41</td>
<td>11.39 (5.05)</td>
<td>4</td>
<td>2.84</td>
</tr>
<tr>
<td>5</td>
<td>Teaching Technological Pedagogical Knowledge (TTPK)</td>
<td>40</td>
<td>24.38 (6.93)</td>
<td>8</td>
<td>3.04</td>
</tr>
<tr>
<td>6</td>
<td>Teaching Technology, Pedagogy, and Content Knowledge (TTPCK)</td>
<td>40</td>
<td>11.73 (4.11)</td>
<td>4</td>
<td>2.93</td>
</tr>
<tr>
<td>7</td>
<td>Teaching General Differentiated Instruction (TGDI)</td>
<td>40</td>
<td>26.98 (6.05)</td>
<td>7</td>
<td>3.85</td>
</tr>
<tr>
<td>8</td>
<td>Teaching Differentiated Instruction with Technology Knowledge (TDITK)</td>
<td>40</td>
<td>21.38 (7.88)</td>
<td>6</td>
<td>3.56</td>
</tr>
</tbody>
</table>
* Note: Scale 1-5

**DITPACK by Scales and Instructor Groups.**

Quantitative survey responses were also analysed by scales among four groups of instructors and within each group. Analyses of Variance (ANOVA) disclosed differences among instructor groups for each scale (see Figure 2). Two scales, Teaching General Pedagogical Knowledge (TGPK) and Teaching General Pedagogical and Content Knowledge (TGPCK), did not reveal significant differences. The smallest difference of 0.14 in mean teaching confidence perception scores among all four groups of instructors was in TGPK. The next smallest difference of 0.72 was in the scale of TGPCK. This suggests that, according to self-reported data from the survey, general pedagogical knowledge and general pedagogical and content knowledge are taught at a similar level across all courses of the teaching program.

Survey responses regarding perceived competence in each of the seven scales are shown in Figure 2. Comparing all four groups, instructors of special education courses have the highest scores in two scales, 4.64 in TGPK, and as expected, 4.42 in Teaching General Differentiated Instruction (TGDI). The group of instructors teaching technology courses also has highest scores in five scales. Predictably, their group score of 4.69 in the Technology Knowledge and Attitude (TKA) scale, 4.38 in the Teaching Technological Content Knowledge (TTCK) scale, and 4.13 in the Teaching Technological Pedagogical Knowledge (TTPK) scale were their three highest scores among all scales. What was unexpected is that, although the group of technology instructors has the second lowest score of 3.61 in TGDI scale, this group has the highest score of 4.92 in the Teaching Differentiated Instruction with Technology Knowledge (TDITK) scale. Scores for the group of teaching methods instructors were higher than scores of core education group in all scales. Scores for the group of core educational courses instructors were the lowest
among all four groups. As shown in Figure 2, based in the survey data, instructors teaching technology seemingly are more confident that they are preparing preservice teachers to integrate technology. Instructors of special education and instructors teaching methods also indicated strong confidence that they blend content, pedagogy and technology in their courses.

![Figure 1. Average Technology and Teaching Confidence Perception Scores by Instructors](image)

Instructional focus regarding teaching to differentiate instruction with technology is evident by analyzing scores within each group. Instructors of special education (N=13) reported highest confidence score of 4.64 in the scales of Teaching General Pedagogical Knowledge (TGPK) and score of 4.42 in TGDI, while the lowest score of 3.39 for this group was in TTPK. These scores are as expected and reflect the emphasis of special education curriculum. Instructors of core education (N=18) have the highest confidence score of 4.64 in the scale of TGPK and the lowest
score in the scale of 2.14 in TTCK. Group of instructors of core education represented the largest number of survey participants, but their confidence scores are overall lowest between all other groups. There are two possible reasons for this indication. First, preservice teachers at the beginning of the program take the core educational courses and the focus on DI and technology integration is not the focus of instruction at that time. Secondly, with 18 instructors teaching core educational courses, there are more of the instructors are part time lecturers, that in any other instructor group. Part time lecturers may have more challenges to collaborate with each other and with full time faculty, and they also may have less time at the campus to learn about available technologies.

Instructors of technology courses (N=4) scored 4.93, the highest score on TDITK and the lowest score of 3.63 recorded for TGPCK. Overall, technology group demonstrated the highest confidence scores in five out of eight scales. One understandable reason is that this survey was mainly concerned with technology integration into DI. The other reason may be the fact that there are only four instructors in this group; most of them are full time faculty with many years of experience. Instructors of teaching methods (N=6) have the highest confidence score of 4.50 in the scale of TGPK and the lowest score of 2.67 in the scale of TTCK. This lowest score may be explained by the fact that this score combines scores of instructors who teach teaching methods in different content area. Instructors teaching literacy methods score high on technological content in literacy, but low on technological content in math and vise versa for the instructors teaching math methods, however, the group score of 2.67 includes scores of all teaching methods instructors. For this group of instructors these scores were also expected and justified by the goals of their curriculum. As shown on Figure 3, significant differences were found for the six scales out of eight.
Table 2. Results of ANOVA: P Values based on Faculty Survey

<table>
<thead>
<tr>
<th>No.</th>
<th>Technology Confidence and Teaching Knowledge Scales</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Technology Knowledge &amp; Attitude</td>
<td>0.0275*</td>
</tr>
<tr>
<td>2</td>
<td>Teaching General Pedagogical Knowledge</td>
<td>0.1131</td>
</tr>
<tr>
<td>3</td>
<td>Teaching General Pedagogical and Content Knowledge</td>
<td>0.1883</td>
</tr>
<tr>
<td>4</td>
<td>Teaching Technological Content Knowledge</td>
<td>0.0007*</td>
</tr>
<tr>
<td>5</td>
<td>Teaching Technological Pedagogical Knowledge</td>
<td>0.0012*</td>
</tr>
<tr>
<td>6</td>
<td>Teaching Technology, Pedagogy and Content</td>
<td>0.0053*</td>
</tr>
<tr>
<td>7</td>
<td>Teaching General Differentiated Instruction</td>
<td>0.0149*</td>
</tr>
<tr>
<td>8</td>
<td>Teaching Differentiated Instruction with Technology</td>
<td>0.0003*</td>
</tr>
</tbody>
</table>

*p < .05

Additional Post-Hoc analyses were conducted to determine specific groups of instructors that had significant differences in mean scores. The instructor group teaching educational core courses scored lower than the instructor groups teaching technology and special education courses on six scales out of eight. Both group of special education instructors and the group of instructors teaching technology courses scored significantly higher on all six scales than the group of instructors teaching core educational courses. It is reasonable and expected that instructors teaching core educational courses are less concerned with integrating technology and DI, but focused more on general pedagogical principles.

Instructors’ Evaluation, Recommendations, and Implications for Improving Preparation to DITPACK.

While analyzing the survey results, it became clear that general pedagogical knowledge and general pedagogical and content knowledge are offered at a similar level across all courses of the teaching program. Survey results confirmed that all instructors within the four groups are knowledgeable about using technology, yet the scores indicated the way technology is integrated into content and pedagogy are much lower than the general technology knowledge scores. The analyses of discussion with instructors, data from open-ended items, and observational notes were used to examine reasons for this disconnect.
In this study, instructors were given the opportunity to express their opinions regarding the current state of the preparing preservice teachers to DI with technology within the teaching program. Instructors’ surveys scores and comments were categorized into three thematic groups: disconnection among instructors, available technology, and professional development. Instructors were asked to use a scale of 1-4 to approximate what percentages of the teacher education instructors provide an effective model of combining content, technology, and teaching approaches in their teaching. The median score of 2.18 implies that only slightly over 50% of instructors effectively integrate pedagogy, content, and technology. However, participating instructors also commented that it is difficult to evaluate the current state of teaching DI with technology. They stated that they were unfamiliar with the curriculum of the whole program and the kind of preparation students currently receive in the area of DI with technology in other courses. Lastly, they stated that they have no way of knowing what and how other instructors teach in their classrooms.

In response to an open-ended item of the survey that asks instructors to describe a specific episode where they modeled differentiating instruction using technology in a classroom lesson, 48% of all survey participants said that they had not modeled DI using technology in their courses. The other 52% of instructors stated that they used some technology-based tools in their courses, such as Power Point, video clips and web-based resources for research. For example, one instructor wrote “my students work in groups to research progressive schools’ websites to gather information that they later use to create a plan for a potential progressive schools.” Similarly, another instructor shared, “I have used video in the classroom to emphasize and reiterate the essential elements of a reading. I have also had students prepare multimedia presentations.” Although these instructors provided examples of assignments and class activities
that encourage students to use technology resources as part of their work, these examples do not demonstrate that these activities were specifically designed to teach preservice teachers how to use technology resources to address different learning needs, but rather technology was used in a more general way to enhance the course.

Another open-ended item on the survey asked instructors to describe a specific episode where they provided an opportunity for preservice teachers to demonstrate DI with technology. 44% of survey participants stated that their courses did not include assignments or any opportunities where students could demonstrate their use of technology for DI. Representative statements from this survey item include, “I have not done this,” or “none.” Another 44% of survey participants either did not reply to this item or offered nonspecific replies, such as “[preservice teachers] are asked to use differentiation and technology”. Only 12% of all participants were able to offer examples with more specific details, such as “students create digital stories and use this as one mode for storytelling” and “students circulate through center activities one of which is at the class computer to engage in a variety of activities.”

However, survey results did not answer how different groups of instructors perceive and implement DI and integration of technology, whether or not different groups of instructors think about using technology to DI in similar ways, or have the same understanding of DI and technology integration. These are important questions, because instructors’ interpretation of DI with technology guides their instruction and therefore determines how well prospective teachers are being prepared in this area. Survey responses to open-ended questions, observational notes, and data from multiple interviews were analyzed to examine instructors’ opinions and points of view in more depth. The main themes identified were: the value of differentiated instruction and the need for a coherent program vision for preparing preservice special education teachers to DI,
uneven implementation of DI with technology, the need for wide-ranging access to technology, and instructors’ concerns and recommendations for improvements in area of preparing preservice teachers to DITPACK.

The value of differentiated instruction and the need for a coherent program vision for preparing preservice special education teachers to DI. Without exception, during the interviews all instructors conveyed strong positive views about differentiating instruction and the importance of preparing prospective teachers to DI. A few instructors noted that they teach differentiation by modeling, in the form of class discussion, and by incorporating various learning activities. Instructors provided some specific examples of teaching DI and explained how they help preservice teachers acquire skills to DI. Although, there was no evidence that instructors used a common framework to teach DI, it was clear that differentiating instruction is a very important concept in this teaching program. One methods instructor stated,

They [the teachers] make small adjustments, or, sometimes, bigger adjustments, to try to meet students where they are at. I think just about everything I do in my method class is about differentiating. Teaching them [preservice teachers] to be aware of prior knowledge and use that as scaffolding for current and new material, to give each student the best way in. We try to create different ways to access prior knowledge and connect students to the content.

Another methods instructor reiterated the same idea, “To be honest with you, I only know of the literacy courses. You can’t teach literacy without differentiation.” This same instructor pointed out that prospective teachers are taught to differentiate instruction by showing how to gradually release responsibilities from the teacher to the learner. This instructor uses an adapted strategy, where the teacher and students follow the same steps “I do - you watch, I do - you help, we do,
then you do.” These examples show that these methods instructors teach DI and focus on the “process” aspect of differentiation instruction. They understand the necessity of teaching prospective teachers to scaffold and recognize that different students will require different amounts of time and teachers’ active involvement to reach the same learning goal.

Instructors from the special education group also expressed that DI is a foundation of special education. One special education instructor put it very directly, “Differentiated instruction is a huge emphasis [in the teaching program], it really is.” Another special education instructor shared that during the field experience, special education preservice teachers are guided to focus on the learning needs of individual students by solving problems, designing supportive activities, and preparing and implementing differentiated lessons.

However, instructors also acknowledged that this is not easily accomplished. One special education instructor mentioned, “I find with our undergraduates that they do not have experience yet, it [DI] is abstract to them. Returning teachers can connect to it [DI] differently and take it to another level. We should have them [preservice teachers] spend more time in classroom [before teaching DI]” Two other instructors echoed the same opinion. “A lot of differentiating comes with experience.” Most of interviewed instructors felt that it is difficult for students to think about DI without prior experience in the classroom and they agreed that focusing more on DI during the field experience would help preservice teachers to better understand the concept of DI and offer them opportunities to practice DI with guidance from experienced college instructors and from partnering classroom teachers. However, “We have to be more careful about which school we choose to host our students. That can really make or break students’ experience with differentiation.” One instructor was concerned that if preservice teachers get assigned to a class where a “one size fits all” model is mostly used by the classroom teacher, that is what the
preservice teachers will learn, regardless how much modeling they receive from their college instructors. What this indicates is that the program has less control for how DI is enacted in field experiences, possibly causing a lack of coherence between coursework and practice.

Instructors believe that the teaching program does provide ample opportunities for students to practice the concept of DI within their teacher education courses while they learn how to create unit plans, a variety of lessons, and design assessments. For example, during the interview, one instructor of a special education course described her class assignments that were designed to teach DI. In this class, preservice teachers were given a scenario of a particular student who experienced academic difficulties because of a learning disability. Preservice teachers were asked to design and then modify a lesson to suit the needs of that particular student. In another assignment, special education preservice teachers were provided with a scenario of an inclusive class, which included a diverse student population. For that assignment, preservice teachers were required to design a tiered lesson to differentiate for the variety of students’ level of skills. Based on the instructor’s description of these activities, the instructor introduced the general principle of how preservice teachers can “modify material and adapt lessons” and offered to preservice teachers the opportunity to consider the individual students and how specific disabilities might affect their learning needs. This instructor also focused the preservice teachers’ attention on the fact that each class may have students with a variety of abilities, level of skills, and motivation.

During the observation of one of the method teaching classes, preservice teachers viewed a short video clip about polar bears, and then were asked to work in small groups and brainstorm possible differentiated activities using this video clip as a starting point of project based learning. The preservice teachers came up with a few ideas. One was that students could use a webcam to
observe the daily life of a polar bear at the zoo and then use a blog to record what they saw. Other suggestions were that students could include some elements from a variety of content areas, such as art, science, and literacy to make a newscast on polar bears, or that a guest speaker from the zoo could speak in class and answer students’ questions about polar bears. During this class activity, the instructor did not ask preservice teachers to differentiate instruction for specific types of students with special learning needs, but preservice teachers had to think about activities that could appeal to young learners and provide learning opportunities for students with diverse learning preferences by using visual, kinesthetic, and auditory modalities. Similar to methods instructors, this special education instructor provided examples, where perspective teachers also learn how to DI by focusing on the “process” aspect of DI. However, unlike the methods instructors, instead of emphasizing different levels of skills, this instructor focused on showing the perspective teachers how to address students’ preferred learning styles.

During the observation of math teaching methods class, the instructor focused on teaching preservice teachers to offer students a variety of strategies of how they could solve a problem. The instructor modeled, discussed with the class, and asked preservice teachers to demonstrate how they would teach students using various different strategies to resolve the same problem. Preservice teachers could directly model a strategy by thinking out loud, use a visual aid to follow the problem structure, or ask students to use various counting, recall, or derived facts strategies. The instructor pointed out that for some students using fingers could be a very helpful strategy not just for counting, but especially when students use fingers to help themselves to scaffold a more complex problem. In this class, the instructor provided preservice teachers with an opportunity to use and reflect on the idea that students should not be taught to mechanically use only one way to solve a problem, but should be encouraged to think creatively and choose a
strategy that works best for them. The instructor highlighted the point that even modifying small things could provide students with an essential support they would need. While this was an example of preparing preservice teachers to DI, the instructor did not use this term, instead the term “scaffolding” was mentioned. This instructor explained that a teacher must often make changes to the instructional material, such as the textbook and handouts. He also emphasized that preservice teachers should keep in mind that when they differentiate instruction, it is not “necessarily [to DI] for each student, but rather group of similar students.” In this case, the instructor described to preservice teachers the concept of multilevel teaching and addressed instructional material accommodations focusing on the “content” aspect of DI. While these are very important ideas related to DI and the instructor used an effective way of presenting these issues to preservice teachers, perhaps they would be able to better connect DI aspects and elements, if the instructor showed them how these ideas are related and where they are placed within overall DI framework.

The above examples and discussions with instructors revealed that instructors consciously prepare preservice teachers to DI, however, it seems that they each perceive DI somewhat differently and choose to focus on different characteristics of students, such variable abilities, level of academic readiness, concrete vs. abstract thinking, learning preferences, etc. When instructors taught the aspects or model elements of DI, they did not make explicit how these strategies relate to each other and how they are parts of an overall DI framework. For example, instructors could specify how each support strategy or material adaptation are parts of the content, process, product, affect, and learning environment aspects of DI. In addition, each DI strategy could be categorized as access, low-impact, or high-impact differentiation techniques. Because there was no common framework, instructors also did not use a common
vocabulary when preparing preservice teachers to DI; for example, they used terms such as differentiation, scaffolding, adaptations, modifications, support and release of responsibilities interchangeably. It appears that the program does not have a common framework for DI in their classes or what aspects of DI preservice teachers are learning in other classes.

While all interviewed and observed instructors were very cognizant of teaching to DI and integrated a variety of activities designed to prepare preservice special education teachers to DI, it shows that instructors have not developed a guide of common principles for teaching DI. Perhaps stronger sequences and connections from course to course could be established to help instructors to coordinate DI training and allow for an extension of learning based on prior knowledge of preservice teachers.

**Uneven implementation of DI with technology.** Integrating technology into differentiating instruction was the other aspect that interviews and observations were focused on. While almost all interviewed instructors were knowledgeable and enthusiastic about the concept of differentiated instruction in general, five of the ten instructors were not as comfortable with the idea of differentiated instruction with technology. One instructor pointed out, “I think we often provide opportunities for differentiating instruction, but not necessarily using technology.”

It is not uncommon for educators to disagree on how much and how technology should be used in teaching. While many educators are passionate about technology integration, others are much more cautious. Instructors participating in this study similarly represented a range of views on this matter. Aligned with the quantitative results from the survey, during the interviews, many instructors pointed out the benefits of using technology such as immediate student assessment, opportunities to adjust instruction based on data, helping students to make strategies visible, and using technology-based resources to engage students. Eight out of ten
interviewed instructors expressed a positive view of using technology for DI. One instructor stated, “It is the key – technology. Young people know how to use technology. We need to teach them how to apply it to support different needs of learners.” Another instructor commented that it was, “interesting to think about how to prepare them for technology that we don't even know yet”, while a third instructor expressed, “I think they [students are] more engaged [when technology is used] and that is a huge benefit, they are more engaged and they understand [how technology works] a lot quicker than we do.”

Overall, many instructors agreed that integrating technology can have a beneficial effect on student engagement and learning, but views on technology in the classroom and the time that needs to be allocated for preservice teachers to learn how to integrate technology during the teacher preparation program were more diverse. For example, two interviewed instructors cautioned that technology could also distract students or replace pedagogy all together. One instructor, who was observed to generally like using technology, stated, “I think it’s important for students to critically think about whether technology is enhancing the learning or impeding the learning. In some instances we see both.” Similarly, another faculty member noted,

We also have an interactive board [in school]. Sometimes, I am not sure that there is not an overuse of that [technology use]. I think sometimes with students with multiple disabilities, I am not sure if they are really getting it. Like if they are doing morning meeting, it is very, it is almost like TV. I do not know if they are really engaged. They are certainly, you know, motivated by the visuals and the auditory, but I worry sometimes that it is overdone and there is not enough multisensory [interaction]. You are getting visual and auditory, but I believe our kids need more multisensory application sometimes. I see that as a little drawback, you know.
The ideas that “technology needs to further pedagogy” and “not to use technology just to use it” came up early in the interviewing process and were later confirmed by nearly all instructors. “[It is important] to learn the basic principles of differentiating instruction before the technology. Once you know about the basic principles of differentiation, you can then start making determinations about which kinds of tools you might need.” Discussions with instructors about DI with technology revealed that they do not see technology as a complete solution. While instructors recognize the potential support that technology can provide, they are also concerned with keeping focus on learning principles while engaging technology for DI, rather than just creating more experiences for students to use technology tools. Three Instructors also shared examples that illustrated that technology is not always reliable and commented that when something does not work, teachers must have a backup plan. Instructors realize that with new developments in the education process, such as computer-based PARCC assessment and the use of new teacher evaluation procedures, where technology integration is a component, preparing preservice teachers to integrate technology into instruction is a critical aspect of every teacher preparation program.

As discussed earlier and as shown in Figure 3, based on the survey results, instructors teaching technology had the highest score in the TDITK scale, but not in the TGDI scale. This result was somewhat puzzling considering that presumably technology instructors do not have as high a level of expertise to DI as instructors teaching special education courses and instructors teaching methods courses. Data from open-ended responses and interviews helped to clarify this seeming inconsistency. It is possible that the survey items about DI with technology were not interpreted differently. When technology instructors responded to items about differentiation of instruction, some of them may have thought about differentiating instruction for their own
students (preservice teachers). As most of the assignments and class activities allow for freedom to choose either a technology tool or a topic based on each student’s interest, DI in education technology courses is a common occurrence. For example, one of the instructors shared “All of the students enrolled in my course are required to create what we call the ‘MMP’ or Multimedia Montage Project. This MMP can be based off of anything the student chooses in relation to their teaching (or occupation), from presentation creation to website development.” A project-based approach can definitely be one effective way to DI, but this quote from the open-ended response demonstrates that this technology instructor meant DI for her own students rather than teaching preservice teachers how to DI with technology in K-12 classrooms. Similarly, during an interview one technology instructor started to share that DI was not necessary in the class, as students at this level have excellent reading and writing skills, until it was clarified that we were discussing DI for the future students of the preservice teachers. These examples of different viewpoints could explain the difference between scores of TGDI and TDITK for technology instructors.

However, even after taking this possible misunderstanding into consideration, based on the survey and interview results, it appears that technology instructors believe that they carry the main load of preparing prospective teachers to integrate technology. One instructor shared his experience of DI using technology, such as using a smart board in class and later posting screencast video lectures for students to review. It is valuable for preservice teachers to see modeling of the multiple ways of delivering content using technology that can support individual learning.

One technology instructor explained that as a part of the Education and Computers course, preservice teachers get exposure to assistive technology and its role within the universal
design environment. Preservice teachers get a basic definition of assistive technology and complete an in-class activity where they explore some of the digital tools that can help students with writing, reading, math, etc. In addition, another technology instructor described that in the Computer and Education course preservice teachers exposed to many different technology tools, such as podcasting, web blogging, and web creating, and choose one technology or tool to focus on more extensively while working on their project. Preservice teachers are also required to research new technology tools and present them in class. During observations of Computers and Education classes, preservice teachers shared their findings about video communication, robotics, 3D printing, and presented their ideas about how to use Web 2 tools to enrich lesson plans and promote their future students’ thinking skills. It was obvious that technology courses are a great starting platform for preservice teachers to be exposed to a variety of technology tools, get hands-on experience using them, and to understand how technology can expand learning opportunities.

However, the Computer and Education technology course is focused on “using the computer and technology in a variety of educational settings across all subject areas.” Therefore, while preservice teachers taking this course are exposed to a variety of technology tools, they are not explicitly taught how to DI using technology and do not have enough time and opportunity to practice the content-specific tools that they need to know in order to effectively differentiate instruction for their students. Based on observations and interviews with technology instructors, it seems that after preservice teachers take the education technology course, they are ready to take their teaching with technology skills to the next level. Instructors of methods and special education courses could teach preservice teachers how to DI by integrating a variety of general, content specific, and specially designed technology tools for children with special needs.
As shown in Figure 2, instructors of special education had the second highest score of 4.27 on the TDITK scale and instructors teaching methods had the third highest score of 3.61. Instructors of special education and instructors teaching methods followed a similar pattern of teaching DI with technology. They were observed to integrate technology for DI in a variety of teaching methods, mostly in the form of discussions, but again without any visible continuity or coordination among courses. For example, in one class a guest speaker presented and demonstrated how to use a variety of assistive technology devices ranging from low tech, such as an object board, to high tech, such as iPad apps, to promote meaningful communication. In another class, the instructor showed a video clip of elementary school students participating in project-based learning, where they had different assignments and took a variety of roles reflecting their different levels of skills. Preschool teachers and instructors discussed how the roles were assigned according to various strengths of each student. Even a student, who did not yet speak any English, had a chance to participate by memorizing how to say simple phrases. Preservice teachers had an opportunity to see and discuss how DI was implemented. Yet a third instructor included class discussion about using technology based on learning centers as a way to manage differentiation of instruction. In this class, preservice teachers considered and discussed iPads station, where students could use many apps to practice their skills, to be a learning center. These different approaches of teaching preservice teachers to DI with technology again demonstrate that instructors realize the value of using technology for differentiation of instruction and assessment and expose preservice teachers to a variety of tools and methods. However, connecting these various strategies to an overall DI framework and providing preservice teachers more hands-on experiences using technology to DI could help them to develop skills and improve their self-efficacy in DI with technology.
In addition to data from observations, interviews with special education instructors confirmed that they aim to integrate technology into their instruction and discuss how technology can be used to enhance teaching and to differentiate instruction. Preservice teachers are encouraged to research technology tools and incorporate them into their projects, such as lesson and unit plans. During class observations, neither special education instructors nor methods instructors had any class activities where preservice teachers themselves were required to use technology tools for DI. During the observed lessons, preservice teachers did not have an opportunity to conduct a class activity using technology tools for content, process, product, affect or learning environment lesson adaptations.

Despite this, methods and special education instructors conveyed general approval for technology integration and discussed how technology can be used for DI. For example, one methods instructor described specific details of an assignment,

Students are taught to give ‘booktalks’ using Prezi and other technology tools. They were required to create these ‘booktalks’ with differentiation in mind, letting their own students understand how difficult the particular book was, or to whom it might appeal.

Another instructor talked about a more general approach, having students do independent research of technology-based tools,

Students researched programs such as Classroom Dojo, speech-to-text accommodation applications, and other types of technology that support literacy, mathematics, science, and social studies. We also discuss ways that technology could be used to assess student learning, differentiate instruction and the mode of assessment.

Core education instructors had the lowest score of 2.69 on TDITK scale of the survey. Data from the interviews and observations confirmed that DI with technology is not a main focus for
core education instructors and it is not expected that DI with technology should be addressed in these core courses such as Intro to Education. During an observation, an instructor of a core education course did not use any technology tools in class. One reason for this is that this classroom had no technology equipment available at all, which limited what the instructor could do during her lesson. During the follow up interview, she shared that she would like to incorporate video clips and parts of different movies to illustrate her points, as she does when she teaches in a classroom that is equipped with screen and projector. She also shared her belief that both instructors and preservice teachers need to be more proficient using technology tools for teaching. She also shared her concern that it might be assumed that preservice teachers would have an opportunity to learn how to teach with technology in their practicum, however, depending on the placement, not all preservice teachers get that opportunity. “[Preservice teachers] are put in the classroom where it [technology integration] is not happening necessarily, so they are already feeling this conformity ‘I shouldn’t bring out all my bells and whistles, I should know only a few. I also think that they [preservice teachers] do not get chance to practice using technology tools in teacher ed. practice.”

Across all courses, the majority of instructors, both during the observations demonstrated and interviews, discussed using Power Point presentations, video clips, message boards, and the program learning management system for submission of assignments. In addition, as part of class activities, preservice teachers were often required to present in class using PowerPoint or Prezi slides.

Data from the survey, interviews, and observations illustrate that instructors recognize the value of using technology and do try to incorporate technology based learning opportunities in their courses. While observation of one class for interviewed instructors is clearly not sufficient
to see all instructional methods and class activities used by instructors for preparing preservice teachers to DI with technology, the interviews also provided a space for instructors to discuss this across their entire course. Two main issues were exemplified during observations: the lack of consistency in implementing DI with technology in the teacher education program and the fact that preservice teachers did not have many opportunities to use technology for DI themselves. For example, during only two observations of technology instructors, did preservice teachers have access to and use of computers themselves. Based on this, as well as questions during the interviews, it could be assumed that most of the preparation to DI with technology tends to be theoretical in nature, with discussion of tools and possible strategies to DI being a main instruction method. Instructors generally addressed DI based on content (what to teach) and process (how to teach). However, during interviews, instructors provided examples of affect (connecting ideas and feelings) and learning environments (grouping students and using digital spaces), which are all aspects of DI, but this was not observed in their class activities.

While class discussions and activities related to DI with technology observed in classes were valuable and thoughtful, some aspects of DI, such as product and learning environment, were not included, therefore preservice teachers did not have an opportunity to add useful technology tools for these aspects of DI into their teaching arsenal. Likewise, no common framework was used for teaching perspective teachers to DI, which would include all DI aspects and could be adapted to address different levels of DI. In addition to an overall DI framework, instructors did not have a collection of common technology tools available for each DI aspect, which would support further integration of courses in the program.

Instructors’ concerns and recommendations for improvements in area of preparing preservice teachers to DITPACK.
Instructors expressed concern that they do not have an established process to learn about DI concepts and teaching methods used by instructors of other courses. Without knowing how the program overall prepares preservice teachers to integrate technology for DI, it is difficult for instructors to align course specific learning goals, assignments, and a consistent framework for DITPACK. During interviews, instructors made comments such as, “I have no idea what they are doing in Literacy class”, “It is hard to coordinate, there is a certain sense of independence.” One instructor responded to an open-ended item, “Some questions ask to rate other professors which is inappropriate.” This illustrates the level of disconnection among instructors of the program. It became apparent that while most of the full time instructors worked closely with each other within their own departments, they did not have the means to collaborate with colleagues from other departments. Instructors reiterated that there is no established procedure for all instructors to discuss and coordinate curriculum, students’ assignments, and teaching methods regarding DI with technology, although instructors agreed that the best way to prepare preservice teachers to DI with technology is to integrate learning opportunities related to DI with technology into courses across the program.

Furthermore, based on interview results, part time instructors are even more isolated and expressed dissatisfaction that they did not know the concepts and methods that other instructors were using to teach their students. One part time instructor explained, “I would like to have time to collaborate with other professors so we can generate ideas on how to teach them to differentiate. I don't even know other professors in my students cohort, so it is not like I can even email them.” Most instructors interviewed expressed their desire for more coordinated collaboration. They noted that it would help if they were more familiar with what is covered in each course and routinely had opportunities to visit each other’s classrooms during teaching,
discuss sequences of concepts and assignments, and have a chance to collaborate with instructors from different departments. One instructor commented, “I think it would take more coordination between courses. I actually have very little idea what is happening in special education courses. I really do not know what they do in there. How do they define DI? Is it similar to how I define it? I think we need to define it [DI], …we have common vocabulary, but not a common definition.” One technology instructor also explained how collaboration would be very beneficial for teaching students to DI with technology in a more consistent and planned manner, and how teaching to integrate technology should be part of all courses and not just addressed in one course, “every class can benefit from a technology lens.” The same technology instructor expressed, “other instructors here can invite me to speak in their class [if they are not as proficient with technology tools].” Another instructor communicated a similar opinion, “Using technology in context is more beneficial than taking the course on all of the technology that is [currently] available. Learning should be continuous and across all courses.” These comments suggest that instructors would welcome the opportunity to develop a common vision and a more systematic approach to preparing prospective teachers to DITPACK.

In addition to the need to develop a common vision and guiding principles for teaching DITPAK, instructors also expressed their concerns about technology currently available in classrooms. All instructors participating in the interviews agreed that currently there is a shortage of technology available in the majority of classrooms. They pointed out that some of the classrooms had only recently gotten Smart boards, but these classrooms are not big enough to accommodate classes larger than ten to twelve students. Instructors also communicated dissatisfaction about the lack of other technology resources available to instructors for teaching prospective teachers to integrate technology into instruction. For instance, “Many of the
classrooms we teach in have very limited technology and therefore we are limited in what we can support the preservice teachers in”. Another instructor commented,

> It's frustrating to talk about Smart Boards, which are present in many public school classrooms, without being able to use them in my own instruction. It would also be helpful to have iPads or tablets that could be used to try out new apps and ideas as a class.

In addition, instructors expressed that it was unrealistic to expect students to bring their own equipment. Even when students do, some bring laptops, other have iPads or different tablets, making it difficult to plan for all possible variations of equipment, especially considering that most educational tools do not work on all types of computer equipment in the same way or at all. As one instructor explained, “Learning different education apps is important, I don’t think we prepare them [prospective teachers] a lot. Lack of the resources here prevents us from preparing teachers. Their students will have Chromebooks in the classroom, but they [pre-service teachers] are not ready to manage or use them.”

When asked for suggestions to improve, many instructors agreed that before students can get ample preparation to DI with technology or integrate technology into instruction, the teaching program must find ways to provide technology for use in all classrooms. One instructor voiced disappointment that there was no real opportunity to use technology in class, and communicated his suggestions for improvement,

> They should start with equipping and updating the classrooms. This room is not necessarily ready for technology use… Students see me talk about a lot of things, but yet I do not have equipment to demonstrate it. I can show them what Smart board can do, but there is not Smart board in here. I think that we also need to have different forms of technology. We can talk about the apps, and I am hoping that they will download them,
but I cannot model for them. We do not have an iPad cart to utilize. ... I would love to show them how to do reading workshop using document camera, etc.

Collectively, instructors expressed that access to the right technology, such as smart boards, laptops and tablets in the classroom would enhance teachers’ preparation, and that budget limitations is the main reason for insufficient technology resources, “I wish I could bring students to a computer lab, have them practice and create lessons.” Based on interview discussions, faculty members do realize that the lack of technology is not an easy challenge to overcome and requires constant attention and time, especially considering that technology is changing so rapidly. Instructors suggested that besides adding equipment to the program, establishing closer relationships with local school districts could help in resolving this issue, where prospective teachers could learn and practice using various schools’ technological resources. With technology constantly evolving and transforming the ways of teaching and learning, it is very important to consider the time and support needed for instructors to be able to integrate technology into their own teaching as well as preparing preservice teachers to DITPACK.

The need for flexible professional development opportunities and the lack of time to keep up with new technologies is another topic that instructors brought up frequently during interviews and in their open-ended items responses. For example, “I need to improve my knowledge, understanding, and comfort level with integrating technology in order to differentiate instruction.” Instructors reported that they want more support for learning and using technology, stating the need for “More professional development for faculty on technology integration and more incentives for spending the time to do this.” Based on the qualitative data, some instructors felt that they do not get recognition for spending time mastering their own technology skills;
therefore without program support, instructors may consider that preparing preservice teachers to integrate technology is not an essential part of the program. This is a key concern. When instructors discuss the value of using technology for teaching and learning, but do not use it themselves or teach preservice teachers to integrate technology effectively, preservice teachers get a mixed message. This could be connected to the need to develop a coherent program vision with guiding principles for preparing preservice teachers to DITPACK.

Other faculty members expressed similar thoughts about the importance of keeping up with the fast pace of technology and the need for ongoing training for faculty members. For instance, one instructor replied to an open-ended item, “I believe that this is a very important skill for prospective teachers to develop and that the instructors may need more individualized training in the area of using technology in order for this to be fully accomplished.” Many instructors expressed that they would benefit from assistance in learning not only about the latest apps and web resources, but also how to use these tools to teach prospective teachers to differentiate instruction. One instructor pointed out, “List of resources could be a great start, I do not have time to research a lot of tools.” The same instructor also said, it is important that when workshops are offered, they should be offered a few different times or recorded, because many instructors, especially part time instructors, who also teach in public schools, cannot attend workshops during the hours when their public schools are in session. Instructors suggested that there is expertise available within the teaching program and, perhaps, it would be possible and certainly it would be beneficial to set up ongoing opportunities for collaboration and learning from each other.

One instructor emphasized that new teachers need to be ready for tomorrow’s classroom, which without a doubt will include a variety of technology, and that even today, “In elementary
school it is extremely important to use technology with the students. We are working with many tools at school, we [are] just learning about PARCC now, which is computer-based assessment…” Another instructor noted that preservice teachers also need to be better prepared to use technology to teach students with severe disabilities, such as autism, cerebral palsy, multiple disabilities, etc. “There are many technologies to serve students with severe disabilities, but our students do not know them. They need to be exposed to technology that would be helpful to those specific groups.”

**Discussion**

The purpose of this study was to examine how well prospective special education teachers are being prepared to address the variable learning needs of students by differentiating instruction through using technology. Three key findings emerged from the quantitative and qualitative analyses. Instructors involved in the preparation of special education teachers recognized the importance of differentiated instruction, acknowledged that while integrating technology can be a potentially effective method, they do not currently prepare pre-service teachers well to differentiate instruction with technology, and identified the main reasons for the shortfall in this area, such as lack of coordination, lack of technology available, and varying levels of instructors’ proficiency to integrate technology effectively. Instructors also offered their suggestions on how to better prepare teachers to differentiate instruction by integrating technology.

First, although instructors overwhelmingly expressed that differentiation of instruction (DI) is a very important component of effective teaching, they also noted that currently there is no systematic implementation of teaching to DI. Instructors preparing special education teachers fully embrace DI and recognize that it is an absolutely, necessary practice that must be
implemented in inclusion classrooms. This finding supports prior research and practices of inclusive education, “the use of differentiated instruction was associated with promoting choice-making, providing students with meaningful rationales, and providing structure in the classroom…providing optimal challenges and learning conditions for all students to help them succeed and feel competent” (Roy, Guay and Valois, 2012). Instructors expressed the opinion that the concept of DI is emphasized across most courses of the teaching program and that students have ongoing opportunities for developing the skills necessary for DI. However, the actual practice is demonstrated in a wide variety of methods and levels, since preparing students to DI is left up to individual instructors.

Second, while instructors perceived technology to be beneficial for students’ learning, specifically when it is used for differentiation instruction, they also articulated that integrating technology into preparing teachers to DI is currently not implemented in a planned, systematic and cohesive way. Ertmer & Ottenbreit-Leftwich (2010) discussed that teacher education programs can influence students’ understanding of good teaching as “one that incorporates the use of technology to improve teaching and learning practices” and that pre-service teachers should be required to demonstrate evidence that they can use technology tools to help their students achieve learning outcomes. Currently, this viewpoint is not reflected in the program’s set of goals. It is left to a few individual instructors, often without technology to support their efforts, to train pre-service teachers to integrate technology into instruction.

Moreover, instructors had specific suggestions about overcoming these limitations and improve the preparation of pre-service teachers. For example, they suggested that building closer and more focused partnerships with local school districts could allow for better access to classroom technology resources and expanded opportunities for student practice. Instructors
agreed that better access to technology resources, such as more smart boards in classrooms, and Laptops and iPads carts, are critical to enable pre-service teachers to construct a knowledge base of appropriate technology-based tools, such as applications, devices and web-resources, and learn how to use them to support best teaching practices. It is also important to consider that most instructors working with pre-service teachers completed their education at a time when technology was much less integrated and prominent in the field of education. Therefore, instructors need to have professional development opportunities not only on how to use new technology tools but also how to apply these skills in student-centered teaching and how to incorporate technology-enriched learning activities into their courses.

Third, and potentially the most useful and practical finding, in addition to expanding access to instructional technology and receiving professional development, collaboration and coordination among instructors in the program would be the most beneficial step toward the improvement of preparing prospective teachers to differentiate instruction with technology. Instructors expressed that they would benefit from establishing the practice where instructors will have an opportunity to visit each others classrooms, have access to syllabi and course materials, and have regular open discussions about the goals and curriculums of the other required and elective courses, especially from others departments. Instructors recommend to preservice teachers to participate in professional development, observe and learn from other teachers and work closely with colleagues. However, when instructors in teacher program do not follow these recommendations themselves, they send mixed message to preservice teachers.

Results from the survey also indicated that there are significant differences in the average items scores of Technology Confidence and Teaching Knowledge Scales among the four groups of instructors. Currently some instructors feel that integrating technology and modeling how to
use technology-based tools along the way are not their responsibilities. Specifically, instructors of core educational courses had the lowest self-reported average item score for technology integration into teaching compared with instructors of special education courses, methods courses, and technology courses. Therefore, developing a clear vision among instructors of how to prepare pre-service teachers to succeed in a technologically evolving environment would be an important first step. Aligning curriculum, goals, and learning activities across all courses of the teaching program should follow vision development.

Overall, the findings of this study show that instructors involved in the preparation of special education teachers to DITPACK highly value differentiated instruction, but they agree that purposefully designed, well coordinated, and a systematically integrated approach to prepare preservice teachers to DI with technology is essential, and that the teacher education program needs to improve this aspect of teacher preparation. The teaching program has to find a way to resolve the issue of technology shortage in the classrooms. Instructors also will benefit from ongoing, up-to-date, flexible, and systematic professional development opportunities, so they can better support learning of preservice teachers to DITPACK.

One possible way to address preparation to DITPACK is by using framework described by Salend (2010). This framework can be adapted as a base for designing preparation of preservice teachers to DITPACK. As shown in Figure 4 (Appendix B), this framework is built on the core beliefs that the individual learner is in center of the teaching and learning process, and that all students will be able to learn when DI is based on their readiness, learning profile, and interests. This framework consists of five components: content, process, product, affect and learning environment. The teaching program may choose to designate specific courses to teach aspects of each component. For example, the overall framework could be introduced to
preservice teachers during selected educational core courses. Content and process can be addressed in methods teaching courses by specific content areas. In special education courses, preservice teachers can expand their knowledge by focusing on additional strategies for the process, affect, and learning environment. Using this same framework across the program, with the same terminology, and by integrating technology tools across all courses will provide preservice teachers with systematic learning opportunities to DITPACK and more coherent what in this teacher education program.

The main limitations of this study are the measuring instructors’ perceptions based on self-reporting, limited observations and the focus on only one teacher program. However, both quantitative and qualitative measures used in this study provided distinctive insights into several aspects of preparing pre-service teachers to differentiate instructions by integrating technology, particularly by examining this issue from the instructors’ point of view. It is vital to note that instructors recognized this topic is very important. Even the fact of participating in this research has already prompted many instructors to review their teaching practices and make adjustments to classroom activities and projects. During the interviews, four instructors shared their thoughts on what they personally plan to do to help pre-service teachers to DI with technology. In addition to affecting instructors in this teaching program, this study will assist faculty members, administrators, and providers of professional development at other colleges in the decision-making processes regarding coordinating efforts and ensuring that pre-service teachers have sufficient learning opportunities to differentiate instruction by integrating technology.

While this study is restricted only to one teacher preparation program, coherence of the program that discussed here has broader application. It is likely that this issue is not completely addressed in other teacher preparation programs, which also might be in the process of
evaluating and aligning their courses and efforts to prepare preservice teachers to integrate technology into differentiated instruction. This study might have implication and provides meaningful illustration and beneficial research to educators in the field who strive to better understand integration of technology use into teacher preparation training and related issues. This study contributes to the expansion of the research area that has sprung from the inclusion movement, empowered by forceful technology development and focused on educating diverse population of students, including those with the special needs in general education settings.

Further research is recommended to study effective methods and challenges of preparing special education teachers to use technology in student-centered teaching. This study provided instructors’ point of view on this important issue, however, to complete the picture, students’ input and perspectives would be very valuable addition to the research. In addition, it will be useful to learn more about the accomplishments and setbacks of integrating technology to support individual learning needs of students from the new special education teachers in the field. This would provide important information on how to integrate the development of DITPACK skills into the curriculum of teaching program.

A key question of education is how improve learning opportunities for each student regardless of learning profiles or abilities. The significance of this study is to contribute to the knowledge base of how to better prepare preservice teachers to differentiate instruction with technology, enabling new teachers to more effectively support each student’s individual learning within inclusive classrooms.
References


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Appendix A - Instructors Survey

Technology Knowledge and Attitude (TKA)

1. I know how to solve my own technical problems.
2. I can learn technology easily.
3. I keep up with important new technologies.
4. I frequently play around with new technology.
5. I know about many different technologies.
6. I have the technical skills I need to use technology.
7. I know how to use a variety of technology tools (e.g., Wikis, Blogs, Podcasts, Apps, Google Docs, etc.).
8. Using technology in class can improve my instruction and delivery of content material.
9. Instructional technology can be used to improve student learning.

Teaching General Pedagogical Knowledge (TGPK)

1. I teach prospective teachers to assess student performance in the classroom.
2. I teach prospective teachers to adapt their teaching based upon what students currently understand or do not understand.
3. I teach prospective teachers to adapt their teaching style to different learners.
4. I teach prospective teachers to assess student learning in multiple ways.
5. I teach prospective teachers to use a wide range of teaching approaches in a classroom setting.
6. I teach prospective teachers about common student understandings and misconceptions.
7. I teach prospective teachers to organize and maintain classroom management.

Teaching General Pedagogical Content Knowledge (TGPCK)

1. I teach prospective teachers to select effective teaching approaches to guide student thinking and learning in mathematics.
2. I teach prospective teachers to select effective teaching approaches to guide student thinking and learning in literacy.
3. I teach prospective teachers to select effective teaching approaches to guide student thinking and learning in science.
4. I teach prospective teachers to select effective teaching approaches to guide student thinking and learning in social studies.

Teaching Technological Content Knowledge

1. I teach prospective teachers about technologies that they can use for teaching mathematics.
2. I teach prospective teachers about technologies that they can use for teaching literacy.
3. I teach prospective teachers about technologies that they can use for teaching science.
4. I teach prospective teachers about technologies that they can use for teaching social studies.

Teaching Technological Pedagogical Knowledge

1. I teach prospective teachers to choose technologies that enhance their teaching approaches for a lesson.
2. I teach prospective teachers to choose technologies that enhance students' learning for a lesson.
3. The GSE teacher education program has caused prospective special education teachers to think more deeply about how technology could influence the teaching approaches they can use in the classroom.
4. GSE special education prospective teachers are thinking critically about how to use technology in the classroom.
5. I teach prospective teachers to adapt the use of the technologies that they are learning about to a variety of teaching activities.
6. I teach prospective teachers to select technologies to use in their classroom that enhance what they teach, how they teach and what students learn.
7. I teach prospective teachers to use strategies that combine content, technology, and teaching approaches that they learned in my course(s)
8. I teach prospective teachers to choose technology resources that enhance the content for a lesson.

Teaching Technology, Pedagogy, and Content Knowledge

1. I teach prospective teachers to appropriately combine mathematics, technologies, and teaching approaches.
2. I teach prospective teachers to appropriately combine literacy, technology, and teaching approaches.
3. I teach prospective teachers to teach lessons that appropriately combine science, technology, and teaching approaches.
4. I teach prospective teachers to teach lessons that appropriately combine social studies, technology and teaching approaches.

Teaching General Differentiated Instruction

1. I teach prospective teachers to modify goals and expectations for students to match their academic readiness levels
2. I teach prospective teachers how to plan for different class activities and assignments to match students’ skills (e.g. present information in a different sequence, give more explanations)
3. I teach prospective teachers how to provide students with lower skill levels with additional aids or tools (e.g. study guides, graphical organizers, etc.)
4. I teach prospective teachers how to evaluate the effectiveness of teaching adjustments (e.g., monitor subsequent achievement and progress)

5. I teach prospective teachers how to analyze data about students’ academic progress to make decisions about teaching adjustments

6. I teach prospective teachers how to use alternative materials to match students’ skills (e.g., books below and above grade level)

7. GSE special education prospective teachers would benefit from more differentiated instruction training as part of the teaching program (adjusting plans, assignments and assessments for different types of learners)

**Differentiated Instruction with Technology Knowledge**

1. I teach prospective teachers a variety of specific technology resources, applications and tools to use for differentiated instruction

2. I teach prospective teachers how to use technology to present information using multimedia (text, images, audio, video)

3. I teach prospective teachers a variety of specific technology resources, applications and tools to use for behavior management

4. I teach prospective teachers how to use applications for management of the differentiated learning process (assignments, assessments, grading, data analysis)

5. I teach prospective teachers about a variety of specific technology resources, applications and tools to use for engagement and motivation of struggling learners.

6. I teach prospective teachers how to use a variety of learning applications to support differentiated instruction

7. I teach prospective teachers how to use technology to create their own instructional materials to match students’ skills levels

**Teacher Education Opinion**

1. The GSE professors in the teaching program appropriately model differentiating instruction using technology in their teaching.

2. The courses of the teaching program will prepare prospective teachers to differentiate instruction by using technology

3. In courses I teach as part of the teaching program I provide prospective teachers with many opportunities to teach using technology for differentiating instruction

4. In general, approximately what percentages of the GSE teacher education professors provide an effective model of combining content, technologies and teaching approaches in their teaching?

5. In general, approximately what percentages of the GSE teacher education professors provide prospective teachers with the opportunity to differentiate instruction using technology?

6. Describe a specific episode where YOU effectively demonstrated or modeled differentiating instruction using technologies in a classroom lesson. In your description please include details about the course, content, specific technology, and differentiation of instruction.
If you have not modeled this, please indicate that you have not.

7. Describe a specific episode where you effectively provided a learning opportunity for prospective teachers to demonstrate a lesson or part of a lesson combining content, technologies and differentiated instruction.
   • In your description please include details about the course, content, specific technology, and differentiation of instruction.

If you have not provided any opportunities for prospective teachers to teach a differentiated lesson or a part of a lesson using technology for DI, please indicate that you have not.

• Please comment about the topic of differentiating instruction by integrating technology and offer suggestions on how to improve students’ preparation to differentiate instruction by integrating technology.

If you do address the topic of differentiation in any way in any of your courses, would you be interested in participating in a study about preparing prospective teachers to differentiate instruction with technology?

Participation in this study consists of an observation and interview. A researcher will observe selected part(s) of your course related to the differentiation of instruction and/or using technology resources for differentiation as suggested by you. An observation should last no longer than one class period or less. After the observation, you will take part in an interview, for about 30-45 minutes, at a mutually agreeable time and location. Your study data will be confidential.

• Yes, I address this topic in my courses and would like to participate in this study.
• No, thank you. I address this topic in my courses, but rather not participate in this study.
• No, thank you - I do not address this topic in my courses at all.

This is the last section of the survey. Please provide your demographic information, which will be used for the purposes of this study ONLY.

Your Name:

Your RU e-mail address and/or any other email you prefer:

Gender:

• Male
• Female

Age range:

• 26 - 35
• 36 - 45
• 46 - 55
• 56 - 65
• 65 +

I teach courses for students in:

• 1st Year of Teaching Program
• 2nd Year of Teaching Program
• 1st Year and 2nd Years of Teaching Program
• Other

Area(s) of Specialization / Course(s) I teach at GSE (please check all that apply):

• Education Introductory Courses (Introduction to Education, Educational Psychology, Individual & Cultural Diversity in the Classroom)
• Core Elementary Education 1 - (Learning and Teaching in the Early Childhood Classroom, Practicum in Early Childhood/Elementary Education I)
• Core Elementary Education 2 - (Practicum in Early Childhood/Elementary Education II, The Teaching Profession)
• Special Education (Introduction to Special Education, Materials and Methods in Special Education, Assessment and Measurement for Special Education, Classroom Organization for Special Education, Electives in Special Education (293:522***; 293:610; 293:525; 293:509))
• Teaching Methods / Literacy (Literacy for Students with Disabilities, Literacy Development in the Early Years, Literacy Development in the Elementary and Middle School, Teaching ELL,
• Teaching Methods / Mathematics (Teaching Mathematics in the Elementary School)
• Teaching Methods / Science (Science in the Elementary School)
• Teaching Methods / Social Studies (Teaching Social Studies in the Elementary School)
• Teaching Internship (Teaching Internship, Teaching Internship Seminar)
• Educational Technology (Introduction To Teaching With Digital Tools, Web-Based Multimedia Design For Educators, Developing Digital E-Learning Environment)

Please list the course(s) you are teaching during 2014-2015 school year:

Would you be willing to share your syllabi and/or other supplemental course materials related to the topic of this study?

• Yes (I will respond to email and send my latest syllabi and possibly other course material for your analysis)
• No, thank you

If you agree to participate in this study further, please indicate the best way to contact you (email, phone) and thank you very much for your anticipated participation. Thank you for your time and input.
References


Appendix B – Aspects of Differentiated Instruction

- **Content** (what to teach)
- **Process** (how to teach)
- **Product** (how students demonstrate content mastery)
- **Affect** (how students connect their thinking & feelings)
- **Learning Environment** (classroom design & flexible grouping)

**Student**
- Readiness
- Interest
- Learning Profile
Preparing Special Education Teachers to Differentiate Instruction by Integrating Technology

Natalia Kouraeva
Dr. Dan Battey, Chair

Image: Integrating technology into the classroom. © Shutterstock/legenda
Approximately 6.4 million children ages 3 to 21 or about 13% of all students were served under the Individuals with Disabilities Education Act and provided with special educational services in 2011-12.

Inclusive Environment

Every child is a precious resource whose full potential must be tapped. We cannot afford to leave anyone out of our efforts.

U.S. Department of Education

Problem of Practice
How well are SPED teachers being prepared for Inclusion?

Four states had increases in inclusion in all grades and subjects, 23 states had increases in at least one grade/subject. No states had decreases in all grades/subjects

Kitmitto (2011)

Differentiated instruction is based on the premise that instruction should be adapted to the students' different learning styles, interests, and ability levels

Tomlinson, 2001

Teachers’ abilities to differentiate instruction is essential
Aspects of Differentiated Instruction

- **Content** (what to teach)
- **Process** (how to teach)
- **Product** (how students demonstrate content mastery)
- **Affect** (how students connect their thinking & feelings)
- **Learning Environment** (classroom design & flexible grouping)

Differentiated Instruction Using Technology

Image by N. Kouraeva

Image from: Galleryhip.com
Purpose of Study

To investigate whether prospective special education teachers receive ample preparation and develop sufficient capability to differentiate instruction by integrating technology.
Research Questions

- How and to what extent do selected GSE instructors prepare prospective special education teachers to differentiate instruction by integrating technology knowledge, pedagogical knowledge and content knowledge (DITPACK)?

- To what extent do prospective SPED teachers feel that they are prepared to differentiate instruction by integrating technology knowledge, pedagogical knowledge and content knowledge (DITPACK)?

- What are the similarities and differences between GSE instructors and special education preservice teachers’ perceptions regarding DITPACK, and what can be done to improve the preparation to DITPACK?
Conceptual Framework TPACK

From TPACK to DITPACK

Image by N. Kouraeva

Image by: Koehler, Mishra, and Cain, 2013
Methods

Research Design

• Sequential Mixed Methods
• “Collection of both quantitative and qualitative data sequentially” (Creswell, 2009, p.18)
• Mixing analyses to broaden the understanding of a research problem
Participants

Two–year teaching program at the Graduate School of Education (GSE) of Rutgers University

41 instructors involved in preparing SPED teachers at GSE:
- special education - 13
- core education – 18
- content methods – 6
- educational technology - 4

46 students in the first and second year in the program:
- first year - 23
- second year - 13
- unknown year - 10

Data Sources

- Instructors’ Survey – 41 out of 66 = 62%
- Students’ Survey – 46 out of 73 = 63%
- Instructors’ Observations (8) & Interviews (10)
- Students’ Focus Group Interviews (first & second years in the program)
Data Collection - Instructors

Survey
- Adapted from the work on TPACK with preservice teachers (Schmidt et al, 2009).
- Teaching General Differentiated Instruction – seven new questions
- Differentiated Instruction with Technology Knowledge – seven new questions
- Added general demographic and three open-ended questions
- The final survey consisted of 57 items divided into seven sections.

Focus of observations:
- Reflection of unique instructors’ perspectives on DI and DI with technology
- Methods of teaching to DI and DI with technology
- Students’ involvement in technology integration for DI

Focus of interviews:
- Addressing aspects of DI
- Teaching and learning with technology
- Unique teaching methods
- Evaluations and recommendations

Data Collection – Students

Survey
- Similar survey, changes in wording
- Example:
  Instructors:
  - I teach perspective teachers to adapt their teaching style to different learners.
  Students:
  - I can adapt my teaching style to different learners.

Focus of observations:
- Students’ involvement in class activities
- Students perspective on DI and DI with Technology

Two focus group Interviews - first and second year in the program

Focus of Interviews:
- How well do students feel prepared to DI
- How did they learn to DI
- Specific tech. tools, projects, activities, courses – addressing DI and DI with technology
- Recommendations for improvements
Data Collection Timeline

- **Instructors Survey**
  - Sep-Oct

- **Students Survey**
  - Nov-Dec

- **Observations & Interviews**
  - Nov-Dec

- **Students Focus Groups**
  - Dec

Questions:

1. How and to what extent do selected GSE instructors prepare prospective special education teachers to DITPACK?
2. To what extent do prospective SPED teachers feel that they are prepared to DITPACK?
3. What are the similarities and differences between GSE instructors and special education preservice teachers' perceptions regarding DITPACK?

Measures and Data Analysis

**Quantitative**

- Used STATA: Descriptive Statistics (arithmetic means and standard deviation)
- Conducted ANOVA Test to compare groups with post-hoc Tukey. The significance level in analyses was considered $p < .05$.

**Qualitative**

- Used Dedoose software: Interpretation and Analyses – to describe and explain individual experiences and variations
- Original Codes
- Refined Codes
- Themes
- Confirming & Disconfirming
Reliability

• The Pedagogical Content Knowledge, Technological Pedagogical Content Knowledge (TPACK) model has been used previously for survey instruments and interview protocols.
• According to Schmidt et al (2009), the TPACK instrument was evaluated for content validity by three researchers with extensive expertise of TPACK and also tested specifically for measuring TPACK capabilities of pre-service teachers.
• The internal consistency reliability (coefficient alpha) ranged from .75 to .92 for the seven TPACK subscales - this range is considered to be acceptable to excellent” (Schmidt et al, 2009)
• DI component is new, but the same format was followed and tested

Validity

• Data triangulation was utilized to increase the validity - different sources of information were used. For example:
  • Data from class observations was checked and confirmed by the instructors’ interviews
  • Data collected from instructors’ interviews was checked by data collected from student focus group interviews
  • Quantitative data collected by surveys checked by data from class observations and interviews
Results

Quantitative  Qualitative

Reporting Results

Instructors’ Surveys
Instructors’ Observations and Interviews
Students’ Surveys and Focus Groups Interviews
Compare Instructors and Students Perspectives
Instructors

Learn to differentiate instruction with technology

Instructors’ Average Technology and Teaching Confidence Scores by Scales

<table>
<thead>
<tr>
<th>No.</th>
<th>Scales of Technology and Teaching Confidence</th>
<th>N</th>
<th>M &amp; SD</th>
<th>No. of Items per Scale</th>
<th>Average Item Score for each Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Technology Knowledge and Attitude (TKA)</td>
<td>41</td>
<td>34.41 (5.89)</td>
<td>9</td>
<td>3.82*</td>
</tr>
<tr>
<td>2</td>
<td>Teaching General Pedagogical Knowledge (TGPK)</td>
<td>41</td>
<td>30.44 (4.45)</td>
<td>7</td>
<td>4.34</td>
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<tr>
<td>3</td>
<td>Teaching General Pedagogical Content Knowledge (TGPK)</td>
<td>41</td>
<td>13.17 (3.95)</td>
<td>4</td>
<td>3.29</td>
</tr>
<tr>
<td>4</td>
<td>Teaching Technological Content Knowledge (TTCK)</td>
<td>41</td>
<td>11.39 (5.05)</td>
<td>4</td>
<td>2.84</td>
</tr>
<tr>
<td>5</td>
<td>Teaching Technological Pedagogical Knowledge (TTPK)</td>
<td>40</td>
<td>24.38 (6.93)</td>
<td>8</td>
<td>3.04</td>
</tr>
<tr>
<td>6</td>
<td>Teaching Technology, Pedagogy, and Content Knowledge (TTPCK)</td>
<td>40</td>
<td>11.73 (4.11)</td>
<td>4</td>
<td>2.93</td>
</tr>
<tr>
<td>7</td>
<td>Teaching General Differentiated Instruction (TGDI)</td>
<td>40</td>
<td>26.98 (6.05)</td>
<td>7</td>
<td>3.85</td>
</tr>
<tr>
<td>8</td>
<td>Teaching Differentiated Instruction with Technology Knowledge (TDITK)</td>
<td>40</td>
<td>21.38 (7.88)</td>
<td>6</td>
<td>3.56</td>
</tr>
</tbody>
</table>

*Note: Scale 1-5
Key Points – Instructors Survey

- Instructors of special education courses rated themselves highest in two scales, 4.64 in Teaching General Pedagogical Knowledge, and 4.42 in Teaching General Differentiated Instruction
- Scores for the group of methods instructors were higher than the scores of the group of core education courses in all scales
- Self reported scores for the group of core educational courses instructors were the lowest among all four groups
Key Points – Instructors Survey

• The group of instructors teaching technology courses rated themselves highest in five scales
• Unexpected: the second lowest score of 3.61 in Teaching General DI scale - the highest score of 4.92 in the Teaching DI with Technology Knowledge
• Possible explanation

DITPACK by Scales and Instructor Groups

1. Special Education: N=13: 4.64 in TGPK - 3.39 in TTPK
2. Core Education: N=18: 4.64 in TGPK - 2.14 in TTCK
3. Technology: N = 4: 4.92 in TDITK - 3.63 in TGPCK

* Scores combined different content areas
Significant Differences in Mean Scores

- The group of special education instructors and the group of instructors teaching technology courses both rated themselves significantly higher on six scales out of eight than the group of instructors teaching core education courses.
- Possible explanation:
  - Lower scores for core education group were expected and justified by the goals of their curriculum
  - With 18 instructors teaching core educational courses, there are more of the instructors who are part time lecturers, than in any other instructors’ group

Do we Prepare our Preservice SPED Teachers to DI with Technology?

- Instructors were asked to use a scale of 1-4 to approximate what percentages of the teacher education instructors provide an effective model of combining content, technology, and teaching approaches in their teaching
- Instructors’ beliefs revealed:
  The median score of 2.18 implies that instructors believe that only slightly over 50% of instructors effectively integrate pedagogy, content, and technology

Image from: www.gettyimages.com
## Qualitative Insights

Instructors’ Evaluations, Recommendations, and Implications for Improving Preparation to DITPACK

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## Instructors: Themes, Topics and Patterns

- The value of differentiated instruction
- Shortage of technology
- Uneven implementation of DI with technology
- Need for coherent program vision
Instructors’ Comments – DI at GSE

“Differentiated instruction is a huge emphasis [in the teaching program], it really is.”

“You can’t teach literacy without differentiation”

“They [the teachers] make small adjustments, or, sometimes, bigger adjustments, to try to meet students where they are at. I think just about everything I do in my methods class is about differentiating.”

Instructors’ Ways of Teaching DI

1. Tiered lessons to differentiate for the variety of students’ level of skills
2. Visual, kinesthetic, and auditory modalities to address diverse learning preferences
3. Common modifications for students with high-incidence disabilities (LD)
4. Scaffolding strategies and teaching to think creatively
Examples

For one assignment preservice teachers were required to design a tiered lesson to differentiate for the variety of students' level of skills - "modify material and adapt lesson."

Another instructor asked preservice teachers to provide learning opportunities for students with diverse learning preferences by using visual, kinesthetic, and auditory modalities (Polar Bear Activity).

Teaching prospective teachers to scaffold- teacher and students follow the same steps "I do - you watch, I do - you help, we do, then you do."

Another instructor focused on teaching preservice teachers to offer students a variety of strategies of how they could solve a problem. For instance: a strategy by thinking out loud, using a visual aid to follow the problem structure, or asking students to use various counting, recall, or derived facts strategies. According to this instructor, students always should be encouraged to think creatively and choose a strategy that works best for them.

Uneven Implementation of DI with Technology

1 Variation in instructors’ perspectives on technology use

Shared ideas: “technology needs to further pedagogy” and “not to use technology just to use it”, and “I think we often provide opportunities for differentiating instruction, but not necessarily using technology.”

“It is the key – technology. Young people know how to use technology. We need to teach them how to apply it to support different needs of learners.”

“I think it’s important for students to critically think about whether technology is enhancing the learning or impeding the learning. In some instances we see both.”
Uneven Implementation of DI with Technology

2 Shortage of technology in classrooms

“Many of the classrooms we teach in have very limited technology and therefore we are limited in what we can support the preservice teachers in”

“It’s frustrating to talk about Smart Boards, which are present in many public school classrooms, without being able to use them in my own instruction. It would also be helpful to have iPads or tablets that could be used to try out new apps and ideas as a class”

“Learning different education apps is important, I don’t think we prepare them [prospective teachers] a lot. Lack of the resources here prevents us from preparing teachers. Their students will have Chromebooks in the classroom, but they [our students] are not ready to manage or use them.”

Uneven Implementation of DI with Technology

3 Lack of established process to collaborate about DI and DI with technology with instructors of other courses

“I think it would take more coordination between courses. I actually have very little idea what is happening in special education courses. I really do not know what they do in there. How do they define DI? Is it similar to how I define it?”

“I have no idea what they are doing in Literacy class”

“It is hard to coordinate, there is a certain sense of independence.”

“I would like to have time to collaborate with other professors so we can generate ideas on how to teach them to differentiate. I don’t even know other professors in my students cohort, so it is not like I can even email them.”
Uneven Implementation of DI with Technology

Variable technology skills, professional development and incentives to integrate technology

“I need to improve my knowledge, understanding, and comfort level with integrating technology in order to differentiate instruction.”

“More professional development for faculty on technology integration and more incentives for spending the time to do this.”

Instructors expressed that they lack the time to research continuously changing technology resources

Missing Framework?

Levels of DI techniques:
• access
• low-impact
• high-impact

Types and severity of disabilities
Types of environment
Types of technology
### Students’ Average Technology and Teaching Confidence Scores by Scales

<table>
<thead>
<tr>
<th>No.</th>
<th>Scales of Technology and Teaching Confidence</th>
<th>N</th>
<th>M &amp; SD</th>
<th>No. of Items per Scale</th>
<th>Average Item Score for each Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Technology Knowledge and Attitude (TKA)</td>
<td>45</td>
<td>34.55 (5.02)</td>
<td>9</td>
<td>3.83*</td>
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<tr>
<td>2</td>
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<td>3</td>
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<td>6</td>
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<td>13.63 (2.80)</td>
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<td>4.15</td>
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<td>Teaching Differentiated Instruction with Technology Knowledge (TDITK)</td>
<td>39</td>
<td>24.87 (4.56)</td>
<td>6</td>
<td>4.14</td>
</tr>
</tbody>
</table>

*Note: Scale 1-5
First year students rated themselves highest on:
  • 4.15 in Teaching General Differentiated Instruction
  • 4.08 in Teaching General Pedagogical Knowledge.

Second year students rated themselves highest on:
  • 4.39 in Teaching Differentiated Instruction with Technology Knowledge
  • 4.25 in Teaching General Differentiated Instruction
**DITPACK by Scales and Student Groups**

**Good News:**
Students in the second year of the program rated themselves higher than students in the first year of the program on all eight scales.

The largest difference in score between the students in the first and second year is 0.71 points in Teaching General Pedagogical Content Knowledge.

The smallest difference – 0.06 points in scores is in Teaching General Pedagogical Knowledge.

The second smallest difference of scores in Teaching General Differentiated Instruction is fairly minor - 0.10 points. This is an indicator that developing more systematic approach of teaching preservice teachers to DI should be an area of focus for this program.

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**Results of ANOVA: P Values based on Pre-Service Teachers (Students) Survey**

<table>
<thead>
<tr>
<th>No.</th>
<th>Technology Confidence and Teaching Knowledge Scales</th>
<th>P Value</th>
</tr>
</thead>
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<td>1</td>
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<tr>
<td>3</td>
<td>Teaching General Pedagogical and <strong>Content</strong> Knowledge</td>
<td><strong>0.0001</strong>*</td>
</tr>
<tr>
<td>4</td>
<td>Teaching Technological <strong>Content</strong> Knowledge</td>
<td><strong>0.0014</strong>*</td>
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<td>5</td>
<td>Teaching Technological Pedagogical Knowledge</td>
<td>0.1644</td>
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<td>6</td>
<td>Teaching Technology, Pedagogy and <strong>Content</strong></td>
<td><strong>0.0005</strong>*</td>
</tr>
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<td>7</td>
<td>Teaching General Differentiated Instruction</td>
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</tr>
<tr>
<td>8</td>
<td>Teaching Differentiated Instruction with Technology</td>
<td>0.1482</td>
</tr>
</tbody>
</table>

*p < .05
Students’ Evaluations, Recommendations, and Implications for Improving Preparation to DITPACK

Students: Themes, Topics and Patterns

- Connecting courses, experiences, and goals
- Technology - hinders modeling and practicing
- Learning to DI – mostly in school practicum
- More preparation for low incidents & severe disabilities
Students on Disconnect

“We felt that classes were so disconnected and they shouldn’t, they should overlap in a positive way”

“I think that we would be better to prepared to differentiate, if our professor got together and decided how each thing needs to be done. I’ve been getting a lot of mixed messages and it is not helpful.” (template for lesson plates, main focus, etc.)

“If there are ways that professors could talk to each other… we could do a project, even if it was the same project, but using technology across the board for math, science, social studies – so we have something to connect across the board”
### Students on Technology in the Classrooms

“I also say something that kind of hinders modeling with technology and us being able to teach using technology that there is not much technology in the classroom to do that modeling and that practicing.”

Images from: www.tiki-toki.com

### Every Course and Practicum Counts

<table>
<thead>
<tr>
<th><strong>First year students:</strong></th>
<th><strong>Second year students:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Comfortable with personal use of technology, but believe they need to know more how to use technology in the classroom</td>
<td>- A lot more confident about DI and DI with technology</td>
</tr>
<tr>
<td>- Mentioned one specific example of technology resource – Starfall.com</td>
<td>- Draw a lot from their practicum experience, talk about learning needs of their specific students &amp; challenges they encountered to DI with technology</td>
</tr>
<tr>
<td>- Believe that it is important for SPED teachers to know how to use technology well, but “use it with caution”- concerned about students’ social interaction</td>
<td>- Discussed a variety of specific tools</td>
</tr>
<tr>
<td>- Teaching with technology is practical and engaging</td>
<td>- Believe that “Technology can engage students, add bonus to the lesson” and promote “critical thinking skills”</td>
</tr>
<tr>
<td>- “We talk about DI a lot, but I do not feel confident that I can do it”</td>
<td>- Discussed PARCC – students in must learn computer basics and how to type</td>
</tr>
<tr>
<td></td>
<td>- Technology effects teaching style</td>
</tr>
</tbody>
</table>
Students on DI with Technology

"GSE is doing good job letting us to know what is out there, we even get handouts, but there is not really any hands-on use"

"Incorporating DI tech into every single class. What would be a good technology in science and math, teach us about content specific technology, and go beyond just websites"

Preparation to DI for Students with Low Incident and Severe Disabilities

"I am lucky in a sense that my are verbal and they can communicate their needs and wants, but I am worried that someday I will teach self contained Autism and I will have students that are non verbal and I will have to understand this giant board with pictures"

"We just learning general disabilities and focusing more on higher incidents mild disabilities. We do not get a chance to look at more severe disabilities, we just focused on learning disabilities and it is not enough"
Modeling to DI with Technology

- During both focus group interviews:
  - Students could not remember specific example when instructor had modeled how to DI with technology
  - Students also could not remember specific activities when they had an opportunity to demonstrate how they would DI with technology
  
  - They realize it is challenging to have all technology available at GSE
  - At a minimum they want to know how to use: smart boards, iPads, and communicators

Push us Further-
Ask More Questions and Let us Practice

“Maybe an assignment, where the professor would constantly say ‘Oh, it’s [DI] not working on me, what are you going to do now? What are you going to do next?’ Push us further…Give us opportunities to practice and give us credit just for trying”

Students asked for less lecturing, less theories and more opportunities to practice

Image from: learnenglish.teens.britishcouncil.org
Do Instructors and Students See Eye to Eye?

General Pedagogical Knowledge is the ONLY scale where instructors rated themselves higher than students: Instructors – 4.34, Students - 4.08

Technology Knowledge and Attitude scale – almost the same, students rate themselves only 0.01 point higher: Instructors – 3.82, Students - 3.83

Interesting:
General Differentiation of Instruction – students rated themselves much higher than instructors: Instructors – 3.84, Students - 4.15
Differentiation of Instruction with Technology – difference is even greater – in fact, it is the largest difference between the two groups: Instructors – 3.56, Students - 4.14

Possible explanation: more positive attitude toward technology? Confidence of youth and inexperience?
This finding was not confirmed during focus group interviews.
Discussion

GSE Instructors:

- Recognize the importance of differentiated instruction
- Acknowledge that integrating technology can be a potentially effective method to DI
- Agree that improvement in preparation of pre-service SPED teachers to differentiate instruction with technology is needed
**Key Findings**

**GSE Students:**
- Recognize the importance of differentiated instruction
- Second year students are more capable to DI by using technology
- Acknowledge that integrating technology to DI can be very challenging for GSE
- Agree that they do not currently get ample preparation to differentiate instruction with technology

---

**Recommendations**

*Take Action Now!*

*Image from: thepowerofparttime.tv*
Developing a clear vision among instructors of how to prepare pre-service teachers to succeed in a technologically evolving environment would be an important first step.

Modeling and Allowing for Practice can be an effective strategy for developing DITPACK

Lu & Lei, 2012

Images from: www.techedlab.com
Map Courses to Address All Aspects of DI and DI with Technology

- Core Education Courses
- Special Education Courses
- Teaching Methods Courses
- Educational Technology Courses

Introduction of General DI Framework

Student’s Readiness, Interest, Learning Profile, and Affect Aspect of DI

Content, Process and Product Aspect of DI

Environment Aspect of DI (one to one, blended, online, etc.)

Recommendations

Ways to Improve Preparation of SPED Teachers to DITPACK in the Future.
To improve preparation to DIPACK for SPED teacher in the future, GSE needs:

- More and better technology in the classrooms
- Systematic professional development opportunities for DITPACK
- Strong incentives for instructors to integrate technology into teaching
- Mutually beneficial relationships with school districts to offer pre-service teachers more opportunities to use districts’ technology to practice DITPACK

Study Limitations

- It may be difficult to replicate this study and generalize its findings due to its uniqueness and specific context

- Measuring instructors’ perceptions based on self-reporting - self-reported data may not be as accurate as reporters may believe

- Limited observations and the focus on only one teacher program
Significance of the Study

Contribution to the field:
• Koehler & Mishra (2005) suggested to teach TPACK by presenting preservice teachers with instructional problems and have them resolve them by designing technological artifacts.
• Lu & Lei (2012) proposed to integrated live dual modeling (LDM) that includes behavior and cognitive modeling to improve TPACK preparation
• This current study extends TPACK to adapt it for the special education field to DITPACK and recommends developing and implementing more complex framework to help preservice teachers to develop not only TPACK skills, but also teach them to use those TPACK skills for meeting learners’ individual needs, in other words – preservice teachers will learn how to DITAPCK

Significance of the Study

Ludlow (2001) presented us with two possible outcomes of technology and teacher education in special education as “Disaster or Deliverance.” She called upon us as individuals, as a faculty or as a profession “to construct knowledge of technology application in special education”, “develop a set of guiding principles to assist special educators and teacher educators in incorporating emerging technologies into service delivery for people with disabilities”, and “design and deliver a comprehensive system of preservice and inservice training for prospective personnel to prepare them to use technology well in elementary, secondary and post secondary programs.”

This current study is a response to Ludlow’s call to action. This self evaluation and beginning of a dialogue about the current state of preparing preservice SPED teachers to DITPACK at GSE is a first step toward creating a more “comprehensive system” of preservice training and making sure that we are moving toward “Deliverance” and away from “Disaster”
Thank You for Your Attention

Please comment or ask questions . . .

References:


Ludlow, B. L. (2001). Technology and Teacher Education in Special Education: Disaster or Deliverance?. *Teacher Education And Special Education, 24*(2), 143-63.


Chapter 4: Differentiate Instruction with Technology Learning Modules

“For people without disabilities, technology makes things easier. For people with disabilities, technology makes things possible …”

National Council on Disability

Upon successful completion of these modules, students will be able to demonstrate an understanding of the concept of differentiating instruction (DI) and its aspects, use selected web-based instructional technology and create original technology-based lesson components to differentiate instruction for all students.
Module 1
Differentiated Instruction

Learning Objective:

Describe differentiated instruction (DI) and distinguish five aspects of differentiated instruction.

Pre-assessment:

1. In order to differentiate instruction, teachers must prepare a separate lesson plan for each student

True

(That is not correct. Preparing individual plans for each student is neither a realistic nor necessary task, because all students should have access to the same general curriculum)

False

(Well done, that is correct. Teachers should provide appropriate levels of challenges for all students)

2. In order to differentiate instruction, teachers must know their students well and provide several learning options, or different paths to learning

True

(Well done, that is correct. Students may have different learning needs and teachers help them to reach their learning goals)

False

(That is not correct. Without knowing students, teachers cannot adjust lessons objectives, activities and outcomes)
Exposition:

View and discuss the video clip “What is Differentiated Instruction” by Carol Tomlinson:

https://www.youtube.com/watch?v=01798frimeQ&feature=youtu.be

One of the nationally recognized leaders in the field of DI, Carol Ann Tomlinson, has repeatedly shared her views on differentiated instruction (DI) and responsive teaching. She has been stating that differentiation is not a recipe or instructional strategy, but rather a way of thinking about teaching and learning, a philosophy based on these principles:

· The differences in students are significant and make a major impact on students learning needs, pace, and amount of support needed;
· Students will learn the best when a supportive adult pushes them slightly beyond their comfort level where they can work without assistance;
· Students benefit from making connections between curriculum and their interests;
· Students are more effective learners when they feel respected and significant;
· The main job of schools is to maximize the capacity of each student;

(Tomlinson, 2000).

Differentiated instruction reflects what was once considered “common sense” for effective teaching and dates back to the time when children were typically educated in one-room schoolhouses, with one teacher responsible for educating all students of a wide range of ages and levels of readiness and abilities. Although education has been
transformed in many ways since that era, with the recognition of diversity in students and inclusion of students with special learning needs, differentiated instruction has more formally and legally become a necessary element of successful inclusive classrooms. Differentiated instruction requires planning, commitment and knowing students well (performance levels, prior assessments scores, academic and social strengths and weaknesses, interests, IEP’s goals, etc.).

**How Teachers Can Differentiate Instruction for Students?**

Teachers can tailor the curricular goals and teaching strategies to the individual strengths and challenges of their students and their learning environment. It is also important to use individualized curricular, teaching and instructional materials accommodations, and universally designed materials. Teachers can also provide personal support; address students’ learning styles, preferences, and sensory abilities; and consider the acceptability of their chosen strategies.

**Aspects of Differentiated Instruction**

DI Aspects /Educators differentiate:

- **Content** - (what they teach) information
- **Process** - (how they teach) a series of steps taken to achieve a particular goal
- **Product** - (how students demonstrate mastery) the result of a process
- **Affect** - (how students connect their thinking and feelings) emotions and reactions
- **Learning environment** - (how the classroom or on-line environments are designed) the physical or virtual settings and contexts, in which students learn

Aspects of Differentiated Instruction

Kouraeva, N., *Aspects Of Differentiated Instruction (Image based on the text of J. Salend)*

**Instruction can be differentiated using these effective practices:**

- Tailor curricular goals and teaching strategies
PREPARING SPECIAL EDUCATION TEACHERS

- Individualize and personalize the curriculum
- Use backward design and a range of formative and summative assessments
- Use curricular accommodations
- Use individualized teaching/instructional accommodations
- Use instructional materials accommodations
- Provide personal supports
- Address students’ learning styles and preferences
- Address students’ sensory abilities

Practice activities:

Directions: Read the case study below and match differentiated instruction strategies to the DI aspects

Mrs. Smith teaches a 7th grade inclusion Language Art class. There are 18 students in her class. Five students have special learning needs and have IEPs. One of her students, Jim, has dyslexia, a specific reading disability. He has difficulty reading because he is struggling to identify speech sounds and relate them to letters. Isabella is a hard of hearing student. She has mild hearing loss, but does need accommodations. Alex is third of the five. He has a hard time with writing activities and staying on task; he was diagnosed with ADHD last year. Nate just recently joined Mrs. Smith’s class. He is diagnosed with ASD (Autism Spectrum Disorder). Nate is high functioning, but he is having a difficult time adjusting to his new classroom environment. James, has expressive language disorder. It is difficult for him to express his ideas in words. He also gets very frustrated when other students do not understand him. Sometimes, he gets upset
and stops talking to anyone. Mrs. Smith uses a variety of strategies to differentiate instruction for her students.

1. Mrs. Smith uses https://rewordify.com/ to simplify difficult English paragraphs. She enters hard sentences into the box at the top of the page or she enters the web site URL, clicks “Rewordify text” and she instantly has an easier version for Jim to read during classwork or homework. This is an example of strategy modifying:

   - **Content**
     
     *(Well done, that is correct. Content is information)*

   - **Process**
     
     *(That is not correct. Process is a series of steps taken to achieve a particular goal)*

   - **Product**
     
     *(That is not correct. Product is the result of a process, such as an essay, poster, slides for a the presentation, etc. produced by students)*

   - **Affect**
     
     *(That is not correct. Affect is students’ emotions and reactions)*

   - **Learning environment**
     
     *(That is not correct. Environment is the physical or virtual settings and contexts in which students learn)*
2. During her 7th grade class, Mrs. Smith uses circular seating arrangements to offer Isabella the advantage of seeing all class members. This is an example of a strategy modifying:

- **Content**
  (That is not correct. Content is information)

- **Process**
  (That is not correct. Process is a series of steps taken to achieve a particular goal)

- **Product**
  (That is not correct. Product is the result of a process, such as an essay, poster, slides for a the presentation, etc. produced by students)

- **Affect**
  (That is not correct. Affect is students’ emotions and reactions)

- **Learning environment**
  (Well done, that is correct. Environment is the physical or virtual settings and contexts, in which students learn)

3. For the explanatory writing assignment, Mrs. Smith asks students to select their own topics. She anticipates that Nate will select cars, because she knows he is very knowledgeable about cars and their features, because learning details about different car models is his favorite thing to do. Mrs. Smith hopes by writing and presenting on the topic of his interest, Nate will succeed on this assignment and start his work in class on a positive note. This is an example of strategy modifying:
– Content

(That is not correct. Content is information)

– Process

(That is not correct. Process is a series of steps taken to achieve a particular goal)

– Product

(That is not correct. Product is a result of a process, such as an essay, poster, slides for a presentation, etc. produced by students)

– Affect

(Well done, that is correct. Affect is students’ emotion and reactions)

– Learning environment

(That is not correct. Environment is the physical or virtual settings and contexts, in which students learn)

4. Alex needs support to organize his thoughts and stay focused. Mrs. Smith decides to use a graphical organizer to help Alex with the planning stage. She also suggests that Alex works together with another student to research the topic and discuss ideas for the essay. This is an example of strategy modifying:

– Content

(That is not correct. Content is information)

– Process

(Well done, that is correct. Process is a series of steps taken to achieve a particular goal)
– Product

(That is not correct. Product is a result of a process, such as an essay, poster, slides for a presentation, etc. produced by students)

– Affect

(That is not correct. Affect is students’ emotions and reactions)

– Learning environment

(That is not correct. Environment is the physical or virtual settings and contexts, in which students learn)

5. Mrs. Smith decides that instead of presenting his topic in front of the class, James will have the choice of creating a poster or a short video clip. She believes that James will be more successful without the pressure of speaking in front of the class, although he still can record his speech in advance and add a sound track to his video clip. This is an example of strategy modifying:

– Content

(That is not correct. Content is information)

– Process

(That is not correct. Process is a series of steps taken to achieve a particular goal)

– Product

(Well done, that is correct. Product is a result of a process, such as an essay, poster, slides for a presentation, etc. produced by students)

– Affect
(That is not correct. Affect is students’ emotions and reactions)

– Learning environment

(That is not correct. Environment is the physical or virtual settings and contexts, in which students learn)

Assessment:

Differentiated instruction:

a. Means keeping content similar for all students but modifying input and output expectations for some

(Well done, that is correct. By differentiating instruction teachers provide access to the content for all students)

b. Means providing students with different content entirely

(That is not correct. Teachers can differentiate instruction by modifying just some elements of the content, process, environment or product)

c. Is not necessary in some classrooms

(That is not correct. All students learn differently and can benefit from differentiated instruction)

d. Requires very little planning

(That is not correct. In order to differentiate instruction, teachers need to know their students and plan to address a variety of learning needs, which requires additional planning time)
Reading:

Module 2

Differentiated Instruction is Student Centered
Get to Know Your Students

Learning Objective: To prepare to differentiate instruction, research and select technology tools that can help teachers to know their students including their preferred learning styles, interests, multiple intelligences, and personal qualities such as personality, disposition and motivation.

Anticipatory Set:
How do you prefer to learn?
Should you try to adjust instruction to students’ learning preferences or should students be able to adjust to teachers’ teaching preferences?

Exposition:
Differentiated instruction is responsive teaching that is based on the learning preferences, interests and readiness of the student. DI is responding to various students’ needs by providing a balance of direct instruction, modeling, shared and guided practice, and independent student work.

Quality Differentiated Instruction is:

Student Centered. Teachers must DI to provide appropriately stimulating learning experiences for all students. Teachers lead their students to take increasing responsibility for their own learning and success.

Rigorous. Students are given challenging instruction to motivate them, offer them an opportunity to learn and advance their skills. Students become engaged in content that conveys depth and breadth of the concepts and materials.
Relevant. Essential learning is the goal of the DI. Students are encouraged to make choices about what they will learn and how they will demonstrate what they have learned. (Tomlinson, 2003)

Each student’s traits must be considered for successful DI:

Affect
Student affect reflects how students feel about themselves, their work, and their school environment. Students are much more likely to succeed if they have positive affect than if they have a negative, or neutral affect. With a positive affect a student can be more fully engaged and successful in learning (Tomlinson, 2003).

Readiness
Student readiness is the current level of knowledge, understanding, and skills as it correlates to a particular sequence of learning. Readiness reflects what the student knows, understands, and is able to do. Readiness does not mean student ability. Readiness varies widely over time, subject, and context. Knowing each student’s readiness level is critical when preparing to differentiate instruction.

Interest
Interest means topics and subjects that evoke desire to learn. Interest plays a great role in students’ motivation. When teachers make purposeful efforts to connect the required content to student interest, students are more engaged and make greater progress.

Learning Profiles
Learning profile refers to how students learn best. A student’s preferred learning style, interests, intelligence, and cultural background all influence a student’s learning profile. Teachers can extend the ways students learn best by considering a student’s learning
Read Chapter 10. The How To's of Planning Lessons Differentiated by Learning Profile from the book How to Differentiate Instruction in Mixed-Ability Classrooms, 2nd Edition by Carol Ann Tomlinson. Review the tools for diagnosing students' readiness, learning profiles and interests.

The text of this chapter can be found here:


Practice activities:

1. You are a new elementary level teacher and have been assigned to work in a fifth grade class. Your class roster shows that twenty students have been assigned to your class and five of them have been identified with special learning needs.

Use https://www.surveymonkey.com/ to develop two surveys: one for students and one for parents. You plan for students to fill out this survey in the computer lab in the first week of school. You expect that students will spend 10-15 minutes on this activity.

Parents will fill out this survey at home. Decide what questions to include that will help you to know your students better, as you plan to DI considering their level of readiness, interests, and learning profiles.

2. Eric is a 10-year old boy of average intelligence. He was diagnosed with ADHD and has an IEP. He reads on grade level and is above grade level in both science and math. However, when it is time to write in the classroom, Eric will do anything to avoid the activity. He gets out of his seat, balls up his paper, walks around the room, teases his
peers and plays with his pencils. You plan to DI for Eric and allow him to use a computer to improve his writing in your class. Research web-based tools and use them in a learning activity that will help Eric to stay engaged and become a better writer.

3. Max is struggling with learning his multiplication tables. He gets very upset when other students correct his answers. Sometimes Max shouts to other students, sometimes he just shuts down. Research and select three web-based resources that can help Max to learn his multiplication facts at home. Write a note to Max’s parents recommending these resources and how they can support Max’s learning.

4. You are a new elementary level teacher and have been assigned to work in a fifth grade class. Your class roster shows that twenty-five students have been assigned to your class and seven of them have been identified with special learning needs. James, a 9-year old boy, is one of the students with special needs. He was diagnosed with Asperger’s Disorder (Autism spectrum) and has an IEP. James has difficulties transitioning from one activity to another. He gets very anxious and asks many questions about what else will happen today. Research web-based tools to help James stay calm, organized, and have better transitions. Write a one or two page summary, including the tools you selected, your reasons and how they can assist James.

**Reading:**

Module 3

Using Technology to Differentiate Content

Learning Objective:

Explore a variety of technology tools and demonstrate skills using web resources to differentiate content for diverse student learning needs.

Pre-assessment:

1. What technology tools can teachers use to provide access accommodations to ELL students?
   a. On-line calculator
   b. On-line dictionary
   c. Spellchecker
   d. All of the above

Exposition:

Content – concepts and information that students are expected to learn. In inclusive classrooms all students should have an access to the same core content, but it does not mean that all students will be able to learn at the same complexity level. Content should be differentiated to meet students’ learning needs. Teachers can modify content in many different ways. Technology tools and web resources can be used for content adaptations. To provide all students with access to the content, teachers may need to use access differentiation techniques, such as visual aids, audio, and online translations.
To modify the complexity of the material presented to students, teachers may use *multilevel teaching strategies*, where students are given the same lesson, but at varying level of difficulties.

**Practice activities:**

1. **Differentiation Techniques for Modifying Access to Content**

   **Directions:** Explore the web resources provided below. These resources can be used to provide students with better access to the content. After learning more about these resources, select the grade level, subject area, and a concept you plan to teach. Create a learning activity for approximately 10-15 minutes of the class time and modify it to provide students with 1-2 *one or two* different ways to access the content.

   **Curriculum and Content Access**

   Access Differentiation Techniques “provide students with access to the curriculum and do not affect the level of mastery expected from students”(Salend, 2009)
a. Free tool for converting .pdf files (text) into mp3 files (audio) -
   http://www.zamzar.com
b. Free tool for creating infographics – make ideas visual
   http://www.easel.ly/
c. Free tool (requires sign up) for creating graphical organizers (mind maps)
   https://www.goconqr.com
d. Research and select your own tool[s] that will help your students to access content.

Submit the content (information) that your students are expected to learn, a description of the original activity and two modified version[s] of the content. Write a paragraph reflecting on using technology tools to modify content, explain what you learned, what were the challenges and what you would do more efficiently the next time you need to modify content.

2. Multilevel Teaching Differentiation Techniques

Directions: Explore the web resources provided below. These resources can be used to adjust content for different levels of difficulty. After learning more about these resources, select the grade level, subject area, and a concept you plan to teach. Create a learning activity for approximately 10-15 minutes of class time and modify it using technology tools for two or three levels of difficulties.

Modifying Text for Multilevel Teaching

Modifying text to change the complexity of the information can help students to access
the information. Any text that has been altered from its original print format is considered a modified text.

a. Free tool that can help you to change text according to your students’ reading needs: https://rewordify.com/

b. Free readability test tool: http://read-able.com/

c. Free tool for generating “word clouds” from text that you provide: http://www.wordle.net/

d. Research and select your own tool that can be used to modify text for multilevel teaching

Submit the content (information) that your students are expected to learn, a description of the original activity and two or three modified versions of the content. Write a paragraph reflecting on using technology tools to modify content, explain what you learn, what were the challenges and what you would do more efficiently the next time you need to modify content.

Assessment: Submitted Assignment

Reading:

Module 4

Using Technology to Differentiate Instruction by Process and Product

Learning Objective:

Provide students with different types of learning processes and products by using engaging and interactive strategies with technology

Questions for reflective class discussion:

1. How does a product-centered or a process-centered environment effect the learning of a diverse group of students?
2. What are the differences and similarities in grading approach?
3. What are your experiences regarding product-centered or a process-centered environment?
4. Which environment do you prefer and why?

Exposition:

Learning itself can be defined as a “process that brings together personal and environmental experiences and influences for acquiring, enriching or modifying one’s knowledge, skills, values, attitudes, behavior and world views.” There are a variety of learning theories that address different aspects of the learning process, such as Behaviorism, Cognitive psychology, Constructivism, Social learning theory, Socio-constructivism, Experiential learning, Multiple intelligences, Situated learning theory and community of practice, and 21st century learning or skills.

(http://www.unesco.org/new/en/education/themes/strengthening-education-)
For this exercise *Process* is defined as a series of actions, changes, or functions bringing about a result. ([http://www.thefreedictionary.com/process](http://www.thefreedictionary.com/process)) In order for students to achieve a specific learning objective, they must get involved in series of actions or steps that are focused on this learning objective. The teacher designs learning activities, assignments and projects to help students to reach a specific learning goal.

*Product* is a result of the process, for example: a written story, set of slides, poster, etc.

**Practice activities:**

**Directions:** Select the grade level and subject area, then decide on learning objective (use core standards as a guide). Design a mini-project that can be completed within 2-3 lessons (1.5 hours – 2 hours). Write at least two versions of students’ directions using technology to provide them with two differentiated processes and end products that they can select from choose to reach the same learning goal. As you are creating your two processes and writing directions for your mini-project, make sure to test all technology tools yourself and ensure that you will offer students free and easily accessible resources. Create samples of each product for each process for and submit them with your two sets of directions.

In addition, write a paragraph reflecting on using technology tools to modify process and product, explaining what you learned, what the challenges were and what you can do more efficiently the next time you need to modify process and product.
Example of modifying process and product:

Learning goal: Students will be able to identify, apply and explain the functions of three essential short story elements: plot, conflict, and resolution.

Process #1: Students will use a comics creating tool [http://www.readwritethink.org/files/resources/interactives/comic/] to develop a plot, conflict and resolution as a prewrite activity for a short story and present it to the class explaining the function of each element. This process will appeal to students who can come up with ideas for the story but prefer expressing them using visual instead of written elements.

Process #2: Students will use a plot generator, such as [http://writingexercises.co.uk/plotgenerator.php] to receive a random plot line and expand it to create a story that they will present to the class, explaining the function of each element. This process will appeal to students who have difficulty selecting a main idea but like to write when direction is provided.

Process #3: Students will use a story creation tool [https://storybird.com/]. They will select a series of original art illustrations and develop a plot by using pictures to develop an idea for the story.


Assessment: Submitted Assignment
Module 5

Using Technology to Create Engaging Learning Environments and Support Differentiated Instruction

Learning Objective:
Understand and use technology based learning environments to foster students’ engagement and differentiate instruction (DI) and use a web based learning management system (LMS) to support DI.

Anticipatory Set:
1. Based on your experiences as a student or teacher, how have learning environments affected your learning and performance? Provide an example.
2. Do you prefer to work on a project by yourself or in a small group? Why?
   Think of the different types of learning needs of different students (ELL, learning disabilities, gifted and talented, etc.). What are the pros and cons of learning online or working in blended environment?

Exposition: What is a 21st century learning environment?
“The term ‘learning environment’ suggests place and space –a school, a classroom, a library. And indeed, much 21st century learning takes place in physical locations like these. But in today’s interconnected and technology-driven world, a learning environment can be virtual, online, remote: in other words, it does not have to be a place at all. Perhaps a better way to think of 21st century learning environments is as the support systems that organize the condition in which humans learn best –systems that accommodate them
unique learning needs of every learner and support the positive human relationships
needed for effective learning. Learning environments are the structures, tools,
and communities that inspire students and educators to attain the knowledge and skills
the 21st century demands of us all.”


1. Read and discuss the rest of the white paper developed based on the review of the
   literature, drawing on works from renowned educators and authors such as John
   Dewey, John Bransford, Linda Darling-Hammond, Richard Elmore, Deborah
   Meier, Michael Fullan and many others. The paper can be found here:

2. View the short video “New Jersey High School Gets 3-D Virtual Classrooms”
   (link is below) and discuss the benefits of virtual environments for students with
different learning needs: https://www.youtube.com/watch?v=ETMJGOPiG7I

“A learning management system (LMS) is a software application or Web-based
technology used to plan, implement, and assess a specific learning process. Typically, a
learning management system provides an instructor with a way to create and deliver
content, monitor student participation, and assess student performance. A learning
management system may also provide students with the ability to use interactive features
such as threaded discussions, video conferencing, and discussion forums.”

(http://searchcio.techtarget.com/definition/learning-management-system)
Components of an LMS

There is no standard industry definition or published standard defining the components of an LMS, but the features are in common:

- Creation of class rosters
- Uploading and management of documents containing curricular content.
- Delivery of course content over web-based interfaces, most often allowing remote participation by the instructors, students or both.
- Creation and publication of course calendars.
- Interaction among students and instructors, such as instant messaging, email, and discussion forums.
- Methods of assessment and testing (creating and grading pop quizzes, etc.).

(https://www.mindflash.com/learning-management-systems/what-is-lms)

Practice activity:

Directions:

1. Explore the following web resources to learn how to create engaging, respectful and productive technology-based learning environments:
   
   https://www.commonsensemedia.org/ - teach students to become respectful digital citizens
   
   http://www.aurasma.com/#/explore - augmented reality platform
   
   https://www.classdojo.com/ - manage behavior, engage students and parents
   
   http://www.symbaloo.com/ - visual bookmarking tool
Select one these website for a more detailed examination. Use https://www.nearpod.com to create an on-line 7-10 minutes presentation with interactive components. Include the following:

- What is a 21\textsuperscript{st} century learning environment? (use the white paper from www.p21.org)
- Summarize your selected website’s key features that relate to creating a unique learning environment
- Explain how this website can be used to promote DI.

**Directions:**

Explore the variety of web-based LMS (learning management systems) provided below. After learning more about these resources, select a grade level, subject area, and a concept you plan to teach. Select one LMS to create your “class” and three groups of students within your class.

For this assignment you will use a multilevel teaching approach to differentiate instruction. Create a class assignment and modify it to be suitable for three levels of students’ skills: the original assignment, an assignment modified for extra support, and an enhanced assignment for students with more advanced skills. Assign each version of the assignment to appropriate group of students. Submit the three versions of your assignment and one information page that includes: the LMS you chose to use, the reasons for your choice, a short reflection on how you developed the three versions (DI) and what you liked and disliked about using your selected LMS for this task.
Web-based LMS to explore:

1. https://www.schoology.com/
2. https://www.edmodo.com/
4. Choose your own LMS that supports delivery of variable assignments to the students in the same class

Example:

You can see an example of a modified assignment on Edmodo.com. To view all three modified versions of the same assignment with additional supporting documents, video clip and samples of the required product, you will need to log in three times as three different students.

Login to Edmodo.com:

1. To see the original assignment
   
   ID: greenRUstudent
   
   Password: greenRUstudent
   
   Enter RU_Example Class
   
   Enter Green Small Group

2. To see the version of the assignment modified for students who need extra time and support
   
   ID: yellowRUstudent
   
   Password: yellowRUstudent
   
   Enter RU_Example Class
   
   Enter Yellow Small Group
3. To see the version of assignment enhanced for students with more advanced skills

ID: blueRUstudent

Password: blueRUstudent

Enter RU_Example Class

Enter Blue Small Group

**Reading:**


21st Century Learning Environments


References:

Cobb, A. (2010). To Differentiate or Not to Differentiate? Using Internet-Based Technology in the Classroom. *Quarterly Review Of Distance Education, 11*(1), 37-45.


Ludlow, B. L. (2001). Technology and Teacher Education in Special Education: Disaster or Deliverance?. *Teacher Education And Special Education, 24*(2), 143-63.


Interest, and Learning Profile in Academically Diverse Classrooms: A Review of

http://aim.cast.org/learn/historyarchive/backgroundpapers/text_transformations#.VWia1abSjbU

Appendix – Technology Resources for DI

Technology is just a tool. In terms of getting the kids together and motivating them, the teacher is the most important.

~Bill Gates

Technology Resources for Differentiating Instruction Across Subject Areas

<table>
<thead>
<tr>
<th>Any Subject</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="https://www.schoology.com/home.php">https://www.schoology.com/home.php</a></td>
<td>Free LMS with many features</td>
</tr>
<tr>
<td><a href="https://www.nearpod.com/home.php">https://www.nearpod.com/home.php</a></td>
<td>Unique interactive content delivery and learning experiences</td>
</tr>
<tr>
<td><a href="http://www.socrative.com/">http://www.socrative.com/</a></td>
<td>Create and administer self-graded tests and quizzes</td>
</tr>
<tr>
<td><a href="https://classroom.google.com/ineligible">https://classroom.google.com/ineligible</a></td>
<td>LMS and apps</td>
</tr>
<tr>
<td><a href="https://www.edmodo.com/">https://www.edmodo.com/</a></td>
<td>Free LMS with many features</td>
</tr>
<tr>
<td><a href="http://www.studentguide.org/the-complete-guide-to-project-based-learning/">http://www.studentguide.org/the-complete-guide-to-project-based-learning/</a></td>
<td>StudentGuide.org is a collection of useful resources – project based learning – any grade</td>
</tr>
<tr>
<td><strong><a href="http://www.studentguide.org/50-fantastic-resources-for-new-teachers/">http://www.studentguide.org/50-fantastic-resources-for-new-teachers/</a></strong></td>
<td>50 resources for new teachers</td>
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<tr>
<td><strong><a href="http://bie.org/">http://bie.org/</a></strong></td>
<td>Project Based Learning (PBL)</td>
</tr>
<tr>
<td><strong><a href="http://www.freetech4teachers.com">http://www.freetech4teachers.com</a></strong></td>
<td>Excellent collection of free technology resources for teachers</td>
</tr>
<tr>
<td><strong>Literacy / Language Arts</strong></td>
<td></td>
</tr>
<tr>
<td><strong><a href="http://www.readwritethink.org/">http://www.readwritethink.org/</a></strong></td>
<td>Excellent resources – content partners: International Literacy Association, National Council of English Teachers</td>
</tr>
<tr>
<td><strong><a href="http://www.reading.org/">http://www.reading.org/</a></strong></td>
<td>Web of the International Literacy Association</td>
</tr>
<tr>
<td><strong>Mathematics</strong></td>
<td></td>
</tr>
<tr>
<td><strong><a href="https://phet.colorado.edu/">https://phet.colorado.edu/</a></strong></td>
<td>Mathematics and science – interactive simulations</td>
</tr>
<tr>
<td><strong><a href="http://www.studentguide.org/a-complete-list-of-online-math-resources/">http://www.studentguide.org/a-complete-list-of-online-math-resources/</a></strong></td>
<td>StudentGuide.org is a collection of useful resources for students</td>
</tr>
<tr>
<td><strong><a href="http://illuminations.nctm.org/">http://illuminations.nctm.org/</a></strong></td>
<td>Web resources for teaching and learning mathematics for grades pre-K—12 (designed by the National Council of Teachers of Mathematics)</td>
</tr>
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</table>
### Social Studies

<table>
<thead>
<tr>
<th>Link</th>
<th>Description</th>
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<tbody>
<tr>
<td><a href="http://www.nationalgeographic.com/">http://www.nationalgeographic.com/</a></td>
<td>High quality reading, video, images, and games for any grade</td>
</tr>
<tr>
<td><a href="http://edsitement.neh.gov/">http://edsitement.neh.gov/</a></td>
<td>Lesson plans and materials for SS, History, and LA – any grade</td>
</tr>
</tbody>
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### Science

<table>
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<tr>
<th>Link</th>
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<tr>
<td><a href="http://www.si.edu/">http://www.si.edu/</a></td>
<td>Excellent resources, original documents, etc.</td>
</tr>
<tr>
<td><a href="http://sciencenetlinks.com/">http://sciencenetlinks.com/</a></td>
<td>Interactive activities and lesson plans – all grades</td>
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</table>

### ESL

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<tr>
<td><a href="http://www.oxfordseminars.com/esl-teaching-resources/">http://www.oxfordseminars.com/esl-teaching-resources/</a></td>
<td>Web by Oxford Seminars is the leading provider of teacher training certification courses</td>
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</table>

### Technology Resources for Differentiating Instruction Across Disabilities

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<th>Link</th>
<th>Description</th>
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<tbody>
<tr>
<td><a href="http://ctdinstitute.org/cafe">http://ctdinstitute.org/cafe</a></td>
<td>Web by the Center on Technology and Disability (CTD) is funded by the U.S. Department of Education’s Office of Special Education Programs (OSEP). Good Webinars for PD.</td>
</tr>
<tr>
<td><a href="http://www.help4adhd.org/en/education/teachers">http://www.help4adhd.org/en/education/teachers</a></td>
<td>Web by The National Resource Center on ADHD</td>
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<tr>
<td>(NRC): A Program of CHADD (Children and Adults with Attention-Deficit / Hyperactivity Disorder)</td>
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<tr>
<td><a href="http://www.addresources.org/category/adhd-education/">http://www.addresources.org/category/adhd-education/</a></td>
<td>ADHD Directory and ADHD Information</td>
</tr>
<tr>
<td><a href="http://www.additudemag.com/adhd/article/4039.html">http://www.additudemag.com/adhd/article/4039.html</a></td>
<td>Web of ADDitude, the leading destination for families and adults living with ADHD and learning disabilities.</td>
</tr>
<tr>
<td><a href="http://www.nclld.org/">http://www.nclld.org/</a></td>
<td>Web by National Center for Learning Disabilities</td>
</tr>
<tr>
<td><a href="https://www.autismspeaks.org/autism-apps">https://www.autismspeaks.org/autism-apps</a></td>
<td>Apps for Autism – any age</td>
</tr>
<tr>
<td><a href="http://www.apple.com/education/special-education/ios/">http://www.apple.com/education/special-education/ios/</a></td>
<td>Apps for special education</td>
</tr>
</tbody>
</table>

**Technology Resources for Creating Teacher Made Material for DI**

<table>
<thead>
<tr>
<th><a href="https://vimeo.com/">https://vimeo.com/</a></th>
<th>Create and view video clips</th>
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<tbody>
<tr>
<td><a href="https://voicethread.com/">https://voicethread.com/</a></td>
<td>Ed.VoiceThread – use your voice, video or text</td>
</tr>
<tr>
<td><a href="http://rubistar.4teachers.org/index.php">http://rubistar.4teachers.org/index.php</a></td>
<td>Create rubrics</td>
</tr>
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<td>URL</td>
<td>Description</td>
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<tr>
<td><a href="https://www.blendspace.com/">https://www.blendspace.com/</a></td>
<td>Create lesson in 5 minutes</td>
</tr>
<tr>
<td><a href="https://scratch.mit.edu/">https://scratch.mit.edu/</a></td>
<td>Create interactive activities</td>
</tr>
<tr>
<td><a href="https://www.canva.com/about">https://www.canva.com/about</a></td>
<td>Tools for graphic design</td>
</tr>
</tbody>
</table>
Chapter 5: Conclusion

This study set out to explore how instructors involved in a teacher education program prepare preservice special education teachers to develop sufficient capability to differentiate instruction by integrating technology. The study also sought to learn whether preservice special education teachers feel that they are being well prepared to differentiate instruction by integrating technology knowledge, pedagogical knowledge and content knowledge. In addition, the study focused on the similarities and differences between GSE instructors and special education prospective teachers’ views on the importance of DI, integrating technology to DI, and how preparation to DITPACK could be improved.

In this chapter, I discuss the framework of this study, the modified survey tool I chose to use, and the key findings of my study across all three artifacts with regard to the relevant research. Next, I explain the limitations of this study and suggest directions for further research. Finally, I discuss the significance of this study for teacher preparation in this teaching program and more broadly in the field of special education.

Findings

The work of educators and researchers (Ludlow, 2001; Tomlinson, 2001, 2003, 2013; Kara-Soteriou, 2009; Brownell, 2010; Salend, 2011; Edyburn, 2013; Koehler, Mishra, & Cain, 2013) informed this research and guided me in studying how this teacher preparation program currently addresses the important aspects of teaching preservice teachers to differentiate instruction and, more specifically, prepares them to DI with
First, I address findings with respect to the TPACK framework discussing the immediate findings of this study. In making explicit the TPACK framework, Mishra, Koehler, and Kereluik (2009) state that “Learning technical skills alone is not sufficient—learning how to integrate technologies into teaching is equally important.” Similar to other researchers (Abbitt, 2011; Lu & Lei, 201), I also used the TPACK framework as a lens through which to examine how educators incorporate the knowledge of technology into teacher knowledge. The findings of this study align well with the TPACK framework on how to best train special education preservice teachers on how to integrate technology into their teaching.

According to Abbitt (2011), “Preservice teachers’ beliefs about their ability to use this knowledge in a classroom environment provide a measure that can assist in assessing the success of teacher preparation for technology integration.” Preservice teachers’ beliefs about their ability to integrate technology are very valuable information for a teaching program.

However, in addition to measuring teachers’ ability to TPACK, I adapted this tool and expanded it to also measure preservice teachers’ beliefs about their ability to differentiate instruction (DI) and DI with technology. I added two scales to TPACK turning it into DITPACK. For special educators ability to effectively work with all students regardless of their learning profiles, skills of differentiating instruction are critical. In addition, I also expanded the use of the original TPACK survey tool by using it not only for measuring beliefs of preservice teachers, but also for measuring beliefs of
instructors who are involved in preparing special education preservice teachers.

By using the DITPACK as a survey tool, I have tried to explain the complex relationship among content knowledge, general pedagogical knowledge, technology knowledge and, now, also the more specific knowledge of how to differentiate instruction. I also examined the relationship between the beliefs of preservice teachers and their instructors for all eight scales included in the DITPACK framework. I hope that by modifying the TPACK framework and using modified version (the DITPACK framework) in my study, I can offer a different perspective and a new variation of the already useful the TPACK survey instrument for other researchers in special education fields. In my opinion, development of the DITPACK framework is directly related to the idea expressed by Abbitt, “With the support of ongoing research, the usefulness of the TPACK framework may be extended to provide a model for a relevant, rich, complex, and flexible knowledge base capable of enhancing self-efficacy beliefs for technology integration in the classroom” (2011).

The uniqueness of this study is its focus on evaluating training of special education teachers to DITPACK. Teacher preparation programs for special education teachers must prepare new teachers for “one of the most hardest and most complicated jobs in the field of education. They [Special Education teachers] have been endowed with a federally mandated plan to address all children with special needs” (Payne, 2005). In order to teach students with special needs effectively, special education preservice teachers need to develop different set of skills than general education teachers, therefore their capabilities to DI and effectively use technology to DI is even more critical. This places additional pressure on teacher education programs to find ways to prepare special
educators to adapt to new technologies while reaching an ever-broadening range of students learning needs.

First, one of the key findings is that instructors and preservice teachers overwhelmingly agreed that differentiation of instruction is an effective teaching approach that is necessary in order to promote quality of education and improve students’ achievement (Roy, Guay and Valois, 2012). This study shows that instructors of this teaching program also believe that they provide ample opportunities for preservice teachers to learn how to differentiate instructions. “Differentiated instruction is viewed as the keystone to promoting access to the general education curriculum and appropriate instruction for students with disabilities in successful full inclusion models” (Zigmond, Kloo, and Volonino, 2009). The effectiveness of differentiated instruction and its effects on students’ achievements is supported by other studies as well. After conducting a study investigating for the effectiveness of differentiation in mixed ability classrooms, Valiande, Leonidas, and Koutselini (2011) concluded that, “no other factor contributed to the change in student’s achievement, further than the intervention of differentiated instruction.” Instructors preparing special education teachers in this study fully embrace DI and recognize that it is an absolutely necessary practice that must be implemented in inclusion classrooms. This study contributes to the literature by offering a close-up view of instructors’ reflections on DI and the variety of ways they choose to teach preservice special education teachers to DI.

Second, both groups of the participants, instructors and preservice teachers, agreed that integrating technology to support individual learning needs may be an effective way to DI if it is done with the focus on the learning objectives and not on the
technology itself (Ottenbreit-Leftwich et al, 2012). Effectiveness of integrating technology for DI has been a topic that many researchers have studied closely. Cobb (2010) examined how using an Internet-based software program that differentiates instruction, prescribes learning paths, and allows students to work cooperatively changed overall student achievement in reading skills for the targeted students. Cobb’s work confirmed that “Differentiated instruction with technology is an effective tool for urban school students.” Kara-Soteriou (2009) discussed valuable points concerning the use of technology to differentiate instruction across grade levels. She concluded that certain technologies can be used as advanced tools for targeted learning, quick and private communication, students’ engagement and assessment, with the main goal of designing and implementing differentiated instruction to help all students to learn and reach their potential. During the interviews in this current study, instructors also discussed these concepts and offered their insights on using technology for DI, which reiterated Kara-Soteriou’s finding that teachers do not need to differentiate in all aspects of DI (content, process, product), but even making slight changes in one of the variables can provide needed support to students.

Third, one of the key findings came from analyzing preservice teachers’ focus group data. Preservice teachers provided excellent examples of how they learn to DI in general, however they believe that currently they do not receive ample preparation to differentiate instruction with technology. Aligned with this, they explained that while the teaching program provides plenty of information about technology resources that can be used to DI, instructors do not model enough how to use technology resources for specific content.
In addition, they expressed that there are not enough hands-on activities for them to practice using technology in content related ways. It is noteworthy that both of these points, modeling and practical learning in the context of specific subjects, have already been examined and findings of this study align with prior research.

Modeling as way of teaching TPACK to preservice students, suggested by the participants of this current study, was also explored by Lu & Lei (2012), who proposed to integrated live dual modeling (LDM) that includes behavior and cognitive modeling to improve TPACK preparation and investigated whether Live Dual Modeling was effective in assisting preservice teachers develop TPACK in a technology integration course. According to these researchers, “The findings showed that the preservice teachers demonstrated the initial ability to transfer what they learned in the modeling to classroom teaching.”

Koehler & Mishra (2005) worked with faculty members and masters students to develop an on-line course. They wanted to teach TPACK by presenting preservice teachers with instructional problems and then have them resolve these problems by designing technological artifacts. Researchers noted that by working together on authentic problems, the participants developed significantly in their knowledge of technology application and their TPACK. Koehler & Mishra concluded, “that it is necessary to teach technology in contexts that honor the rich connections between technology, the subject-matter (content) and the means of teaching it (the pedagogy).”

This current study supports findings of Koehler & Mishra, but also adds a different dimension that acquiring TPACK for DI would be better accomplished if DITPACK learning goals and activities would be spread across different courses, instead of offering
one technology integration course. Liu (2011) also conducted a study about preparing preservice teachers to use technology and results revealed that separate courses focused on technology are not enough and it is necessary to focus on technology integration throughout education courses and field practice with guidance from experienced teacher mentors.

In addition to the need for preservice teachers to learn technology with a strong connections to content and pedagogy, teaching experience is another necessary component of this process. This study shows that instructors consider the lack of actual teaching experience of preservice teachers to be one of the major challenges that they have to tackle. Pamuk (2011), who also used the TPACK framework to explore the area of preparing preservice teachers to successfully integrate technology, also acknowledged that “Developing pedagogical content knowledge (PCK) is an important factor in overall technology integration; teachers must make it a priority to acquire PCK before integrating technology. In preservice teacher education, PCK development must be supported with actual teaching experience.” While this study agrees that teaching experience is very important for all preservice teachers, it also emphasizes that special education preservice teachers have an added need for practical experience to develop DITPACK, because they will be working with a more diverse student population than student population of general education.

This study demonstrates that to improve preservice teachers’ competence in DI with technology, the teaching program needs to develop a clear and cohesive framework that would balance theoretical knowledge of DI, practical know-how of using technology resources and, most importantly, practicing designing and delivering DI with technology
in the classrooms of teaching program as well as in the classrooms of partnering schools during preservice teachers’ practicum.

While this current study confirms many previous findings regarding DI, technology integration for DI, and preparing teachers to develop TPACK capabilities, this study also contributes to the literature by offering a distinctive view of how special education preservice teachers are being prepared not only to integrate technology into instruction, but also use it for differentiated instruction. This study provides a detailed examination of how instructors from different course areas (special education, technology, teaching methods, and education core) perceive the aspect of preparing preservice teachers to DI with technology. In addition, this study offers new findings by analyzing data from two perspectives: instructors and preservice teachers. Moreover, by comparing the results of preservice teachers enrolled in the first year of the program to the results of preservice teachers in the second year of the program, this study allows educators to see the progress preservice teachers made in all domains of DITPACK and assists them in coordinating and adjusting course work.

As the inclusion movement continues to grow, how to prepare preservice teachers to differentiate instruction successfully by using technology is a very important area to explore and develop. This current study is a step in this direction. By presenting findings to the faculty of this teacher preparation program and providing recommendations for the near future, such as developing a clear coherent vision among instructors of how to prepare pre-service teachers to succeed in a technologically evolving environment and offering preservice teachers more modeling and hands-on opportunities to practice, this study is the beginning of a dialogue about the current state of preparing preservice SPED
teachers to DITPACK at this teaching program with the aim of moving towards creating a more “comprehensive system” of preservice training to DI with technology.

**Limitations**

The study was restricted to the GSE at Rutgers University of New Jersey and one graduate teacher preparation program. Focusing only on one teaching program did not allow me to make conclusions that could be applied to all teaching programs. Therefore, it may be difficult to replicate this study due to its uniqueness and specific context (Creswell, 2009). Participants’ responses were based on their personal experiences in the Teacher Preparation Program at Rutgers GSE. It also does not accurately account for the participating students’ previous teaching and technology experiences. Participants of this study included 63% of the students majoring in Special Education and 62% of the faculty members teaching students majoring in special education. Therefore, responses are not entirely representative. I conducted eight class observations, ten interviews with instructors, and two focus groups with preservice teachers for this study. I believe that I had very rich and valuable data to analyze, although I realize that, due to the schedules of participants, the number of observations was limited and consequently prevented me from making broader conclusions.

Because qualitative research methods were also used as part of this research, different readers may interpret the data obtained in the second phase of the study differently. Students and instructors contributed to this study by self-reporting certain information, therefore it is important to consider that self-reported data is not as accurate as participants may believe. It is possible, that forgetting important examples of learning opportunities, mixing times or names of courses, projects and activities, or exaggeration
of learning outcomes occurred during this study. I was aware of these possibilities and took the precaution that sample size and crosschecking data did offset the impact of self-reporting.

Given that the literature has not specifically addressed the issue of preparing special education teachers to differentiate instruction by integrating technology, this study provides new perspective and raises key questions about preparing special education teachers to effectively DI with technology after exploring the current status of this aspect of the special education teacher preparation program at Rutgers GSE. Prospective special educators need to not only develop TPACK, but also be able to add the concept of DI to TPACK. They need to rehearse this complex teaching approach during their practice in the field, which should help them to be better prepared to meet the diverse learning needs of all students.

While all teaching programs are unique, they do share the same goal of preparing effective teachers, therefore the findings of this study can be transferred to a different setting of other teaching programs. Although, these results can be directly applicable to the populations from which the sample was taken (Creswell, 2009), e.g. prospective special education teachers and instructors in the Rutgers GSE program, this study offers important findings to the administrators and faculty of other teacher preparation programs with similar goals and structures. I hope that findings of this study will assist college faculty members, administrators and, providers of professional development in decision-making processes regarding coordinating efforts and making sure that pre-service teachers have sufficient learning opportunities.
Further Research

Training preservice teachers of special education, as their role in the classroom and teaching environment continues to evolve, is an extensive and multifaceted process. In addition to becoming highly qualified in the content area, knowledgeable about special education methods of teaching, and capable of addressing the special needs of individual learners, prospective special education teachers also have to demonstrate effectively using technologies in the inclusive classroom.

Training programs not only face the challenge of keeping up with changes in the special education field, but also the equally difficult challenge of staying current in the field of educational technology. There is a need for more research at the local level to allow further assessment of teacher preparation practices. Exploring the following future research strategies could facilitate valuable discoveries and a continued dialogue among preservice teachers educators:

- To examine effective ways of developing DITPACK capabilities in special education preservice teachers. Research can focus on the distribution of the DITAPCK curriculum across the coursework of the entire program instead of offering it in a more concentrated version after teaching practicum to take an advantage of new teaching experience.

- To learn more from the new special education teachers in the field, focusing on the aspects of the DITPACK curriculum that helped them to succeed in the classroom and on the aspects that they felt they did not master well enough while in the teaching program. By examining their practices in different environments (self-contained, co-teaching, different grade levels, etc.) and then mapping
desirable specific skills and resources to the DITPACK curriculum, stronger comprehensive framework and knowledge depository can be compiled for the following cohorts.

- To continue examining how instructors in teaching programs teach DITPACK. It would be helpful to know what are the strategies and tools do teachers educators use and what kind of support do they need. Understanding their teaching methods and the process of choosing resources and learning activities for preservice teachers can give teacher program leaders insight into designing a more effective DITPACK curriculum, providing professional development opportunities for instructors, and improving special education preservice teachers preparation to DITPACK.

**Significance of the Study**

I believe that improving pre-service special education teacher preparation for technology integration is a very important goal and a high priority for every teacher preparation program. According to IDEA, students with special learning needs must have access to the general education curriculum. While schools across the country continue to move toward inclusion, they are already accountable for the performance of students with special needs on assessments aligned with the general education curriculum; therefore the role of special education teachers is the critical one. Teacher preparation programs must prepare prospective special education teachers to teach effectively and function well in an inclusive environment. This study contributes to the expansion of the research area that has sprung from the inclusion movement, empowered by forceful technology development and focused on
educating the diverse population of students, including those with special needs in
general education settings.

This study was conducted at the teaching program at the Rutgers Graduate School
of Education (GSE). The Rutgers School of Education is one of the leading graduate
schools of education. According to the March 2013 U.S. News and World Report,
the GSE is included in America’s top fifty best schools of education. Studying
current teaching practices in one of the best schools of education provided a
meaningful illustration and beneficial research to educators in the field to better
understand integration of technology use into teacher preparation training and related
issues. This study utilized the well-established TPACK model (Abbitt, 2011; Pamuk,
2012; Thomas, Herring, Redmond, and Smaldino, 2013), but also extended it by
combining it with the philosophy and practice of differentiating instruction (DI). This
expanded framework DITPACK is especially applicable for use in the field of special
education and will offer other researchers an additional resource for new research.

The findings of this study can be used during the important future conversation
about increasing the effectiveness of prospective teachers by training them to
differentiate instruction with technology at GSE and other educational settings.
Faculty members teaching courses to prospective special education teachers may use
the findings from this study to guide their decision making selecting courses required
for the program completion and learning activities to be included in their courses.
Results, recommendations of this study, and details of the data may also be useful for
coordinating efforts focused on teaching with technology among instructors.
Program coordinators may be assisted by the conclusions from this study as they
decide whether more time should be allocated during the coursework and field experience to provide students with the opportunity for developing their DITPAC skills. In addition, the results of this study may provide assistance for selecting and providing appropriate professional development for faculty members. With support that is aligned to the needs of instructors, they will be able to better prepare new teachers to acquire practical skills of using technology for differentiating instructions.

A key question of education is how improve learning opportunities for each student regardless of learning profiles or abilities. The significance of this study is to contribute to the knowledge base of how to better prepare pre-service teachers to differentiate instruction with technology, enabling new teachers to more effectively support each student’s individual learning.
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