

Illuminating Skills Through EdTech Mastery: How ISTE Certification Can Facilitate Digital Literacy Curriculum Revision for EPPs

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Abstract

This paper covers the programmatic work undertaken to conceptualize a systematic and cohesive integrated technology experience for pre-service teacher candidates across one Educator Preparation Program (EPP) in Texas, including work to measure digital learning of our pre-service teachers before and after their time in the program. Furthermore, this paper reflects upon 5 years of survey data from graduates and make programmatic recommendations for improvement based on the facilitators' work in becoming certified educators through the International Society for Technology in Education (ISTE).

Keywords: *Educator Preparation Programs, ISTE, Digital Literacy, Pre-Service Teachers*

In 2016, the United States Department of Education (U.S. DOE) sponsored a policy brief that identified challenges and offered guidance to teacher preparation programs in an effort to more effectively integrate technology acquisition and competence within the curriculum of new teacher candidates (U.S. DOE, 2016). Under its Guiding Principle #3, programmatic considerations, the U.S. DOE cited research that single educational technology courses were not sufficient to properly prepare preservice teachers for the future technology-rich classrooms that await them (Kopcha, 2012). Furthermore, the report noted that continuous exposure to instructional technology, rather than single, stand-alone courses, led to improved attitudes and beliefs toward technology and sustained appropriate pedagogical practice among preservice teachers (Polly et al., 2010). Student teaching and the clinical teaching experience is an opportune time to develop positive attitudes towards technology integration and usage in the classroom (Cherner & Curry, 2017). It is vital that all attempts to create digitally literate teachers should originate from within a cohesive program design rather than reside within single “drive-by” course attempts to integrate technology (Kuyatt et al., 2015). Specifically, teacher education programs should attempt to integrate digital technology through

programmatic implementation to, “...ensure preservice teachers' experiences with educational technology are program-deep and program-wide rather than one-off courses separate from their methods courses” (U.S. DOE, 2016, p. 14).

The COVID-19 crisis further exposed the critical need for teacher education programs to implement training practices that prepare future teachers to teach with technology integration by incorporating virtual learning and pedagogies responsive to the distance learning student. To accomplish this purpose, Educator Preparation Programs (EPPs) must collaborate and share data on best practices in how to prepare future teachers as digital learners and leaders with their K-12 partnerships. Another crucial link in this process is to develop a systematic method to determine whether teachers just entering the field possess the skills necessary to enact digital literacy pedagogies in their classrooms so that their students can become proficient in technology through their learning experiences.

Published in 2017, The International Society for Technology in Education (ISTE) developed four sets of technology standards: one for Students, Educators, Education Leaders, and Coaches. The ISTE Standards for Educators specifically provides a comprehensive roadmap to support educators in effectively integrating technology through classroom instruction and assessment. These

standards assist educators in collaboration with peers, finding new depths in their practice, and invites them to rethink conventional approaches to education using technology integration. There are seven ISTE Standards for Educators (2017):

1. *Learner* - Teachers continually improve their practice by learning from and with others and exploring proven and promising practices that leverage technology to improve student learning (p. 5).
2. *Leader* - Teachers seek out opportunities for leadership to support student empowerment and success and improve teaching and learning (p. 5).
3. *Citizen* - Teachers inspire students to positively contribute to and responsibly participate in the digital world (p. 5).
4. *Collaborator* - Teachers dedicate time to collaborate with both colleagues and students to improve practice, discover and share resources and ideas, and solve problems (p. 6).
5. *Designer* - Teachers design authentic, learner-driven activities and environments that recognize and accommodate learner variability (p. 6).
6. *Facilitator* - Teachers facilitate learning with technology to support student achievement of the 2016 ISTE Standards for Students.
7. *Analyst* - Teachers understand and use data to drive their instruction and support students in achieving their learning goals (p. 6).

The ISTE guidance is organized around these standards regarding technology integration and usage in instruction. Furthermore, contained within each standard is a set of individual criteria that further clarifies and defines the behaviors contributing to the digitally competent educator. The ISTE Standards for Educators are universally relevant and applicable for all K-12 teachers, as well as higher education faculty who work with future educators as part of their Educator Preparation Program.

The Texas Education Code (TEC), §21.044, as amended by SB 1839, 85th Texas Legislature, Regular Session, 2017 specifically guides and directs EPP implementation of technology integration and digital literacy competency for teachers in Texas. This code requires the curriculum for all initial teacher certification classes to include instruction in digital learning. EPPs in

Texas must assess each candidate with a digital literacy evaluation followed by a prescribed digital learning curriculum that includes resources to address any deficiencies identified by the digital literacy evaluation. Instruction must be aligned with the ISTE Standards for Educators and provide effective, evidence-based strategies to determine a candidate's degree of digital literacy. Furthermore, candidates must receive as part of the training, instruction in digital learning, virtual learning, and virtual instruction that covers evidenced-based practices to both teach and assess students receiving virtual instruction (TEC §21.044, Amended by SB 226, 87th Texas Legislature, Regular Session, 2021).

Our EPP took several initial steps to comply with the mandates in TEC §21.044. First, we created a digital literacy survey instrument in the form of a 24-question pre- and post-survey that our candidates take to assess their competency with digital literacy. Our program worked to ensure that we were using purposeful technology integration in each of our pedagogy courses, aligned to the ISTE standards. Every undergraduate pre-service teacher experiences a prescribed curriculum that includes 21-hours of pedagogy related courses. The education specific degree plan for our undergraduate initial certification candidates includes the following courses:

- EDUC 2003 Schools and Society
- EDUC 3003 Learning Theory and Development
- EDUC 3482 Teaching Diverse Learners through Technology Development
- EDUC 4113 Design and Implementation of Instruction and Assessment
- EDUC 4243 Classroom Environment and Management
- EDUC 4946 Clinical Student Teaching

Each course has at least one key assignment that focuses on a specific element of both pedagogy and ISTE technology alignment. For example, EDUC 3003 requires students to present an interpretation of a lesson within a specific learning theory framework and use technology to present their lesson to the class. EDUC 4113 requires students to collaborate in groups to interpret and analyze student data on a chosen assessment and then present a plan of action to the class using digital integration. Technology is used as both the collaboration tool (i.e. cloud-based documents)

during the planning process and as the final product for the presentation. We quickly identified EDUC 3482 as a course that needed a complete overhaul since the original course design was still in place and had not been revised in nearly 8 years! Technology, specifically the wide availability of one-to-one devices and learning based applications changed drastically during that time. The redesign of EDUC 3482 focused heavily on the ISTE Designer, Collaborator, and Facilitator standards and incorporated new assignments such as a flipped classroom teaching direct teach lesson, a differentiated learning plan that incorporated technology, and an initial pedagogy-based candidate portfolio. ISTE used our alignment and course redesign process as part of a white paper report they published in 2023 on transforming teacher education (ISTE Research Study, 2023).

One notable programmatic change that occurred when redesigning EDUC 3482, was our observation of the learning objectives alignment in relation to another course, EDUC 4113. The 4000-level course was bloated with instructional objectives and technology integration as the pinnacle instruction and assessment course before student teaching. When redeveloping EDUC 3482, we decided to use this opportunity to reconceptualize it as a prerequisite relief course that would slowly build the foundation of important concepts in differentiation, teaching in different formats, and using different instructional methods prior to candidates finishing the work in EDUC 4113. This was particularly important for the candidate portfolio. The purpose of the portfolio is to house important education related projects during candidates' time in the program and is organized around several national and state standards for teaching (eventually including the ISTE standards). The original portfolio was completed during the final course before clinical student teaching, EDUC 4113. The redesign launch occurred in three phases, across three courses. In EDUC 3482, candidates create their portfolio using Google sites or another chosen website platform and upload at least three artifacts from the current or previous courses. In EDUC 4113, candidates identify and add an additional 7-10 artifacts. Finally, in their clinical student teaching semester, candidates finish their portfolios and publish them for presentation use during teaching interviews or other professional avenues. This portfolio serves as an important assessment of what our candidates learn and their mastery of learning standards during their time in our program. This example demonstrates the programmatic alignment work

that we took to ensure technology integration and digital literacy is not the responsibility of a single course or single course instructor.

The authors represent a diverse EPP in the north Texas regional area charged with preparing future K-12 teachers at the undergraduate and graduate level, and who often teach the EDUC 3482 and EDUC 4113 courses. Our institution is currently ranked fourth in the nation for ethnic diversity according to the 2022 U.S. News and World report (2022), is designated as a Hispanic-serving institution and is the largest university in the nation primarily for women. The EPP hosts a range of traditional and nontraditional students seeking teacher certification, many from minority-represented backgrounds in the K-12 teaching force. Furthermore, both faculty members have held both teaching and administrator positions in K-12 schools and now share their perspectives as teacher educators in higher education programs. This paper will focus on providing insight into two main practitioner-based research questions:

1. Considering the past five years of data, how effective is our digital literacy pre- and post-digital literacy survey at measuring digital literacy competency of our pre-service teachers?
2. What changes should be made in the way that we assess and instruct our pre-service teacher candidates regarding digital literacy curriculum aligned to the ISTE Standards for Educators after going through the ISTE Higher Education cohort certification process?

ISTE Certification as a Catalyst for Change

In the summer of 2023, the two authors of this paper decided to pursue the ISTE Higher Education Cohort (HIED) Certification cohort that consisted of three months of synchronous and asynchronous online instruction around the ISTE Standards, the submission of a final project of artifacts documenting an understanding of eight assigned ISTE criteria, and another six-month portfolio process to submit the remaining 16 artifacts demonstrating mastery for all 24 criteria within the ISTE Standards strands. This cohort was specifically designed for higher education faculty who are working directly with pre-service teacher candidates rather than K-12 teachers working with students. It was during this process that we began to understand the depth of the criteria within each standard that needed to be

introduced to our pre-service teaching candidates. Some of the standards were naturally easy for us to implement such as criteria contained with the Designer and Facilitator standards. After several years of program alignment initiatives and revisions, we had purposefully designed and revised course assignments that achieve criteria aligned in these standards around teaching our candidates how to use technology to accommodate learner differences, align content to standards, design a classroom environment inclusive of digital learning, use assessment to drive learning, and provide opportunities for students to reflect on their learning (Hurlbut et.al., 2020). Other standards were more challenging, and we quickly realized that our

current curriculum narrowly covered important items, such as criteria housed within the Citizen standard. Table 1 outlines a sample of the checklist guidelines required to demonstrate mastery on Criteria 8 of the Citizen standard; this criterion focuses on building empathetic and socially responsible behaviors that contribute to online interactions and digital interactions. Based upon the checklist provided by the ISTE certification cohort, we began to rationalize how our current course instruction and assignments revolving around this standard did not quite go to the depth required for ISTE Certification mastery (see also Figure 1b posted below).

Table 1.
Example ISTE Criteria 8 for Citizen Standard

Criteria	Criteria Focus	Criteria Checklist Statements
8. Implement learning experiences for students to be empathetic and socially responsible.	<p>There needs to be ongoing opportunities for learners to practice contributing positively to online written interactions and discussions. Many of us use protocols with learners that build practice in empathy and socially responsible online discussions.</p> <p>This criterion focuses on the learning and practice around a set of protocols introduced to learners and opportunities to experience, in a safe environment, the implementation of this learning.</p>	<ul style="list-style-type: none"> • My artifact directly shows my instruction on how my learners are instructed and guided to be empathetic and socially responsible when contributing to online written discussions and interactions. • I provide framework(s), protocols, or guidelines for learners to use in online written interactions and discussions. • I give direct evidence in my artifact of how my learners put these guidelines into practice. • If I am using a 3rd party lesson, I showed how I customized and/or adapted it.

Source: 2023 ISTE Certification Course Criteria Guidelines, access provided to registered ISTE cohort members only.

The Digital Literacy Survey Instrument

As part of the required execution of the TEC §21.044 statutes to measure and address Texas pre-service teacher digital literacy and competencies, our Educator Preparation Program (EPP) created and implemented a pre- and post-digital literacy survey in 2017 that addressed the ISTE Standards for Educator framework. Specifically, the EPP program provides candidates entering the program with a mandatory pre-digital literacy assessment as part of their initial EPP application process. They must complete the post-survey at the end of their clinical student teaching experience, just before graduation. Candidates take courses in between entrance and exit to the program that are

specifically targeted to address all seven ISTE standard strands to develop digital literacy skills throughout time in the program, rather than in a single technology course; This is in line with the U.S. DOE’s suggested guidance on technology and digital literacy integration (U.S. DOE, 2016). Development of the survey instrument was presented at the 2020 Society for Information Technology & Teacher Education (SITE) Conference and published online via the conference proceedings (Bush & Hurlbut, 2020). The survey consists of 24 total questions organized around the 24 criteria contained within the seven ISTE Standards for Educators Strands. Each strand consists of three to four questions in the form of multiple-choice,

multiple-answer, and true/false items. Sample questions taken directly from the survey are shown in Figure 1a & b below:

Figure 1a.

EPP Digital Literacy Survey Sample Learner Item

Learner

When trying to select the most appropriate tool to integrate into your class, you should always start with:

- The functionality of the tool
- The summative assessment of the lesson or unit
- The learning goal
- An idea from a professional conference you just attended

Figure 1b.

EPP Digital Literacy Survey Sample Citizen Item

Citizen

A teacher instructs students on how to safely research information on the Internet, participate in electronic discussions, follow accepted practices (e.g., netiquette), and use approved passwords to access information resources. The teacher primarily understands the importance of implementing which of the following objectives of information literacy?

- Students use information effectively to accomplish a specific purpose.
- Students retrieve information effectively and efficiently.
- Students comprehend the legal and social implications of using information.
- Students evaluate information and its sources critically.

We analyzed the data from Google forms and converted participant responses into a spreadsheet format where correct and incorrect answer choices were sorted,

counted, and analyzed for numerical patterns. The raw data analysis of the pre- and post-survey implementation of the digital literacy instrument had several notable observations. First, respondents for both the pre- and post-survey had not been checked for dual submissions. Since the survey was developed and facilitated through a Google form that allowed multiple submissions, it is entirely possible that candidates may have taken the survey more than once. Future data reviews can extract duplicate responses, but this was not feasible at manuscript time due to time constraints. Each candidate used a university-affiliated email address to access and complete the survey, meaning that the survey was only accessible to individuals associated with our institution and EPP. Second, the number of respondents varies greatly from pre- to post-survey due to several factors (pre-survey N=1311, post-survey N=689). Survey data included responses through April 2023 which included a new incoming cohort of candidates who were applying to the EPP program and had to complete the pre-survey as part of the application process. However, the outgoing cohort did not finish the program until May and had not yet completed the post-survey requirement. Furthermore, pre-survey data included responses from candidates who: 1) never started the program after acceptance, 2) started, but did not finish due to withdrawal, 3) changed majors, or 4) decided to pursue the non-certification degree route. These candidates would have taken the pre-survey but would not have been required to complete the post-survey. A preliminary item analysis that compares the number of survey responses, number of correct and incorrect responses for each survey, coupled with corresponding percentages for more accurate comparison since the pre-survey numbers are inflated, is provided in Table 2.

Table 2.*Preliminary Digital Literacy Survey Item Analysis*

ISTE Standards	Item Number	Pre-Survey Correct Items		Post-Survey Correct Items	
		N (1311)	%	N (689)	%
Learner	1	1157	88%	612	89%
	2	752	57%	413	60%
	3	772	59%	469	68%
Leader	4	885	68%	361	52%
	5	1111	85%	522	76%
	6	484	37%	247	36%
Citizen	7	723	55%	344	50%
	8	1072	82%	586	85%
	9	1052	80%	555	81%
	10	1225	93%	641	93%
Collaborator	11	716	55%	364	53%
	12	646	49%	412	60%
	13	768	59%	406	59%
	14	742	57%	467	68%
Designer	15	284	22%	200	29%
	16	828	63%	502	73%
	17	313	24%	149	22%
Facilitator	18	1021	78%	554	80%
	19	917	70%	422	61%
	20	599	46%	427	62%
	21	523	40%	232	34%
Analyst	22	782	60%	445	65%
	23	941	72%	497	72%
	24	490	37%	176	26%

Our Data Dig

Following our participation in the Higher Education ISTE Certification cohort (HEID), we knew that in addition to determining areas of strength and weakness in what candidates learned during the program, we also needed to ensure that the survey questions were accurately aligned to the ISTE criteria in meaningful ways. Reading and learning about the ISTE criteria from an educator viewpoint is one thing, but having to demonstrate mastery of instructional implementation and alignment of the ISTE criteria through a rigorous performance task process to achieve certification is quite another. Preliminary investigation of both the survey questions and raw data revealed some glaring discrepancies in student performance, survey items, criteria alignment, and question difficulty. For example, some of the questions we evaluated suggested that many of the survey items are too easy, as many students get these questions right at the pre-survey stage with little room for growth during the program until the post-survey (*Item #1* 88% pre- and 89% post-survey accuracy). However, other items rank low at both the pre- and post-survey stages

indicating issues with question wording or answer options, such as containing questions too difficult for students to decode at both the pre- and post-stages (*Item #17*).

Questions that contained multiple correct answer choices were often the culprit of lower-than-expected performance on these types of items. Other questions suggested some growth from pre- to post-survey stages (*Items #3, 12, 14-16, & 20*), while final sets of questions indicated very little or negative growth which may be due to ISTE alignment issues or to inadequate coverage in the program curriculum (*Items #4-7, 11, 19, 21, & 24*). Before we can identify curriculum gaps in our program, it is vital that we first determine whether the instrument is effectively measuring mastery of the standards and is adequately aligned to the ISTE criteria as stated. We evaluated the survey items and the student results using three main lenses:

1. Question intent - Is the question measuring what it is supposed to measure?
2. Question alignment - Is the question aligned with the ISTE criteria statements?

3. Question integrity - Is the question too difficult or too easy so that we cannot determine curricular strengths or weaknesses?

This survey, while presented informally at academic conferences and discussed as a formative tool to measure student learning in an EPP program, had not been specifically designed or tested for research use beyond the specific purpose unique to our institution. In 2017, with our limited understanding of the standards, we determined that the instrument was a good start in both aligning our program with digital literacy initiatives and measuring progress of students using the ISTE standards. However, after the ISTE certification process and reviewing actual data, our reflections on this instrument reveal further work needs to be done. After analyzing each survey question and the corresponding student performance on both the pre- and post-assessment through our three viewpoints: 1) Question intent, 2) Question alignment, and 3) Question integrity, we organized our findings through several emerging themes to help us answer our research questions.

Theme 1: Question Issues, Difficulty or Question Type

Many of the questions we analyzed posed problems as we determined that question wording, complex answer choices, or difficulty level prevented students from demonstrating mastery at both the pre- and post-stages. Often, questions that contained more than one right answer (i.e. select all that apply) were the culprit of these question issues. For example, Item #17 of the instrument contained three right answers and all three had to be selected by the candidate to be rated correct. Furthermore, analysis of results on this question showed that students had a higher pre-survey accuracy rate of 24% than the post-survey rate of 22%, demonstrating negative growth. The question required students to have a complete understanding of the items listed as individual answer choice options, but in the second answer choice, there were two opposing ideas listing online instruction and face-to-face instruction together in one option (see Figure 2a). The issue with this answer choice is that students needed to have a complete picture and understanding of how small group instruction could be facilitated in both environments and may have included or rejected this option based on the question containing two different scenarios and their conceptions of

online education, even though both were considered correct.

Figure 2

Item #17 Designer Standard

Which of the following learning techniques allow time for a teacher to pull aside a small group for additional learning during class time? Select all that apply.

- A. Direct Instruction
- B. Online/Face-to-Face Learning**
- C. Project-Based Learning (PBL)**
- D. Flipped Classroom**

The alignment of this question was intended to match up with ISTE Designer Criteria 2.5c which states, “[Teachers] explore and design instructional design principles to create innovative digital learning environments that engage and support learning.” (n.p.) We found that the intent of this question to reflect the learning standard is on target as teachers must learn how to use technology and digital learning environments to maximize instruction and support learning in the classroom. Our cohort work and corresponding artifact documentation as part of the ISTE certification course supported the content of the question, which means this was merely an item issue that needs future revision to adequately assess candidate understanding.

Theme 2: Questions that Demonstrated Curricular Areas of Growth

Some items did appear to demonstrate areas of curricular growth in the program, indicating that the instruction, content, and experiences positively contributed to candidates scoring higher on certain items of the post-survey assessment compared to their pre-survey attempt. An example of this is seen in items 14 and 20. In item 14, students scored 57% correct on the pre-survey and 68% on the post survey. The item shown in Figure 3 was adequately aligned with the collaborator criteria item 2.4d which focused on competently communicating with stakeholders as collaborators in student learning experiences.

Figure 3

Item #14 Collaborator Standard

Teachers at a high school are concerned that the school's new Campus Instructional Technologist (CIT) might restrict their autonomy in choosing and implementing technology in their classrooms. Which of the following would be the best way for the CIT to address this issue during an upcoming faculty meeting?

- E. Offer to meet privately with any teacher who has specific questions or concerns about the role of a CIT.
- F. Explain that the role of a CIT is to serve as a resource and mentor and not as a supervisor of teachers.**
- G. Explain that a CIT focuses on the implementation of technology
- H. Explain that a CIT's primary role is to provide professional development on technology.

Figure 4

Item #20 Facilitator Standard

Which of the following activities can be used to personalize learning in the classroom? (Select all that apply.)

- A. Student created websites to demonstrate understanding**
- B. Guest expert lecturers invited to speak to the whole class
- C. Group-created slideshows to teach a concept**
- D. Google Forms to assess and inform formative learning**

Item 20 shown in Figure 4 demonstrated growth from 46% accurate at the pre-survey to 62% at the post-survey. This is surprising, since this question contained multiple option responses, many of which had item issues discussed in the first theme. However, upon review and alignment of the ISTE standard, this the intent of ISTE Facilitator 2.6c criteria which states, “[Teachers] create opportunities that challenge students to use a design process and/or computational thinking to innovate and solve problems.” (n.p.) was not aligned to the question which seemingly focused more on instructional differentiation. In our HIED ISTE cohort we spent extensive time covering the design process and computational thinking using technology to solve problems. In addition to submitting a learning artifact on this criteria for the final portfolio, we also had to submit a computational thinking planning outline document related to another criteria as part of the cohort coursework. We had a deeper understanding of what this looked like, and we quickly discovered that the question in item 20 did not align with the criteria and would need to be revised, even though the item demonstrated student growth and learning from pre- to post-test.

Theme 3: Questions that Demonstrated Lack of Growth

Lack of growth or negative growth is not ideal when using a survey assessment tool to measure learning progress across an interventional program model such as the one designed in our program. However, several items on our survey demonstrated just that. Items #4 - #6 which were questions all aligned to the ISTE Leader standard demonstrated negative growth (Item #4: 68% pre- to 58% post-; Item #5: 85% pre- to 76% post-; Item #6: 37% pre- to 36% post-). A review of these question items revealed multiple concerns including question wording issues, multiple answers required for an accurate response, true/false items which are harder to statistically verify, and questions not actually aligned to the criteria in the leader standard. Our conclusion here is that the entire Leader Standard set of items would need to be revised to better assess our candidates' learning and mastery of this standard during their time in the program. This was by far one of the harder standards to analyze because of the difficulty in providing our pre-service candidates with authentic experiences to practice the leader criteria in this standard (see Figure 5 for reference).

Figure 5

ISTE Leader Standard Criteria

2.2. Leader

Teachers seek out opportunities for leadership to support student empowerment and success and to improve teaching and learning.

Teachers:

- 2.2.a. Shape, advance and accelerate a shared vision for empowered learning with technology by engaging with education stakeholders.
- 2.2.b. Advocate for equitable access to educational technology, digital content and learning opportunities to meet the diverse needs of all students.
- 2.2.c. Model for colleagues the identification, experimentation, evaluation, curation and adoption of new digital resources and tools for learning.

Pre-service teachers do not yet hold active positions on K-12 campuses, and thus, are not usually part of the vision-setting, advocacy, or decision-making bodies required in this learning standard. Thus, we need to work to become more creative with experiences and opportunities for our pre-service teachers to demonstrate these behaviors relevant to their existing contexts and clinical settings.

Theme 4: Questions Where Growth is Irrelevant because Items are Not Aligned to ISTE Criteria

Sprinkled throughout the other themes and issues we found with the digital literacy instrument, we discovered that much of the growth data (or lack thereof) from the past five years was null due to the glaring issues with the ISTE standard alignment. As we examined the individual questions, we found many items that simply did not meet the essence of the standard or had inaccuracies in the standard/criteria understanding. For example, Item #11 which fell into the Collaborator standard was intended for teachers to focus dedicated planning time to collaborate with colleagues to implement meaningful learning experiences using technology. Item #11 seen in Figure 6 instead showed a focus on how *students* worked together in a learning setting that leveraged technology. This is clearly not aligned to the criteria as intended since the focus is on teachers as collaborators, not students, although this is covered separately in the ISTE Standards for Students.

Figure 6

Item #11 Collaborator Standard

A technology applications teacher is preparing a class to begin work on a group project. Which of the following strategies is most effective in facilitating collaboration and teamwork among group members?

- A. Separating girls and boys into different groups
- B. Limiting each group to three members
- C. Emphasizing group harmony as the most important goal
- D. Modifying group norms as the situation requires**

We found similar issues with another item in the instrument, Item #19 aligned with the Facilitator standard. This item was aligned with ISTE Facilitator Criteria 2.6b which states, “[Teachers] manage the use of technology and student learning strategies in digital platforms, virtual environments, hands-on makerspaces, or in the field.” (n.p.) The focus on this statement is the teacher as a manager or facilitator. The corresponding item #19 is shown below in Figure 7.

Figure 7

Item #19 Facilitator Standard

How can technology help motivate collaboration in the classroom for all students?

- A. Technology allows differentiated instruction
- B. Some students who are reluctant to speak up in class, have found a new voice when given digital tools**
- C. Students are more likely to complete their work if they use technology
- D. Students are more engaged when they use technology in class

The issue with this item is that there is no evidence of teacher management or student engagement in the types of examples mentioned in the criteria statement, rather this seems to be a question about motivating students and providing collaborative opportunities in the classroom using technology. This might be a better question for candidates if re-worded, provided with additional context, and/or aligned to a different standard; however, as is, it is not clearly aligned to Facilitator criteria. Rather, the focus

on the standard should be teacher management as better aligned and identified with the teacher as a facilitator rather than students as collaborators.

Discussion

Considering the thematic issues we discovered when conducting the item analysis of the pre- and post-digital literacy survey items and responses, we will now address our findings within the context of our original research questions.

Research Question 1

- *Considering the past five years of data, how effective is our digital literacy pre- and post- digital literacy survey at measuring digital literacy competency of our pre-service teachers?*

Our conclusion is that our instrument is not effective. We discovered numerous issues with the instrument questions such as items that were too easy and thus showed inflated numbers at both pre- and post-survey assessment intervals. Alternately, we found some items that could potentially indicate areas of growth for our program, however, it was impossible to determine the accuracy or significance of the growth due to the other thematic elements we found related to issues with question wording, ISTE criteria alignment, or question difficulty. Based on the preliminary results of the post-survey percentages and individual item analysis aligned with ISTE Criteria, we can obviously conclude that there are issues with the survey instrument in a variety of ways.

Research Question #2

- *What changes should be made in the way that we assess and instruct our pre-service teacher candidates regarding digital literacy curriculum aligned to the ISTE Standards for Educators after going through the ISTE Higher Education cohort certification process?*

We were often surprised at the results of the survey data, knowing previous efforts to revise, align, and deepen curricular understandings related to digital literacy and competency using technology integration intertwined with pedagogical methodologies in our courses. For example, in the Designer standard, two of the three questions in this

standard ranked as some of the lowest items post-survey (i.e. item #15 pre- 22% and post- 29% respectively). After extensive time analyzing the ISTE criteria and related artifacts required for certification to achieve mastery, these were some of the easiest for us to document in both our coursework and during our final HIED portfolio stage, as we had numerous examples of how our candidates were integrating these opportunities into their lesson design and implementation work. Our pre-service teachers (PSTs) develop their own final portfolios with numerous examples of Designer standard work such as a Flipped Classroom Instructional Video, a virtual learning environment, video presentations of lessons, and data chat assignments. Thus, we expected the survey data to provide us with stronger confirmation of our candidates' learning in this area.

Alternately, when we evaluated other standards and their corresponding criteria as part of the comprehensive certification process, we learned that we were not teaching to the depth required for ISTE certification, which was confirmed by examining some corresponding items in the survey. An example of this can be seen in item 7 which aligns with the Citizen standard. Pre-survey mastery was at 55% percent whereas post-survey mastery went down to 50% demonstrating that the item has potential issues and/or a lack of coverage on this topic in the curriculum. Item analysis of the remaining criteria questions in the Citizen standard told a different story; Items 8 -10 showed that candidates demonstrated a high performance on the pre-survey (82%, 80%, and 93%) indicating that candidates already had a depth of knowledge in the citizen area. Our interpretation of survey performance in the Citizen standard concluded that these items were too easy, shallow in content, and marred by misunderstandings in standard coverage and alignment. Despite strong performance in these three Citizen standard criteria, it is perhaps one of the areas needing the most work based on our ISTE HIED cohort work. We certainly learned through this process that both the survey results and ISTE criteria learning need to be used when making professional judgements about the quality of our program and digital literacy competency mastery of our students.

Final issues we conclude from this process included the complex innerworkings of standards alignment within an Educator Preparation Program (EPP) curriculum. EPPs are responsible for ensuring that teachers are content masters, pedagogical experts, and now digitally literate

leaders. EPPs are tasked with implementing a host of compliance items and standards from accreditation bodies including the: Association for Advancing Quality in Educator Preparation (AAQEP), Texas Education Agency (TEA), State Board for Educator Certification (SBEC) Texas Teacher Evaluation and Support System (T-TESS), Texas Educator Certification Examination Program Pedagogy and Professional Responsibilities (TEXES PPR), and International Society for Technology in Education (ISTE). EPPs often have little time to implement this vast range of standards and components required for entry level teachers to demonstrate mastery; it becomes impossible to for these novices to become competent in every single one. Perhaps a more logical way of implementing technology standards for teacher educators would be to instead adapt the Teacher Educator Technology Competencies (TETCs) which are a set of 12 competencies based upon the ISTE criteria and synthesized to address the most important technology related skills that teacher educators should be addressing in their courses (Foulger et al., 2017).

The structure of the current ISTE certification process provides candidates with several weeks of in-depth criteria learning with feedback from course instructors and uses a comprehensive criteria artifact portfolio as the ultimate assessment of candidate mastery with the ISTE standards. Similarly, an artifact portfolio is likely the most authentic, in-depth way for pre-service teachers to demonstrate mastery with the ISTE standards and is much more comprehensive than a simple pre- or post- digital literacy survey. However, our concern with a full ISTE portfolio approach is considering the gamut of standards novice teachers must demonstrate and the length of time it took us as competent, veteran teachers to fully understand the scope of the ISTE standards and corresponding certification process (10 months), this might not be the most feasible or realistic way to demonstrate pre-service teacher mastery. Pre-service teachers will likely struggle to master simple pedagogical and content-based teaching strategies and adding technology components on top of this complex learning might be too intricate for candidates lacking these experiences. Also, who would grade and evaluate these portfolios? Would we require all faculty members to obtain the extensive ISTE certification badge in order to demonstrate competence in grading the portfolios? For our PSTs who have so many other things they are working to master (planning, instructional

delivery, time management, classroom management, administrative tasks, data analysis, intervention for at-risk students etc.) digital literacy is likely to be low on their list. Thus, we believe that we must select an instrument that can quickly identify specific weaknesses related to digital literacy required by TEC §21.044, so that we can target a plan to address and fill the gaps in a timely fashion; Revising and improving the survey is likely our best option to do this. Candidates can then demonstrate their learning as part of their comprehensive portfolio related to the other accreditation standards for teaching. The quick part of the identification process requires usage of a survey or similar instrument. Further analysis and development of the survey items, in addition to utilizing existing portfolio reflection approaches would be a better way to measure digital literacy competency and growth of our candidates during their time in the program. Portfolios would be a natural extension of what they are already doing in their program with very specific ISTE criteria weaved throughout according to their individual performance on assessment items. Digital literacy curriculum would continue to be integrated in coursework with possible additional modules or projects to address specific areas of weakness in the form of a research or application type project such as a student lesson plan or artifact from the clinical student teaching experience.

Conclusion & Next Steps

Our initial purpose in accessing this data was to determine how our program was effectively preparing the next generation of pre-service teachers to become digitally competent educators, but also to critically evaluate the instrument alignment with ISTE Standards and Criteria considering our new ISTE learning and depth of understanding related to the certification process. Our initial data analysis had some issues with potential duplicates and inflated pre-numbers. However, we found that the raw data were sufficient to suggest major revisions are needed without having to go back and correct inaccuracies in the data. The numerous issues with ISTE Criteria alignment provide evidence of this. The next steps in this process would be to revise and launch a revised survey instrument while monitoring the data in 1 year (versus 5), implement digital learning intervention plans as part of a candidate's existing reflection portfolio, align and update the remaining professional certification surveys that

are aligned with the ISTE Standards for Education Leaders, and evaluate principal survey data regarding digital literacy preparedness on our first-year candidates.

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