ALIGNING *MEANS* AND *ENDS*:

DEVELOPING TECHNOLOGY INTEGRATION SKILLS AND DIGITAL COMPETENCIES WITHIN AN EDUCATOR PREPARATION PROGRAM

A Capstone Project

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ABSTRACT

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Beyond student learning outcomes, there is a growing emphasis within the teacher education field on training preservice teachers to think holistically about the various ways in which their technology integration practices can impact P-12 students' health and wellbeing (Falloon, 2020; Krutka et al., 2020). A focus on P-12 student outcomes is consistent with the stated mission of Marbury College's (a pseudonym) educator preparation provider (EPP) and supports the program's goal of remaining fully accredited. In order to comply with accreditation expectations and state policy, Marbury's EPP is also obligated to train preservice teachers to enact innovative technology integration practices that engage and empower P-12 students in hands-on ways to foster higher-order thinking and accommodate diverse learning needs. Given the Marbury EPP's mission, accreditation goal, and institutional obligations, it is problematic that previous graduates from the EPP often struggled to leverage digital technologies in ways that furthered P-12 student cognition. In light of recent contextual changes, and the Marbury EPP's upcoming 2025 accreditation audit, this case study assessed the ways in which 10 of Marbury's preservice teachers used digital technologies with P-12 students during their fall 2023 field experience placements. This study also explored various factors that seemed to influence the technology integration choices of participants belonging to the EPP's Class of 2024 (n = 5) and Class of 2025 (n = 5) cohorts. Based upon survey, lesson plan, interview, and observational data, this study found that participants often positioned students as passive receivers of digital learning content. This study also found that participants' stated concerns about technology overuse seemed to contribute to a proclivity to limit student access to digital screens. Ambiguous program-wide messaging pertaining to technology integration and discrepant levels of formal and informal programmatic support also seemed to impact participants' technology integration choices. Findings from this capstone inquiry can be used to inform changes within the Marbury EPP's curricular programming so that the program can maintain its accreditation status, produce more digitally competent graduates, and cultivate a more comprehensive regard for P-12 student outcomes.

Keywords: technology integration, preservice teachers, case study, digital competencies

DEDICATION

To Johanna. You are a wonderful mother to our children and the love of my life.

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This capstone inquiry would not be possible without the cooperation of Marbury College's (a pseudonym) preservice teachers, continuous involvement from my colleagues in Marbury's education department, and the hospitality of local P-12 practitioners who welcomed me into their classrooms. I am also especially grateful to:

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- Johanna, Julia, Seneca, and Cecilia, for your love and patience throughout this journey.
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CHAPTER 1: INTRODUCTION

This capstone inquiry explores a problem of practice pertaining to the technology integration skills and digital competencies of *preservice teachers*, or aspiring educators, enrolled in Marbury College's[1] educator preparation provider (EPP). The complexity of this problem of practice stems partly from tension between a focus on *means* versus *ends* (Kaufman, 2000). Accordingly, this chapter begins by explaining the Marbury EPP's obligations to prepare its preservice teachers to enact *student-centered* technology integration practices (CAEP, 2020a; WV Policy 5100, 2021; US Code, 2022), which necessitates a focus on means (Kaufman, 2000). To provide context for readers, this chapter also introduces terminology and theories that pertain to this progressive strain of digital pedagogy (Jonassen, 1996; Papert, 1993; Salomon et al., 1991), refers to comparable studies (see, e.g., Cherner & Curry, 2017), and shares relevant information about this local setting. This chapter's conceptual framework then situates the theories that are most applicable to this inquiry (see, e.g., Kaufman, 2000; Kimmons et al., 2020), interrogates assumptions that undergird student-centered methodologies (Bower, 2019; Clark & Feldon, 2014; Krutka et al., 2020), and elucidates my tacit understandings about this problem of practice (Check & Schutt, 2017; Ravitch & Carl, 2021). In short, it is helpful for readers to know from the outset of this capstone report that my aim as a researcher is to prioritize improved P-12 student outcomes as an end toward which classroom technology integration practices should aim (Falloon, 2020; Kaufman, 2000; Lai et al., 2022).

Background of this Problem of Practice

When the Council for the Accreditation of Educator Preparation (CAEP, 2020a) audits an EPP, the accrediting body looks for evidence that the program's preservice teachers can "model

[1] Names of local people, local institutions, and Rural County are pseudonyms.

and apply national or state approved technology standards to engage and improve learning for all students" (R1.3). Therefore, preservice teachers enrolled in Marbury College's EPP, which is in West Virginia, should approach technology integration in ways that align with the state approved (WV Policy 5100, 2021) standards prescribed by the International Society for Technology in Education (ISTE). ISTE, which is seen as the educational technology field's "peak global body" (Bower, 2017, p. 4), has two sets of standards: ISTE's (2020) Standards for Educators and ISTE's (2021) Standards for Students. It is relevant to this capstone inquiry that ISTE's (2020) Standards for Educators encourage teachers to "rethink traditional approaches" (para. 1), "design authentic, learner-driven activities" (2.5), and empower students by enacting ISTE's (2021) Standards for Students. It is also relevant to this capstone inquiry that ISTE's Standards for Students prescribe ways in which teachers should leverage *digital technologies* (e.g., Chromebooks and iPads) to provide P-12 students with opportunities "to seek feedback" (1.1.c), design "innovative artifacts" (1.4.a), and "express themselves creatively" (1.6).

Both sets of ISTE's (2020, 2021) standards prescribe decidedly student-centered, or "student-driven" (ISTE, 2021, para. 1), classroom technology integration practices. To elaborate, ISTE's (2020) Standards for Educators prescribe ways in which teachers should leverage digital technologies to "accommodate learner differences" (2.5.a), "maximize active, deep learning" (2.5.b), and facilitate "hands-on" (2.6.b) student engagement with learning content. Because student-centered technology integration is a central construct pertaining to this problem of practice, this capstone inquiry scopes the multifaceted ISTE (2020, 2021) standards by focusing primarily on how preservice teachers leverage digital technologies to:

- accommodate diverse learning needs (CAST, 2018),
- enact innovative pedagogy (Hughes et al., 2006; Kimmons et al., 2020),
- facilitate hands-on student engagement with learning content (Hughes et al., 2020; Kimmons et al., 2020),

- foster higher-order thinking (Jonassen, 1996; Kimmons et al., 2020; Salomon et al., 1991), and
- empower students with *agency*, or autonomy and control, over the learning process (Hughes et al., 2020; Kohler et al., 2022).

In this capstone report, references to specific sources in the aforementioned list (e.g., Hughes et al., 2006) are indicative of specific aspects of student-centered technology integration (e.g., an emphasis on innovation). I also cite Kopcha et al. (2020) and Warner et al. (2018) frequently to denote distinctions between student-centered and *teacher-centered* technology integration practices. Whereas student-centered technology integration entails higher levels of cognitive and hands-on student engagement via digital technologies (Hughes et al., 2020; Kimmons et al., 2020), teacher-centered technology integration is more likely to involve projection-oriented devices (e.g., Promethean Boards) for teacher-directed activities such as lectures (Kopcha et al., 2020; Warner et al., 2018).

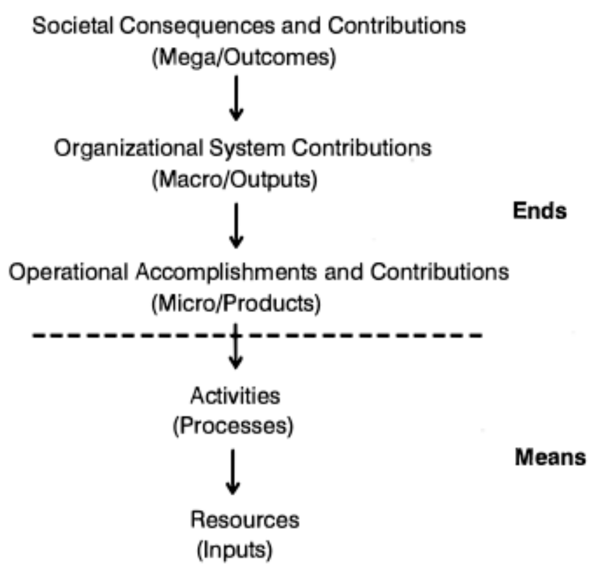
In addition to incorporating seminal theories on student-centered digital pedagogy (Jonassen, 1996; Salomon et al., 1991), ISTE's (2020, 2021) conception of student-centered technology integration also modernizes John Dewey's (1916) century-old attempts to democratize classrooms. This modern progressive pedagogical approach encourages teachers to look for ways to empower students with digital agency, or control, over the learning process (Hughes et al., 2020; Kohler et al., 2022). Hughes et al. (2020) use the term "agency" (p. 558) as a defining characteristic of digitized, "active hands-on learning for creation." On the other hand, Kohler et al. (2022) define digital "agency" (p. 22) as being interchangeable with student "independence" (p. 22). To synthesize these conceptions of the term (Hughes et al., 2020; Kohler et al., 2022), I use *agency* in this report to characterize the varying degree to which students appear to have control over a digitized learning process. For example, students have greater agency over the learning process when they can create digital artifacts (Hughes et al., 2020; Kimmons et al., 2020) as compared to when they engage with skill-and-drill programming (e.g., i-Ready or IXL). For another point of reference, students have zero digital agency when their instructors engage in teacher-centered technology integration practices (Hughes et al., 2020; Kopcha et al., 2020; Warner et al., 2018).

Although the progressive digital pedagogical paradigm can seem “utopian” (Hughes & Read, 2018, p. 1), West Virginia Policy 5100 (2021) requires that the state’s EPPs train preservice teachers to operationalize the student-centered ISTE (2020, 2021) standards and federal law mandates that EPPs train preservice teachers to use digital technologies to support differentiation within the classroom (US Code, 2022). More specifically, federal law requires EPPs to train preservice teachers to operationalize CAST’s (2018) Universal Design for Learning (UDL) Guidelines. The UDL Guidelines prescribe research-based ways in which *adaptive technologies* should be used to meet diverse learning needs. For example, a teacher might allow students to use a computer’s “speech-to-text” (CAST, 2018, 1.2) feature to accommodate learners who have difficulties with typing or spelling.

Beyond compliance with federal and state mandates for EPPs (US Code, 2022; WV Policy 5100, 2021), ISTE’s (2020, 2021) student-centered methodology mirrors CAEP’s (2021) expectation that EPPs train preservice teachers to leverage digital technologies “to maximize active, deep learning” (p. 14) and to accommodate the diverse needs of “all students” (CAEP, 2020a, R1.3). In comparing CAEP’s (2021) phrasing to ISTE (2020) Standard 2.5.b, note that both CAEP and ISTE use identical language in calling for the maximization of “active, deep learning” (CAEP, 2021, p. 14). This similarity reflects CAEP’s and ISTE’s (2020, 2021) shared emphasis on leveraging digital technologies to elicit higher-order thinking. CAEP’s (2020a) standards also explicitly state that EPPs need to be able to demonstrate that their partnerships with P-12 schools produce a “positive impact on diverse P-12 students’ learning and development” (R.3). Thus, there is some tension between CAEP’s standards, which repeatedly call for evidence-based outcomes, and ISTE’s (2020, 2021) student-centered standards, which focus more so on activities that involve hands-on and cognitive engagement with digital technologies (Hughes et al., 2020; Kimmons et al., 2020).

Figure 1.1

Kaufman's (2000) Organizational Elements Model



Note: From *Mega Planning: Practical Tools for Organizational Success* (p. 32), by R. Kaufman, 2000, SAGE Publications, Inc. (https://doi.org/10.4135/9781452220413). ©2000 by SAGE Publications, Inc.

Borrowing from Kaufman's (2000) distinction between *ends* versus *means* (see Figure 1.1), CAEP's (2020a) standards reflect a stronger emphasis on ends, or outcomes, whereas ISTE's (2020, 2021) standards evoke a stronger emphasis on means, or student-centered practices (CAST, 2018; Kimmons et al., 2020). Kaufman (2000), whose Organizational Elements Model is a seminal influence in the performance improvement field, recommends that organizations prioritize their focus on ends rather than means. Kaufman also stresses that performance improvement initiatives should deliberately strive to align ends and means. More specifically, Kaufman recommends that organizations, such as Marbury's EPP, orient their visions and missions towards *mega-level* outcomes. Mega-level outcomes affect the ecosystems surrounding an organization. Kaufman's aim towards the mega level prioritizes service to external beneficiaries (e.g., P-12 students) rather than solely serving *macro-level*, internal interests (e.g., program accreditation).

Consistent with Kaufman's (2000) approach to mega-level planning, the Marbury (2021) EPP's mission statement expressly aligns curricular programming with CAEP's (2020a) standards as part of an overarching plan to equip preservice teachers with the "knowledge, skills, and dispositions to prepare all [P-12] students for a college- and career-ready future" (Marbury, 2021, para. 1). This mission statement aligns mega- and macro-level orientations because it encapsulates both positive P-12 student outcomes (mega level) and compliance with CAEP's (2020a) accreditation standards (macro level). Kaufman (2000) further asserts that *micro-level* products, such as a preservice teacher's technology integration practices, should also align with an organization's targeted mega- and macro-level ends. In applying Kaufman's logic to the technology integration practices of Marbury's preservice teachers, this means that micro-level practices should both contribute to improved P-12 student outcomes and help the EPP demonstrate compliance with accreditation standards (CAEP, 2020a).

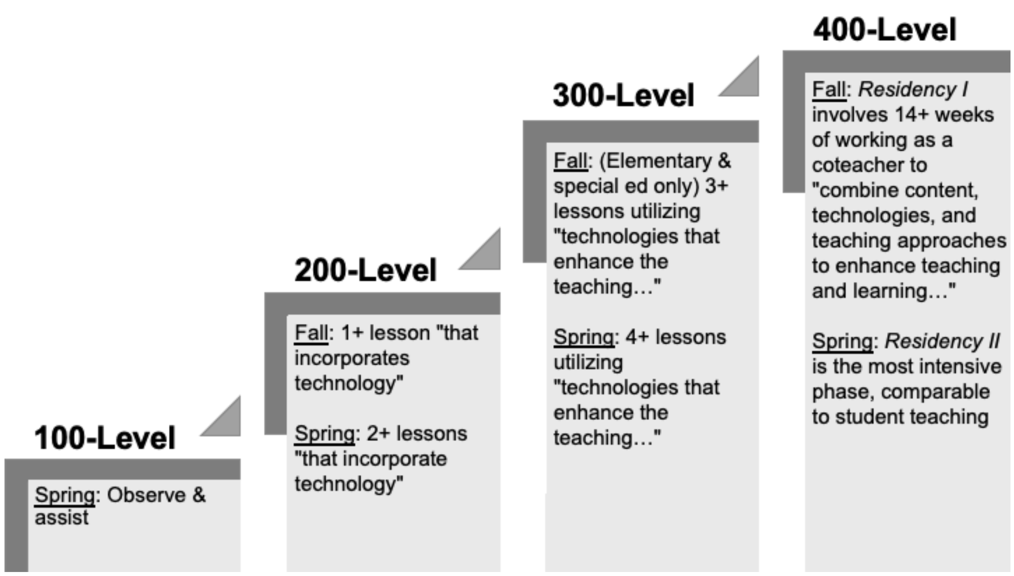
Curricular Programming

To build out Kaufman's (2000) conception of the Organizational Elements Model (see Figure 1.1), *inputs* and *processes* respectively refer to what an organization "uses" and "does" (p. 38). Put in terms of the work of an EPP, Marbury's curricular programming must demonstrate that it uses professional standards from a variety of organizations, including ISTE's (2020, 2021), to comply with macro-level accreditation standards (CAEP, 2020a) and state policy (WV Policy 5100, 2021). Balancing the demands of standards from multiple professional organizations, such as CAEP and ISTE, can be difficult work for an EPP (Comer & Kolodziej, 2022; Elwood & Bippert, 2020). To demonstrate compliance with multiple sets of standards, CAEP officials noted in a previous *Site Visit Report* that most syllabi for Marbury College's education courses included a *crosswalk* (MacKinnon et al., 2018). These crosswalks are typically represented as a grid on syllabi that show how learning goals for a given education course align with multiple sets of standards, including CAEP's (2020a) and ISTE's (2020, 2021).

In examining the 2023-2024 Marbury College (2023) course catalog, it is evident that the course with the most explicit focus on developing preservice teachers' technology integration skills and digital competencies is EDUC 120: Instructional Technology. EDUC 120 is a 3-hour standalone course pertaining to technology integration that is typically taken by Marbury's preservice teachers during either their freshman or sophomore year. Per the Marbury (2023) catalog, EDUC 120 trains preservice teachers to design lessons that are consistent with national- and state-approved technology standards and deploy "technology enhanced teaching and learning strategies" (p. 57). After completing EDUC 120, Marbury's preservice teachers are then expected to leverage digital technologies to enhance teaching and learning as they assume progressively increased levels of responsibility in field experience placements (see Figure 1.2).

Figure 1.2

Field Experience Progression



Per this field experience progression, which is also described in Marbury's (2023) course catalog, preservice teachers are first expected to incorporate digital technologies into lessons that they plan and teach to P-12 students during 200-level field experience placements. This provides opportunities for Marbury's preservice teachers to "model and apply" (CAEP, 2020a, R.1.3) ISTE's (2020) Standards for Educators and ISTE's (2021) Standards for Students. These 200-level field experiences occur during the program's second year.

During their third year in the program, in 300-level field experience placements, Marbury's (2023) course catalog specifies that preservice teachers are expected to utilize digital technologies to "enhance the teaching approaches for the lessons" (p. 60). To support this more advanced expectation for technology integration, Marbury's course catalog also specifies that methods courses (e.g., EDUC 312: Teaching Social Studies) prepare preservice teachers to use digital technologies in discipline-specific ways. This programmatic support and scaffolded progression reflects a commitment to training preservice teachers to "integrate technology effectively in their practice" (CAEP, 2020a, R3.2) and ensures that preservice teachers seeking specialized certification (e.g., physical education) have relevant technology integration skills "in the field(s) where certification is sought" (R.3.3).

Finally, during their fourth year, Marbury's (2023) course catalog states that the program's preservice teachers will "combine content, technologies, and teaching approaches to enhance teaching and learning" (p. 61). The program offers further support to preservice teachers during this 400-level phase through an advanced methods course known as either EDUC 465, EDUC 467, or EDUC 468 depending upon a preservice teacher's major. A large focus of this course involves helping preservice teachers plan and construct a Teacher Work Sample portfolio. These portfolios include lesson plans, instructional artifacts, and rationales that demonstrate how Marbury's fourth-year preservice teachers attain specific instructional objectives in their 400-level field experience placements.

Statement of the Problem

It is noteworthy that many of the Marbury EPP's recent efforts to comply with CAEP's (2020a) standards are responsive to the suboptimal "Accreditation with stipulations"

(*Accreditation Action Report*, 2018, p. 1) rating that the EPP received following CAEP's 2018 audit of the program. Specific critiques of the program were also included in a *Formative Feedback Report* written by CAEP's auditors (MacKinnon et al., 2018). In one salient example of a critique that is pertinent to technology integration, MacKinnon et al. (2018) found that it was unclear how the program's preservice teachers "perform in creating opportunities for students to use technology to enhance learning" (p. 36). In other words, CAEP's auditors found a shortage of evidence to demonstrate that Marbury's preservice teachers could integrate digital technologies into lessons in ways that benefitted P-12 student *learning outcomes*. Learning outcomes are considered by experts (Lai et al., 2022) and practitioners (Kohler et al., 2022) to be the best metric for evaluating the efficacy of educational technology integration practices.

Marbury's EPP regained "Full Accreditation" status with CAEP in the fall of 2020, but a shortage of evidence demonstrating that the program's preservice teachers can leverage digital technologies to improve P-12 student learning outcomes remains a persistent problem. For example, 38% (*n* = 10) of the 26 preservice teachers from Marbury's graduating cohorts of 2019, 2020, 2021, and 2022 did not receive the maximum score of a "4" on the technology integration criterion for their Teacher Work Sample portfolio submissions. That more than one-third of the preservice teachers from these four cohorts fell short of a "4" on this criterion means that the portfolio scorers concluded that 10 preservice teachers' portfolios showed that "Technology is used to engage students" (Marbury College, p. 24), which constitutes a "3" on the program's Teacher Work Sample rubric, but did not not contain sufficient evidence to demonstrate that lessons were being designed in such a way that enabled P-12 students to leverage digital technologies "to *extend*" (Marbury College, 2018, p. 24) their knowledge per language from the Teacher Work Sample rubric. Although this is a seemingly high threshold (earning a "4"), using digital technologies to deepen student understandings is congruent with CAEP's (2021) expectations and ISTE's (2020, 2021) student-centered standards.

Contextualizing the Problem

Findings from research involving other EPPs (Cherner & Curry, 2017; Heath & Segal, 2021; Polly et al., 2020) show that preservice teachers often have difficulty designing lessons that successfully enact the sorts of student-centered practices that ISTE's (2020, 2021) standards prescribe. For preservice teachers, part of the challenge involved with enacting student-centered practices seems to be connected to a common inability of novice educators to perceive how their instructional practices impact student learning (Amador et al., 2015; Fuller, 1969; Hughes et al., 2020). For example, Amador et al. (2015) found that preservice teachers (N = 34) tended to be preoccupied with their own "technical fluency" (p. 103), or technological skills as instructors, rather than having a strong regard for how their technology integration choices could affect student learning outcomes.

Preservice teachers also often lack the requisite classroom management skills that typically accompany successful enactment of student-centered technology integration practices (Heath & Segal, 2021; Shifflet & Weilbacher, 2015). Furthermore, it can be difficult for preservice teachers to conceptualize what student-centered digital pedagogy looks like if they have not seen such approaches modeled successfully in practicum settings (Nelson & Hawk, 2020). From a programmatic standpoint, it can also be challenging for practicum evaluators to understand what constitutes student-centered technology integration if clear definitions and expectations are not explicitly shared between an EPP's teacher educators and the supervisors of practicum experiences (Graham et al., 2009; McGarr & Ó Gallchóir, 2020a).

Another barrier to student-centered digital pedagogy in P-12 settings has historically been a shortage in availability of digital technologies (Ertmer, 1999). Thus, a dearth of digital technologies in the field experience settings surrounding Marbury College may have stifled opportunities for Marbury's preservice teachers to pursue student-centered (CAST, 2018; Kimmons et al., 2020) practices when CAEP last audited the program in 2018. In the interim following CAEP's Marbury audit, the P-12 schools that host field experiences for the EPP's preservice teachers have since adopted *one-to-one* devices as a response to COVID-19. This means that since the 2020-2021 academic year, nearly all P-12 students have had their own personal Chromebooks in the Rural County Schools setting that surrounds Marbury College.

In light of this contextual change, and other efforts to continually improve technology integration skills and digital competencies within Marbury's EPP, it is likely that the program's preservice teachers approached technology integration differently in the fall of 2023 than they did when CAEP audited the program in 2018. If a shortage in availability of digital technologies in practicum settings factored into CAEP's assessment of Marbury's EPP in 2018, then that sort of barrier (Ertmer, 1999) seems to have been drastically reduced by fall 2023. Nevertheless, evidence from CAEP's most recent audit of the Marbury EPP (MacKinnon et al., 2018) and recent graduates' (*n* = 10) TWS portfolio submissions suggest that many of Marbury's preservice teachers lack sufficient technology integration skills and digital competencies to successfully enact student-centered technology integration practices (CAST, 2018; Kimmons et al., 2020).

Purpose of the Current Study

Given the need for a more current appraisal of this problem of practice, the purpose of this case study is to assess the ways in which the Marbury EPP's Class of 2024 and Class of 2025 cohorts approached technology integration in the fall semester of 2023 and to determine what factors seemed to influence their technology integration choices. These cohorts include education majors enrolled in their third and fourth years at Marbury College. The Class of 2024 and Class of 2025 cohorts are better suited for this research than the preservice teachers enrolled in the program's initial two years because they spent more time in field experience settings and assumed a larger share of instructional responsibilities than their counterparts enrolled in the program's initial two years.

This inquiry is compatible with the Marbury (2021) EPP's mission to improve P-12 student outcomes and comply with CAEP's (2020a) accreditation standards. Thus, findings from this research may prove useful to the Marbury EPP's leadership as they continue to iterate curricular plans in anticipation of the program's next CAEP audit in 2025. Beyond an internal institutional focus, findings from this research can also be used to help Marbury's preservice teachers make better informed technology integration choices. Such choices can be impactful for P-12 students in the field experience settings that surround Marbury College.

Research Questions

The following questions drove this inquiry:

RQ1**:** In what ways do Marbury College's preservice teachers use digital technologies with students in field experience settings?

RQ2: What factors do Marbury College's preservice teachers identify as having an influence on their technology integration choices?

Conceptual Framework

Addressing this sort of local problem of practice is characteristic of Ed.D. capstone research, which typically involves a focus on applying what can be learned from existing theories and research to improve circumstances in a local setting (Belzer & Ryan, 2013). Accordingly, rather than working from a *positivistic* paradigm, in which truth is thought to be objective, this case study intends to be pragmatically instructive to local stakeholders and beneficiaries of the EPP at Marbury College (Belzer & Ryan, 2013; Egbert & Sanden, 2020; Mertens & Wilson, 2019). Mindful of this aim, and to enhance the credibility of this study's findings among Marbury's internal stakeholders, this conceptual framework sets out to make my tacit thinking explicit (Check & Schutt, 2017; Ravitch & Carl, 2021). In addition to explaining how my experiences as an adjunct education professor at Marbury College and doctoral student at the University of Virginia affect me as a researcher, this framework also situates research findings using relevant theories (Falloon, 2020; Kimmons et al., 2020; Merriam & Tisdell, 2015).

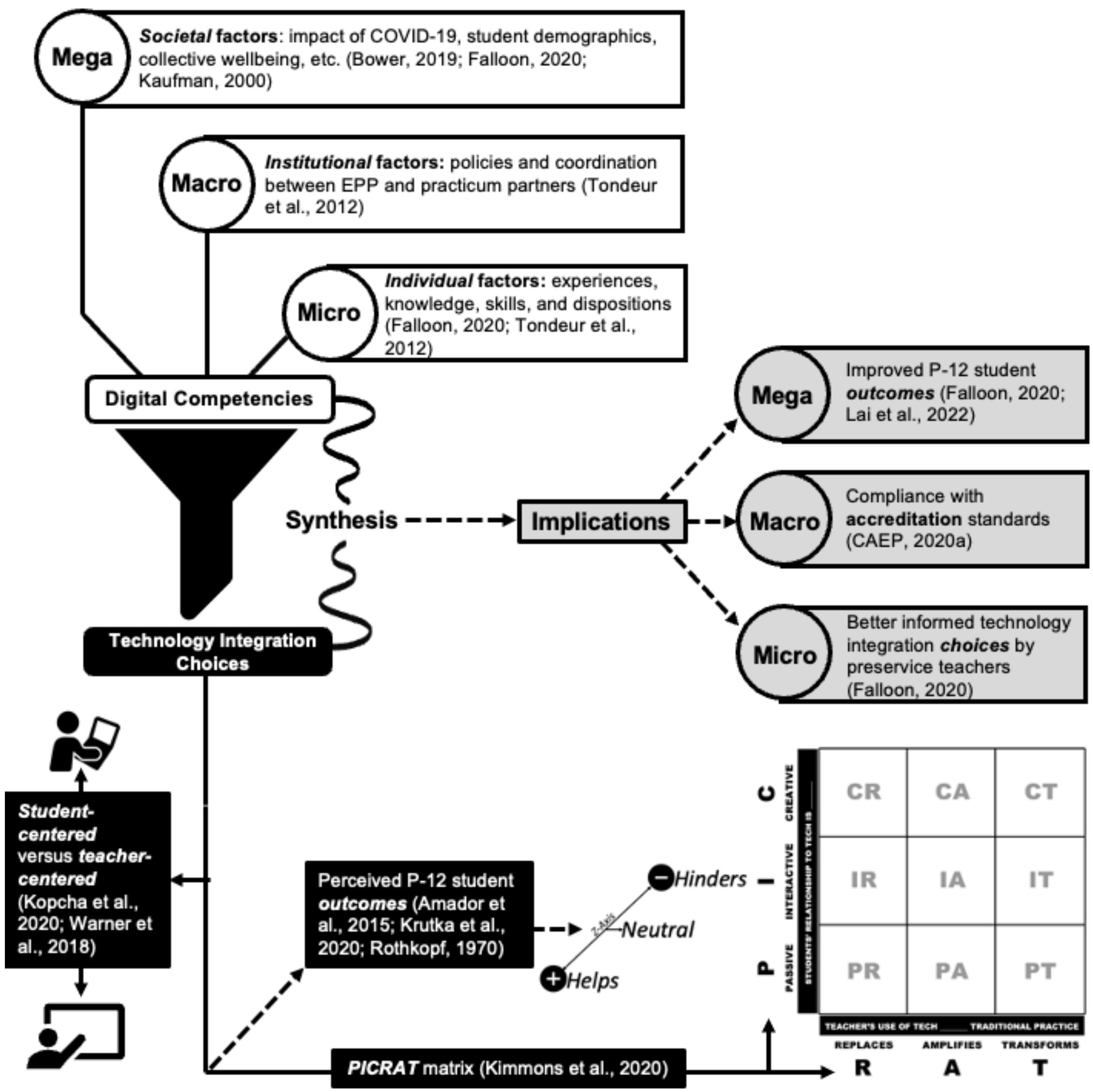
Advanced Organizer

To provide an advanced organizer for readers (Ausubel, 1960), Figure 1.3 depicts an overview of the theories and literature that inform my conceptual framework. Essentially, my conceptual framework consists of three parts. The bottom part of the diagram pertains to my first research question, which calls for specific ways to describe and categorize the technology integration practices of Marbury's preservice teachers (see, e.g., Amador et al., 2015; Kimmons et al., 2020; Kopcha et al., 2020). This bottom part also creates space for considering whether participants and I perceived that their technology integration choices may have hindered P-12 student outcomes (per Amador et al., 2015; Krutka et al., 2020; Rothkopf, 1970). Generally, this focus on student outcomes pertains to P-12 student learning (Lai et al., 2022), but I am also mindful of Krutka et al.'s (2020) influence here. Krutka et al. (2020) encourage teacher educators to help preservice teachers develop a sense of *technoskepticism*, which involves an awareness that digital technologies can endanger people's lives and intrude on personal privacy (Han, 2022). Although this study considers some ways in which technology use can have negative consequences, it is important to emphasize that the primary focus of the data I collected pertains to preservice teachers' technology integration practices and does not attempt to tangibly measure P-12 student outcomes.

Given the potentially negative implications associated with digital technology use, Falloon (2020) encourages teacher educators to train preservice teachers to take a *holistic* view of ways in which an educator's technology integration choices might affect P-12 students' lives (e.g., personal security and wellbeing). Thus, the top part of Figure 1.3 shows how the development of digital competencies can be influenced by a variety of internal and external factors (Falloon, 2020; Kaufman, 2000; & Tondeur et al., 2012). In Figure 1.3, preservice teachers' digital competencies represent the top of a funnel which, in turn, can affect the technology integration choices of each preservice teacher (per Falloon, 2020; Tondeur et al., 2012). Exploring the factors that influence technology integration choices helps answer my second research question. Finally, the grey portion of Figure 1.3., which is situated at center-right, shows how answering both of the questions that drove this inquiry has implications that support improved mega- (Kaufman, 2000; Lai et al., 2022), macro- (CAEP, 2020a), and micro-level outcomes (Falloon, 2020). These implications are discussed primarily in the fifth chapter of this capstone inquiry.

Figure 1.3

Conceptual Framework



Lived Experiences

For further background on how my lived experiences influenced the selection of the theories that shape this conceptual framework, I will begin by recounting a formative experience in the fall semester of 2020. That fall, a salient phrase from a report by CAEP's officials (MacKinnon et al., 2018) piqued my curiosity about this problem of practice. To review, MacKinnon et al. found that it was unclear how Marbury's preservice teachers "perform in creating opportunities for [P-12] students to use technology to enhance learning" (p. 36). Since then, my interpretation (Ravitch & Carl, 2021) of this statement by MacKinnon et al. (2018) has continued to evolve along with my understandings of the theories and research surrounding classroom technology integration.

Initially, I perceived that this local problem of practice stemmed from a shortage of *TPACK*, or technological, pedagogical, and content knowledge (Mishra & Koehler, 2006) on the part of Marbury's preservice teachers. Later, after I developed a better understanding of the Marbury EPP's institutional obligation (CAEP, 2020a; WV Policy 5100, 2021) to prepare preservice teachers to operationalize the International Society for Technology in Education (ISTE, 2020; 2021) standards, I then perceived that the problem was more reflective of the Marbury's EPP inability to train preservice teachers to leverage digital technologies in ways that furthered P-12 students' cognition (Jonassen, 1996; Kimmons et al., 2020). Toward the end of my doctoral studies, I became more aware of ways in which both teacher-centered and student-centered technology integration practices could improve learning outcomes (Kopcha et al., 2020; Lai et al., 2022; Warner et al., 2018) but also came to realize that digital technologies can affect students' lives in negative ways (Dawson et al., 2022; Han, 2022; Krutka et al., 2020). Finally, in conducting this capstone inquiry, I developed a more tangible sense of ways in which adaptive technologies can be used to accommodate diverse learning needs (CAST, 2018).

Although I now have a better understanding of ways in which educators can leverage digital technologies to improve learning outcomes, I also tend to don a more technoskeptical

(Krutka et al. 2020) lens than I did when I first encountered this problem of practice. This technoskepticism makes me inclined to interrogate the common assumption implied by MacKinnon et al. (2018) that digital technologies necessarily *enhance* learning (Bower, 2019; Krutka et al., 2020). Rather than *technology-enhanced learning*, which is a common phrase in the educational technology field (Bower, 2017), Bower (2019) advocates for use of the phrase *technology-mediated learning* to force an anthropocentric recognition that humans control classroom technology integration choices. Along these lines, Bower asserts that digitized design decisions can be made on the front-end, such as when software developers choose to harvest data from P-12 students (Dawson et al., 2022; Han, 2022), or on the back-end, such as when a preservice teacher plans for P-12 students to create digital artifacts (Kimmons et al., 2020).

Thus, at this final stage of my doctoral research, and in light of the University of Virginia's impetus for Ed.D. research to explore problems connected to "equity, ethics, and social justice" (The Carnegie Project, 2022, para. 7), I feel Bower's (2019) technology-mediated learning theory is applicable to my inquiry because it encompasses "sociopolitical elements and individual differences" (p. 1036) and encourages "critical rather than deterministic approaches to learning technology research" (p. 1036). In other words, Bower's (2019) technology-mediated learning lends a conceptual anchor for situating what I find locally against the technology integration issues facing society at this "historical moment" (Ravitch & Carl, 2021, p. 13). This societal-level framing (Bower, 2019) is also congruent with the *teacher digital competency framework* (Falloon, 2020), which is designed specifically for use in teacher education. Like Bower's (2019) theory, Falloon's (2020) teacher digital competency framework enables me to contextualize technology integration norms within my local context against a panoramic consideration of the ethics surrounding technology-mediated learning (Bower, 2019; Falloon, 2020; McDonagh et al., 2021).

Basis in Theory

Two frameworks are particularly useful for framing this capstone inquiry: Kaufman's (2000) Organizational Elements Model and Kimmons et al.'s (2020) *PICRAT* matrix. Kaufman's (2000) delineation between mega-, macro-, and micro-level means and ends helps distinguish between technology integration practices (means) and P-12 student outcomes (ends). Just as Kaufman's model supports categorizations within this broad topic in a systematic way, Kimmons et al.'s (2020) PICRAT matrix helps taxonomize micro-level technology integration practices according to the degree that they support passive, interactive, or creative learning and replace, amplify, or transform traditional teaching practices.

Organizational Elements Model

Kaufman's (2000) Organizational Elements Model is instructive for framing this capstone inquiry in a manner that supports not only the internal organizational interests of Marbury's EPP, but also serves a broader societal interest. Kaufman recommends that an organization's leaders design plans with a focus on an end that has a societal, or *mega-level*, benefit. With this goal in mind, P-12 students can be considered external beneficiaries of the curricular *inputs* of Marbury's EPP. Inputs, according to Kaufman, can include *values*. In terms of values that can affect technology integration choices (Kopcha et al., 2020), Marbury has an institutional obligation (CAEP, 2020a; WV Policy 5100, 2021) to prepare its preservice teachers to enact the student-centered ISTE (2020, 2021) standards. In light of this *macro-level* institutional obligation for Marbury's preservice teachers to enact ISTE's (2020, 2021) standards, the leadership of Marbury's EPP should emphasize student-centered digital pedagogy as a shared programmatic value, or belief that can shape action (CAST, 2018; Kimmons et al., 2020; Kopcha et al., 2020). Aligning the needs of external beneficiaries (e.g., improved P-12 student outcomes), which serves a greater societal good, with macro-level internal organizational interests (e.g., enacting student-centered technology integration practices) is a throughline in Kaufman's (2000) work and in this capstone inquiry.

Although P-12 student learning outcomes are indirectly connected to the Marbury EPP's sphere of influence, producing digitally competent graduates constitutes an output that is more central to the EPP's macro-level mission (Kaufman, 2000). At the *micro level*, evidence of such digital competencies can be seen in the technology integration choices that are made by Marbury's preservice teachers (Falloon, 2020; Kopcha et al., 2020). In this capstone, I liken these technology integration choices to Kaufman's (2000) conception of micro-level *products* because these choices are at least partially shaped by the Marbury EPP's curricular programming (Tondeur et al., 2012). To ensure that Marbury's preservice teachers are prepared to make digitally competent technology integration choices (Falloon, 2020), the EPP is responsible for what Kaufman (2000) refers to as *activities* or *processes*. In terms of curricular programming within an EPP, activities represent the experiences preservice teachers have in Marbury's education courses and in P-12 field experience placements (Tondeur et al., 2012), while processes represent the way that technology integration is modeled and assessed within Marbury's EPP.

Mega-Level Influences and Outcomes. Bower's (2019) technology-mediated learning theory and Falloon's (2020) teacher digital competency framework lend structure to my consideration of how what was happening in P-12 field experience settings might be affected by societal level factors and vice-versa (Kaufman, 2000). The teacher digital competency framework's broad, "socio-cultural stance" (Falloon, 2020, p. 2451) also aligns with Kaufman's (2000) urge for organizations to cultivate symbiotic relationships with their surrounding ecosystems. As this relates to teacher preparation, Falloon (2020) argues that preservice teachers should be trained to consider how their technology integration choices can impact P-12 students' lives.

This sort of prioritization of P-12 student outcomes within an EPP is consistent with the Council for the Accreditation of Educator Preparation's (CAEP, 2020a) standards. Although CAEP's (2020a) standards state that EPPs should have a positive impact on "P-12 student-learning growth” (R4.1), the accrediting body also champions equity and ensuring that preservice teachers can “create safe” (R1.1) learning environments for P-12 students. Thus, a mega-level focus in this capstone inquiry calls for a robust consideration of how technology-mediated learning intersects with ethical issues pertaining to equity and safety (Bower, 2019; Falloon, 2020; Kaufman, 2000). Therefore, rather than focusing myopically on the micro-level technology integration practices of Marbury’s preservice teachers, a mega-level orientation means that I need to also examine societal factors that can affect an educator’s technology integration choices (Falloon, 2020; Kaufman, 2000; Ravitch & Carl, 2021).

To demonstrate how societal factors can impact an educator’s technology integration choices, the literature shows that student-centered practices (Jonassen, 1996; Kimmons et al., 2020) are less likely to occur in schools that have high percentages of students from racially minoritized or low-income families (Hughes & Read, 2018; Rafalow, 2018; Welsh & Harmes, 2018). Although West Virginia is not very racially diverse, at 93% White according to U.S. Census (2019) data, all of the elementary schools that host field experiences for Marbury’s preservice teachers receive Federal Title I funding (WVDE, n.d.). Title I schools are defined as “having high percentages of children from low-income families” (USDE, 2018, para. 1). With this contextual variable in mind, I approached this capstone inquiry with the realization that P-12 student socioeconomic status is a mega-level (Kaufman, 2000) factor that might affect the technology integration choices of Marbury’s preservice teachers.

Beyond scaffolding my exploration of issues pertaining to equity and technology integration, the teacher digital competency framework (Falloon, 2020) also provides a conceptual anchor for contextualizing the sudden influx of digital technologies within West Virginia’s Rural County School district. Rural County Schools, which hosts field experiences for Marbury’s preservice teachers, is like many school systems in the United States in that the district has become newly rich in digital technologies as a byproduct of COVID-19 era spending on education (EdWeek Research Center, 2022b; Teräs et al., 2020; Trombly, 2020). For further background, whereas 45% of K-12 public schools in the United States had one-to-one devices in the 2019-2020 academic year (Gray & Lewis, 2021), 85% of respondents to a survey from a nationally representative sample of educators (*N* = 1,063) indicated that all teachers, students, and leaders in their district had access to personal devices such as Chromebooks or iPads by April of 2022 (EdWeek Research Center, 2022b). Rural County Schools was among the nation's districts that recently acquired one-to-one Chromebooks, having purchased the devices in the 2020-2021 academic year. This trend of purchasing one-to-one devices as a district-wide response to COVID-19 was also common throughout West Virginia (Shaver, 2021).

In terms of providing more *rugged contextualization* for this research setting (Ravitch & Carl, 2021), it is noteworthy that West Virginia ranks 48th out of 50 states in its climate for "technology concentration and dynamism" (Kesteven et al., 2022, p. 43). With U.S. Census data showing that West Virginia is one of only three states that has a declining population (America Counts, 2021), some argue that transitioning away from a coal-fired economy necessitates preparing the populace for work in the knowledge-driven technology sector (Todd et al., 2021). Relatedly, and to be reflexive, I recall optimistically hoping in the fall of 2020 that P-12 students would benefit from the suddenly widespread availability of Chromebooks in Rural County Schools classrooms. On the national scale, such optimism was shared by a majority (55%) of educators (*N* = 2,996) whose survey responses indicated that they felt that improvements in P-12 digital infrastructures would be a sustainable and positive consequence of the global pandemic (EdWeek Research Center, 2022a).

My own optimism waned when I saw how Chromebooks were used, and often not used, in local Rural County Schools classrooms during the 2021-2022 academic year. Over the course of that year, I had several opportunities to enter local classrooms and meet with Marbury's preservice teachers and local inservice teachers as part of my doctoral Field Study. Based upon what I witnessed in formal observations (*N* = 5) and the data I collected through formal and informal interviews (*N* = 20) during the 2021-2022 academic year, I did not perceive that Chromebooks were regularly being leveraged to optimize P-12 student outcomes in Rural County Schools classrooms.

During my Field Study, which sought to improve the way that Marbury's EPP assesses the technology integration skills of its preservice teachers, I also found evidence that there was widespread local frustration with digital technologies in Rural County Schools classrooms. As has been found in other contexts (Bushweller, 2022; Englehardt & Brown, 2019; Haselhorst, 2017), many Rural County educators felt that digital technologies were often a distraction for P-12 students. This sort of frustration inspired a brief experiment with "Tech Free Tuesdays" (Liaison 1, personal communication, Jan. 24, 2023) in a Rural County elementary school that regularly hosts field experiences for Marbury's preservice teachers.

Macro-Level Accreditation and Outputs. Although my own growing sense of technoskepticism (Krutka et al., 2020) has altered the way I view classroom technology integration, the primary motivation that drove my initial exploration of this problem of practice at Marbury College had to do with an evident need to improve the technology integration skills of the EPP's preservice teachers for the sake of maintaining the program's accreditation (MacKinnon et al., 2018). Relatedly, CAEP's officials had identified shortcomings with the processes the EPP used to assess preservice teachers' technology integration skills and noted that the EPP lacked a viable means of monitoring preservice teachers' longitudinal growth (*Accreditation Action Report*, 2018; MacKinnon et al., 2018). Thus, much of the incentive of the Marbury EPP's leadership to work with me as a researcher is inherently tied to an institutional obligation to demonstrate continuous programmatic improvements and compliance with CAEP's (2020a) standards. Accordingly, from the time I began researching this problem of practice in the fall semester of 2020, CAEP compliance has figured prominently into my conversations with the program's leaders.

Therefore, to ensure that my research is mindful of Marbury's macro-level institutional interest in maintaining accreditation, I used what ISTE (2021) refers to as "algorithmic thinking"

(1.5.a) to align CAEP's (2020a) relevant technology integration standards with examples of what compliance with these standards should look like on Marbury's campus and in surrounding P-12 field experience settings. More specifically, as shown in Appendix A, I applied a series of "If…," "then…," and "therefore…" propositions that connect CAEP's (2020a) standards to researchable and observable phenomena. For example, *if* Marbury's preservice teachers "model and apply national or state approved technology standards" (CAEP, 2020a, R1.3), *then* these preservice teachers should be operationalizing the ISTE (2020, 2021) standards because they were approved by West Virginia's Board of Education (2021). *Therefore*, lessons designed by Marbury's preservice teachers should embody a student-centered (CAST, 2018; Kimmons et al., 2020) approach to digital pedagogy because ISTE's (2020, 2021) standards are decidedly "student-driven" (ISTE, 2021, para. 1).

Aiming toward student-centered (CAST, 2018; Kimmons et al., 2020) technology integration practices helps clarify expectations for what effective technology integration should look like within Marbury's EPP. Along similar lines, Professor Alpha and Professor Zeta, who respectively taught EDUC 120: Instructional Technology at Marbury College in the spring of 2022 and the spring of 2023, introduced Marbury's preservice teachers to the PICRAT matrix (Kimmons et al., 2020). PICRAT taxonomizes classroom technology integration based on the ways that digital technologies mediate teaching and learning (Bower, 2019; Kimmons et al., 2020). PICRAT is typically considered to be more student-centered than the TPACK framework (Cherner & Mitchell, 2021; Kimmons et al., 2020; Mishra & Koehler, 2006), but several of TPACK's constructs such as *technological content knowledge* are useful for gauging compliance with CAEP's (2020a) standard that preservice teachers are digitally competent "in the field(s) where certification is sought" (R3.3). Falloon's (2020) teacher digital competency framework encompasses TPACK, along with a broader consideration of issues that pertain to individual and societal wellbeing. These broader considerations are important, as Falloon asserts, because much has changed in the educational technology landscape since Mishra and

Koehler (2006) developed the TPACK framework and preservice teachers increasingly need to be aware that digital technologies can pose dangers for P-12 students (Han, 2022; Krutka et al., 2020; Yadav & Lachney, 2022).

Finally, in terms of using CAEP's (2020a) standards to orient my consideration of the Marbury EPP's macro-level mission (Kaufman, 2000), Marbury's EPP needs to have the digital infrastructure to support "faculty and candidate use of information technology for instruction" (R6.4). This means that there should be sufficient digital technologies and digital infrastructure, such as high-speed internet, available both on Marbury's campus and in field experience settings to enable technology-mediated learning (Bower, 2019; CAEP, 2020a). Although there have recently been vast improvements on these fronts in the practicum settings that surround Marbury's EPP, I was careful to inquire as to whether adequate digital infrastructure was in place in field experience host sites and on Marbury College's campus.

Micro-Level Experiences. In transitioning from macro-level circumstances to micro level experiences, Tondeur et al.'s (2012) Synthesis of Qualitative Data (SQD) model is helpful for identifying six programmatic strategies that have been found to benefit the development of preservice teachers' digital competencies within an EPP. These six strategies are based on a synthesis of prior qualitative studies (n = 19). In short, Tondeur et al. found that improvements in preservice teachers' digital competencies could be linked to their experiences with feedback, collaboration, instructional design, role models, authentic experiences, and reflection. These six types of micro level experiences helped to define the scope of my literature review, influenced my adaptation of survey prompts (Tondeur et al., 2016), and ultimately proved useful for assessing the types of experiences that Marbury's preservice teachers reported having within the EPP.

***Knowledge, Skills, and Dispositions*.** Provided that a given context has adequate digital infrastructure (Ertmer, 1999), a preservice teacher's technology integration choices can be largely affected by how much they know about teaching with digital technologies (Falloon, 2020; Mishra & Koehler, 2006), their skills in enacting specific approaches to digital pedagogy (per Kimmons et al., 2020), and their *dispositions*, or beliefs and attitudes, toward using digital technologies with P-12 students (Falloon, 2020). Although much of the relevant literature (see, e.g., Foulger et al., 2019; Mouza et al., 2017; Thomas & Trainin, 2019) centers on preservice teacher's TPACK, or the knowledge component of being digitally competent, this capstone inquiry is more aligned with Kimmons et al.'s (2020) emphasis on instructional practices. Kimmons et al. (2020) recommend that teacher educators use the PICRAT matrix to "prescriptively guide" and "evaluate" (p. 184) technology integration practices based largely on what P-12 students "are doing with the technology" (p. 184). Thus, in terms of assessing what preservice teachers can *do* (per Wiggins & McTighe, 2011), PICRAT is a useful gauge for appraising "student-focused" (p. 184) technology integration practices "at the activity level" (Kimmons et al., 2020, p. 190).

The degree that an educator subscribes to more student-centered or teacher-centered beliefs about digital pedagogy can also affect their technology integration choices (Kopcha et al., 2020; Nelson & Hawk, 2020; Shifflet & Weilbacher, 2015). Thus, through open-ended survey responses and interview accounts, part of what this inquiry sought to determine is whether any patterns were discoverable in terms of whether participant dispositions toward digital pedagogy were more student- or teacher-centric (Kopcha et al., 2020; Warner et al., 2018). Dispositions are also assessed in this inquiry, per Falloon's (2020) framework, according to the degree that preservice teachers adopted stances that might be considered *technocentric* (Papert, 1987), or favorable toward technologies, versus technoskeptical (Krutka et al., 2020). Each of these dispositions will be explored further in Chapter 2. In short, this conceptual framework is in line with Falloon's (2020) view that preservice teachers should be taught to evaluate digital technologies with objectivity.

Micro Level Products

In addition to looking at the ways in which curricular programming and inputs shaped participant experiences, this capstone inquiry focused largely on looking for evidence of P-12 student and instructor uses of digital technologies that were discoverable in preservice teachers' survey responses, written lesson plans, interview responses, and observations. These examples of ways in which participants' technology integration choices impacted instructional practices fit with what Kaufman (2000) calls a micro level *product*. According to Kaufman, products represent "the building-block results that form the basis of what an organization produces, delivers inside as well as outside itself, and the payoffs for external clients and society" (p. 31). In short, per Kaufman (2000), technology integration practices are micro level products that are delivered to external beneficiaries in field experience settings.

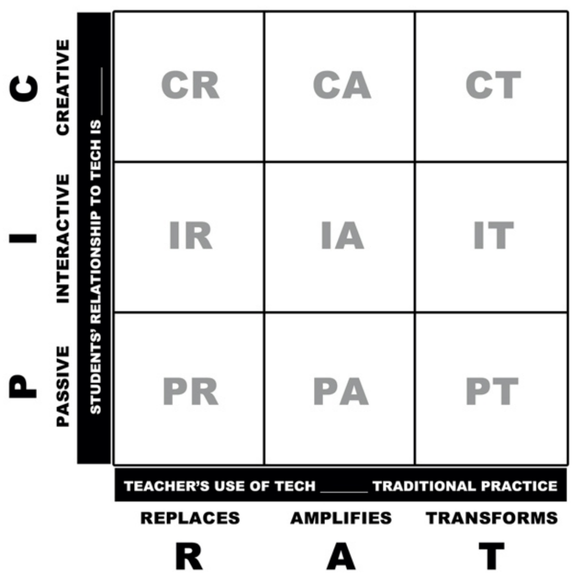
The PICRAT Matrix

In terms of selecting *a priori codes*, the *PICRAT* matrix (Kimmons et al., 2020) is especially useful for answering this capstone's first research question, which looks at the ways in which Marbury's preservice teachers use digital technologies with P-12 students in field experience settings. As seen in Figure 1.4, PICRAT adds a vertical axis to Hughes et al.'s (2006) RAT model. This PIC axis affords a consideration of whether students' cognitive engagement with digital technologies is *passive, interactive*, or *creative*. Passive learning, such as when a preservice teacher uses Google Slides during a lecture, positions P-12 students as passive recipients of information (Kimmons et al., 2020) and is commonly associated with teacher-centric instructional practices (Kopcha et al., 2020; Warner et al., 2018). More interactive approaches to technology integration scaffold opportunities for students to interact directly with content, instructors, or their peers (Kimmons et al., 2020; M. Moore, 1989).

Although Kimmons et al.'s (2020) matrix frames creative and transformative activities as being desirable destinations for student-centered learning (Hughes et al., 2006; Jonassen, 1996; Salomon et al., 1991), Kimmons et al. (2020) also posit that sound pedagogy "should include activities that span the entire matrix" (p. 190). To elaborate, both passive and interactive learning tasks can scaffold later opportunities for P-12 students to create *digital artifacts* that exhibit higher-order thinking (Kimmons et al., 2020; Papert, 1993). Using digital technologies for this sort of project-based creation is consistent with the goals of ISTE's (2020, 2021) student-centered standards. Such artifacts might include a campaign commercial, a screencast, or an infographic (Cherner & Curry, 2017; Eaton, 2017; Walsh-Moorman et al., 2020). These kinds of digital artifacts also typify *transformative* technology integration because they would be far more difficult, if not impossible, to create without digital technologies (Hughes et al., 2006; Kimmons et al., 2020).

Figure 1.4

The PICRAT Matrix



Note. From *Royce Kimmons: Understanding Digital Participation Divides*, by R. Kimmons, n.d., (http://roycekimmons.com/technologies/picrat). CC BY 3.0.

In terms of gauging the degree that technology integration is innovative, Hughes et al.'s (2006) *RAT* model is also useful in this capstone inquiry because the model enables sorting technology integration practices according to whether they *replace*, *amplify*, or *transform* more traditional low-technology, or no-technology, practices (Kimmons et al., 2020). In this RAT taxonomy, replacement is seen as a lateral move wherein the use of digital technologies does not evidently improve teaching or learning (Hughes et al., 2006). To move beyond replacement toward amplification, digital technologies should contribute to improved instructional efficiency or learning outcomes; to move beyond amplification, transformative technology integration occurs when teachers and students pursue learning goals that would not be reasonably possible without access to digital technologies (Hughes et al., 2006; Kimmons et al., 2020).

The theories that undergird PICRAT's (Kimmons et al., 2020) student-centered lens marry over a century's worth of progressive pedagogical influences (Dewey, 1899, 1916; Rousseau, 1762/2019) to late 20th Century ideals about the potential for personal computers to further students' cognitive capacities (Jonassen, 1996; Salomon et al., 1991). Seminal influencers like David Jonassen (1996) cast computers as *mindtools* that can be used to offload lower-order thinking tasks, such as sorting data, to thereby enable learners to devote more cognitive bandwidth toward solving real-world problems (Jonassen, 1997; Salomon et al., 1991). As a lingering effect of engagement with these mindtools (Jonassen, 1996), Salomon et al. (1991) posit that *cognitive residue* in the form of enhanced mental capabilities or novel schema can take root in learners' minds.

An emphasis on searching for physical evidence of cognitive residue, or learning, distinguishes Papert's (1993) *constructionism* from Piaget's (1976) largely similar *constructivist*, or discovery-oriented, paradigm. Constructionism is comparable to constructivism in that both theories seek "to produce the most learning for the least teaching" (Papert, 1993, p. 139). Both constructionism and constructivism also align with ISTE's (2020, 2021) student-centered digital pedagogy, but PICRAT's creators expressly favor constructionism's emphasis on tangible learning artifacts (Kimmons et al., 2020). Relatedly, and in terms of making technology integration researchable, Papert's (1993) assertion that learning artifacts "can be shown, discussed, probed, and admired" (p. 142) helps remove abstractions associated with attaining discovery-oriented learning goals (Mayer, 2004; Piaget, 1976).

In accordance with the scope of this study, I will not attempt to capture this sort of tangible evidence of P-12 student cognitive growth (Bower, 2019; Kimmons et al., 2020). To elaborate, this inquiry does not attempt to empirically show causal links between the practices of Marbury's preservice teachers and outcomes for P-12 students. As mentioned previously, this inquiry deliberately interrogates the assumption that technology *enhances* learning, a *technocentrist* bias that has long been pervasive in the discourse surrounding educational technologies (Bower, 2019; Kimmons et al., 2020; Papert, 1987). To be more precise, the first research question assesses the *technology-mediated learning* tasks that Marbury's preservice teachers designed for use in P-12 practicum settings (Bower, 2019). Bower recommends this emphasis on mediation rather than enhancement to mitigate the longstanding trend toward technocentric bias within the field (Harris & Phillips, 2018; Kimmons et al., 2020; Papert, 1987).

It is also important to acknowledge that PICRAT (Kimmons et al., 2020), like other educational technology frameworks (Cherner & Mitchell, 2021), has its own limitations. As a case in point, despite Kimmons et al.'s (2020) desire to avoid a technocentric framing, the PICRAT model implicitly taxonomizes classroom technology integration according to the degree that P-12 students use digital technologies for tasks that elicit higher-order thinking and transform traditional instructional practices. Though using digital technologies to further student cognition and support innovation are central tenets of student-centered digital pedagogy (Hughes et al., 2006; Jonassen, 1996; Salomon et al., 1991), the assertion that educators should strive to be more innovative warrants interrogation (Clark & Feldon, 2014; Oliver, 2011; Watkins, 1997).

Technoskepticism

To briefly expound, in addition to focusing on using digital technologies to support instructional innovations (Amador et al., 2015; Borup et al., 2022; Cherner & Curry, 2017), the literature on technology integration is also rife with examples of educators finding that digital technologies can be a distraction (see, e.g., Amador et al., 2015; Englehardt & Brown, 2019; Haselhorst, 2017). Furthermore, a relatively small, *technoskeptical* (Krutka et al., 2020) subset of educational researchers (Clark & Feldon, 2014; Harris, 2005; McGarr & Ó Gallchóir, 2020b) argue that there has been too much emphasis on using digital technologies to spur classroom innovations. To account for diverging viewpoints about the ways in which technology integration can impact P-12 student outcomes, the conceptual framework that guides this study therefore includes a consideration, as seen in Figure 1.5, of ways that preservice teachers at Marbury College and I (as the researcher) perceived that digital technologies helped, hindered, or had a seemingly neutral impact on teaching and learning (Clark, 1989; Oliver, 2011).

Figure 1.5

Perceptions About Technology Integration Choices

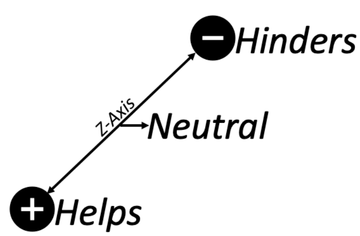
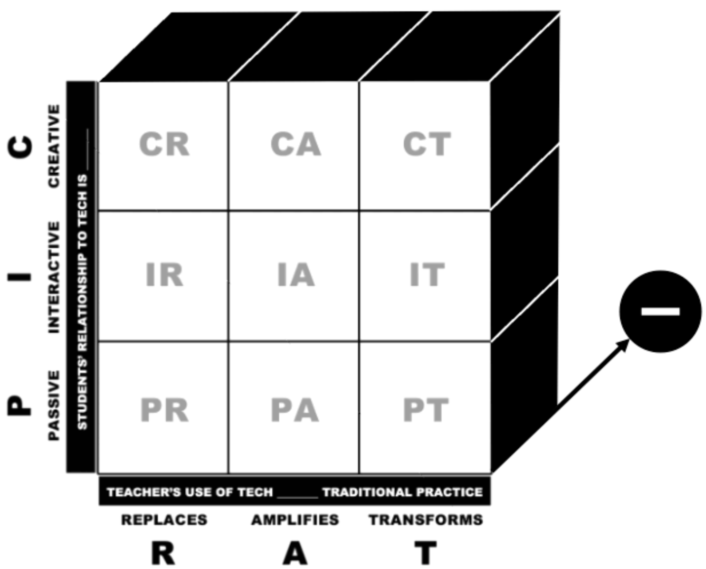


Figure 1.5 draws inspiration from qualitative accounts of research with preservice teachers that began without *a priori* codes for considering how digital technologies could be a hindrance (Amador et al., 2015; Englehardt & Brown, 2019). In both Amador et al.'s (2015) and Englehardt and Brown's (2019) studies, a common theme emerged inductively from preservice teachers' written reflections and interview data: digital technologies were often perceived to be a distraction. With these studies in mind, I wanted to avoid a technocentric bias (Bower, 2019; Papert, 1987) when developing interview questions and choosing survey prompts to help answer my second research question. Whereas the first research question, which pertains to classroom technology integration practices, can be framed largely through PICRAT's x- and y-axes (Kimmons et al., 2020), the second research question explores the factors that influenced

the technology integration choices of Marbury's preservice teachers. Adding an additional z-axis to the PICRAT matrix, as shown in Figure 1.6, enabled me to account for various instances in which the technology integration choices of Marbury's preservice teachers appeared to be affected by the perception that digital technologies could hinder P-12 student outcomes.

Figure 1.6

PICRAT with a Negative Z-Axis



Note. Adapted from *Royce Kimmons: Understanding Digital Participation Divides*, by R. Kimmons, n.d., (http://roycekimmons.com/technologies/picrat). CC BY 3.0.

Like PICRAT's existing axes (Kimmons et al., 2020), the addition of a z-axis to the PICRAT matrix supports my combination of relatively recent theorization (Bower, 2019; Falloon, 2020) with older, seminal works (Clark, 1989; Rothkopf, 1970). More specifically, the recognition that instructional interventions can help, hinder, and have neutral implications for teaching and learning simplifies the language of Rothkopf (1970) and Clark (1989). Whereas Rothkopf (1970) coined the term *mathemagenic* to describe activities that give birth to learning, Clark (1989) introduced the grimmer *mathemathantic* to describe instruction that kills learning. Though this technoskeptical angle is often overlooked in the literature pertaining to technology integration (Bower, 2019; Krutka et al., 2020), digital technologies can hinder learning and sometimes even propagate harm (Han, 2022; Krutka et al., 2020; Yadav & Lachney, 2022). Given these unpleasant realities, ethical quandaries surrounding digital technologies should figure into a robust study of classroom technology integration (Bower, 2019; Falloon, 2020; McDonagh et al., 2021).

Micro Level Heterogeneity. Although this research set out to identify common trends among two cohorts of Marbury's preservice teachers in the fall semester of 2023, it is also important to note that there is vast "heterogeneity" (Bower, 2019, p. 1045) in terms of how technology-mediated learning is designed by educators and experienced by learners (Hughes et al., 2020; Nelson & Hawk, 2020; Wekerle & Kollar, 2022). For example, a PICRAT code of *creative-transformative* in one preservice teacher's lesson plan does not guarantee that all P-12 students who experienced that lesson engaged in higher-order thinking with digital technologies (Bower, 2019; Kimmons et al., 2020). Relatedly, the literature shows that some preservice teachers benefit more from seeing technology integration modeled in educational settings than their peers (Amador et al., 2015; Buss et al., 2018; Polly et al., 2020). To account for individual-level deviations from the norm, this capstone inquiry's qualitative methods intentionally support analysis at the individual level (D. R. Hancock et al., 2021; Polly et al., 2020). To summarize, whereas PICRAT codes (Kimmons et al., 2020) and Likert-scale survey responses (Tondeur et al., 2016) helped quantify trends within Marbury's EPP during the fall of 2023, qualitative data captured the micro level variability of lived experiences for participants in this case study (Egbert & Sanden, 2020; Hancock et al., 2021).

Definition of Key Terms

This section defines key terms that are central to this research.

Agency: the varying degree to which students appear to have control over a digitized learning process (Hughes et al., 2020; Kohler et al., 2022).

Digital Competencies: is a comprehensive term that encompasses an educator's knowledge about teaching with digital technologies (Mishra & Koehler, 2006), ability to use digital technologies to improve learning outcomes (Lai et al., 2022), and dispositions toward new digital technologies (Falloon, 2020). Falloon argues that a digitally competent educator tempers enthusiasm for technology integration with a sense of objectivity about the ways in which digital technologies can impact teaching, learning, and collective “safety and wellbeing” (p. 2452).

Digital Technologies: is a term that is synonymous with *classroom technologies* (Vongkulluksn et al., 2022), *digital tools* (ISTE, 2021) and what European researchers often refer to as *information and communications technologies (ICT)* (McGarr & Ó Gallchóir, 2020b; Tondeur et al., 2021). Tangible examples of digital technologies (Bower, 2019; Falloon, 2020) include personal computers such as Chromebooks or iPads and more presentation-oriented devices such as Promethean Boards.

Educator Preparation Provider (EPP): a program with the central mission of preparing future educators for work in P-12 settings (CAEP, 2020b). Generally, these programs are found at institutions of higher education.

Field Experiences: refers to time that preservice teachers spend afield in P-12 practicum settings doing activities such as observing, assisting, or guiding instruction (CAEP, 2020b). These practicum experiences are known as *field experiences*, or lab classes, within Marbury’s context.

Inservice Teacher: a professional teacher who works in a P-12 setting (IGI Global, n.d.-a).

Macro Level: Kaufman (2000) uses this term to describe outputs at the organizational or institutional level, such as digitally competent graduates. In this capstone inquiry, macro-level plans and measures also describe coordination “*within and between* [*sic*]” (p. 4) Marbury’s EPP and the P-12 schools that host field experiences.

Mega Level: Kaufman (2000) uses this term to frame an organization’s impact on outcomes at the societal level. This capstone also uses *mega level* to encompass what Falloon (2020) and Bower (2019) refer to as *sociocultural* factors (e.g., student demographic characteristics) that can influence an educator’s technology integration choices.

Micro Level: Tondeur et al. (2012, 2016) uses this term to describe experiences that are unique to a specific individual or small group, such as tasks that are completed in a particular class (Christensen & Trevisan, 2023). Micro-level products (per Kaufman, 2000) in this capstone include preservice teachers' technology integration practices.

Preservice Teacher: an undergraduate or graduate student who aspires to become a professional educator (IGI Global, n.d.-b).

Student-Centered Technology Integration: a progressive approach to learning with digital technologies that emphasizes innovation (Hughes et al., 2006); hands-on P-12 student engagement (Hughes et al., 2020), higher-order thinking (Jonassen, 1996; Kimmons et al., 2020; Salomon et al., 1991), and accommodating diverse learning needs (CAST, 2018).

Teacher-Centered Digital Pedagogy: an approach to teaching with digital technologies that typically involves teacher-led activities, such as lecturing via PowerPoint slides (Kopcha et al., 2020; Warner et al., 2018).

Teacher Educator: a professional whose career is devoted to improving the knowledge, skills, and dispositions of current or aspiring educators (Grossman et al., 2018).

Technocentric: the tendency to ascribe achievements in areas such as teaching or learning to digital technologies rather than humans (Kimmons et al., 2020; Papert, 1993).

Technoskepticism: directing "attention to the downsides, constraints, or cultural characteristics that technologies extend, amplify, or create" (Krutka et al., 2020, p. 111).

Technology Integration: a deliberate attempt to use digital technologies in an instructional setting to facilitate teaching or learning (Bower, 2017). This term is used somewhat interchangeably with technology-mediated learning in this inquiry (Bower, 2019).

Technology-Mediated Learning: Bower (2019) recommends using this term rather than *technology-enhanced learning* to avoid the assumption that technologies necessarily improve learning. As mediators of learning, digital technologies link people with one another and provide mechanisms for conveying information.

Chapter Summary

To summarize, this chapter outlines a problem of practice identified by the Council for the Accreditation for Educator Preparation (CAEP) in its 2018 audit of the Marbury educator preparation provider (EPP). According to CAEP's auditors (MacKinnon et al., 2018), there was insufficient evidence to demonstrate that Marbury's preservice teachers were able to use digital technologies in field experience settings to improve P-12 student learning outcomes. This problem of practice, which is reflective both of preservice teachers' technology integration skills and their digital competencies (Falloon, 2020; Kimmons et al., 2020), appeared to be persistent as evidenced by Teacher Work Sample portfolio submissions from the program's graduating 2019 through 2022 cohorts.

After describing this local problem of practice, this chapter also explains how my own views of this challenge have evolved and, in turn, influenced the development of my conceptual framework (Ravitch & Karl, 2021). This conceptual framework (see Figure 1.3) uses Kaufman's (2000) Organizational Elements Model to illustrate how mega-level outcomes, macro-level outputs, and micro-level products can influence preservice teachers' digital competencies and, consequently, their technology integration choices and practices (Falloon, 2020; Kimmons et al., 2020). At the macro and micro levels, Tondeur et al.'s (2012) Synthesis of Qualitative Data model is also useful for illustrating how micro-level experiences within Marbury's EPP can influence the development of a preservice teacher's digital competencies. In turn, specific kinds of experiences with digital technologies in Marbury's coursework and programming are reflective of goals and shared values within the EPP (Kaufman, 2000; Tondeur et al., 2012).

In terms of goals and values, Kaufman's (2000) recommendation to center organizational planning around mega-level outcomes is consistent with the expressed goals of the Marbury (2021) EPP's mission statement: to equip preservice teachers with the "knowledge, skills, and dispositions to prepare all [P-12] students for a college- and career-ready future" (para. 1). The Marbury EPP's goal of improving P-12 student outcomes is also consistent with

CAEP's (2020a) accreditation standards and supports the alignment of mega and macro-level aims (Kaufman, 2000). In terms of micro-level products, the technology integration practices of Marbury's preservice teachers can be assessed partly on the basis of whether they are more teacher-centered or student-centered (Kopcha et al., 2020; Warner et al., 2018). The impetus toward making student-centered choices (CAST, 2018; Kimmons et al., 2020) embodies what Kaufman (2000) considers a values-based input and demonstrates compliance with ISTE's (2020, 2021) standards, state policy (WV Policy 5100, 2021), and federal law (US Code, 2022). Despite these authoritative pressures to favor student-centered digital pedagogy (CAST, 2018; Kimmons et al., 2020), this capstone inquiry aims to assess technology integration practices with objectivity and the utmost regard for holistic P-12 student outcomes (Bower, 2019; Falloon, 2020; Lai et al., 2022).

CHAPTER 2: LITERATURE REVIEW

This literature review consists of two broad sections that pertain to an educator's development of digital competencies and their classroom technology integration practices. Per my conceptual framework (see Figure 1.3), Kaufman's (2000) Organizational Elements Model is central to this line of inquiry. Therefore, the first section of this review focuses on the mega-, macro-, and micro-level factors that can influence the development of an educator's digital competencies (Falloon, 2020; Tondeur et al., 2012). Given the Marbury College educator preparation provider's institutional obligation (CAEP, 2020a; WV Policy 5100, 2021) to train preservice teachers to enact the student-centered International Society for Technology in Education (ISTE, 2020; 2021) standards, the second section then focuses on an educator's technology integration practices, placing a stronger emphasis on student-centered as compared to teacher-centered digital pedagogy (Kopcha et al., 2020; Warner et al., 2018). In making this distinction, Kimmons et al.'s (2020) PICRAT matrix lends objectivity for sorting the degree that specific practices are "student-focused" (p. 184) and "innovative" (p. 192). In both sections of this review, other educational technology frameworks that are common in the literature, such as TPACK (Mishra & Koehler, 2006), prove useful for exploring digital competencies and technology integration practices through a variety of lenses. Finally, this review draws upon empirical research involving inservice teachers (see, e.g., Borup et al., 2022; Karchmer-Klein & Konishi, 2021; Rafalow, 2018) but centers primarily on what can learned from research involving preservice teachers (see, e.g., Cherner & Curry, 2017; Polly et al., 2020; Thomas & Trainin, 2019).

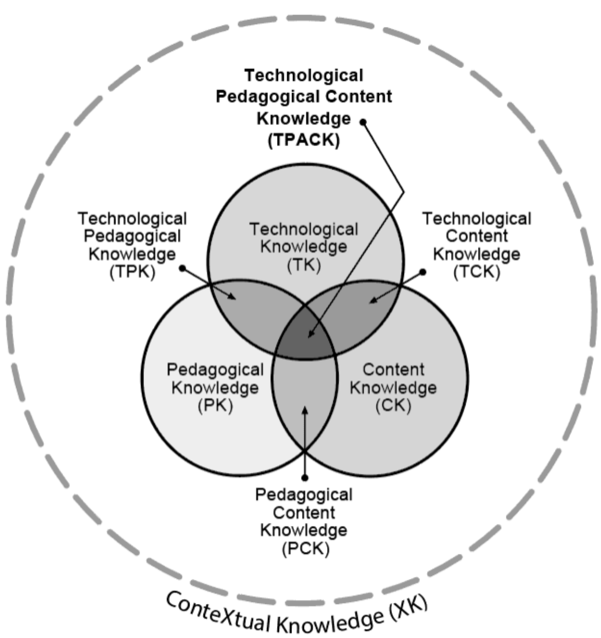
Developing an Educator's Digital Competencies

While frameworks like PICRAT are useful for appraising preservice teachers' technology integration skills (Kimmons et al., 2020), educator preparation providers (EPPs) more typically assess what preservice teachers *know* about technology integration using TPACK's seven constructs (Buss et al., 2018; Mouza et al., 2017; Thomas & Trainin, 2019) as shown in Figure

2.1. Falloon (2020) argues that while TPACK's constructs remain relevant, EPPs should expand their focus beyond technological knowledge and skill development. Falloon suggests that more emphasis should be devoted toward ensuring preservice teachers develop a nuanced *disposition* toward technology integration. Along these lines, Falloon's (2020) teacher digital competency framework, which was designed specifically for use in EPPs, creates space for examining how a preservice teacher's technology integration choices may be influenced by and have implications for surrounding ecosystems. To situate these various ways of digital doing, knowing, and understanding against what is happening at a societal level, it is helpful to organize the relevant literature using Kaufman's (2000) mega-, macro-, and micro-level framing.

Figure 2.1

Mishra's Revised TPACK Diagram



Note: From "Revised Version of the TPACK Image" by P. Mishra, 2018, (https://punyamishra.com/2018/09/10/the-tpack-diagram-gets-an-upgrade/). © 2018 by Punya Mishra. Reprinted with permission.

Mega-Level Outcomes and Influences

Kaufman's (2000) model, which emphasizes aligning internal objectives with the aim of having a *mega-level* impact on society, is a seminal influence in the performance improvement field (see, e.g., Guerra & Rodriguez, 2005; Guerra-López, 2018). Comparable to Kaufman's (2000) mega-level thinking, Falloon's (2020) teacher digital competency framework calls for EPPs to broaden their curricula by striving to raise preservice teachers' awareness of the ways in which their technology integration choices can have a societal impact. In the wake of COVID-19, this sort of societal-level framing is increasingly common in the literature (Krutka et al., 2020; McDonagh et al., 2021; Yadav & Lachney, 2022), but examples of best practices for cultivating this sort of sociocultural awareness within an EPP are scant (Deng & Zhang, 2023; Jung et al., 2020). Nonetheless, a growing subset of educational researchers and theorists has recently begun to challenge longstanding and widely held technocentric assumptions about classroom technology integration (Bower, 2019; Krutka et al., 2020; McGarr & Ó Gallchóir, 2020b). These more technoskeptical authors encourage teacher educators to interrogate the common assumption that digital technologies will inevitably improve the lives of individuals and societies (Bower, 2019; Krutka et al., 2020). Put in terms of the curricular programming within an EPP, there has been a growing emphasis on training preservice teachers to think more critically about the pros and cons of digital technologies (Falloon, 2020; Krutka et al., 2020; Yadav & Lachney, 2022).

While some assert that the complex task of building a broader awareness about the societal-level implications associated with a preservice teacher's technology integration choices necessitates a program-wide focus within an EPP (Falloon, 2020; Sprague et al., 2022; Yadav & Lachney, 2022), Krutka et al. (2020) argue that social studies teacher educators, in particular, should be charged with instilling a sense of technoskepticism in preservice teachers. In light of some of the negative effects of the suddenly increased role for digital technologies in classrooms brought on by the pandemic (Gleason & Heath, 2021; Han, 2022), Krutka et al.

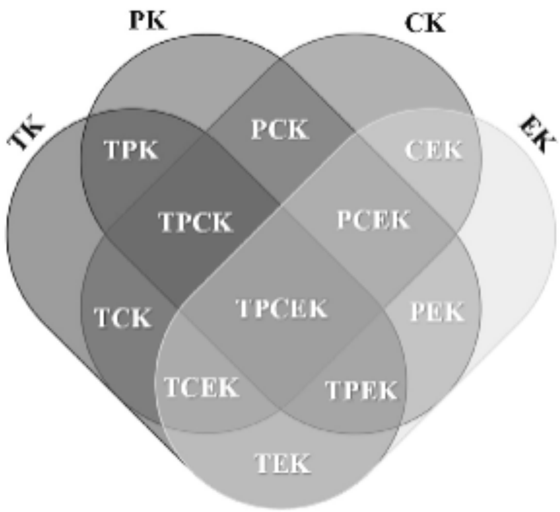
(2020) recommend that both higher education and P-12 social studies classrooms focus more explicitly on exploring the ways in which new technologies can have potentially harmful societal effects.

In terms of determining whether the ethical implications of technology-mediated learning should be addressed throughout an EPP (Bower, 2019; Falloon, 2020), it is important to note that survey research by Carpenter et al. (2020) indicated that many of the 336 teacher educators who responded to the survey felt it was highly important for education courses to "address the legal, ethical, and socially-responsible use of technology in education" (p. 7). Despite this widespread agreement with Falloon's (2020) argument that a digitally competent educator should be aware of the ethical implications associated with classroom digital technology use, some of the teacher educators in the Carpenter et al. (2020) study also stated that exploring the intersection of digital technologies and ethics did not align with the curricular goals of the courses they taught (e.g., math methods). Such sentiment partially supports Krutka et al.'s (2020) argument that much of the work of exploring the drawbacks of specific technologies should take place in social studies classrooms.

Despite the recent increase in advocacy for exploring the ethical and societal implications associated with technology integration choices (Krutka et al., 2020; McDonagh et al., 2021; Yadav & Lachney, 2022), questions about the ways in which teacher educators should address these techno-ethical quandaries "remain largely unanswered in existing research" (Deng & Zhang, 2023, p. 1). To fill this void in the literature, Deng and Zhang created a framework and survey instrument for assessing preservice teachers' *ethical knowledge*. This framework builds on Mishra and Koehler's (2006) TPACK spheres and the widely used Schmidt et al. (2009) instrument for measuring TPACK self-efficacy at the micro and macro levels (per Kaufman, 2000). The resultant framework by Deng and Zhang (2023) is an 11-construct model depicted in Figure 2.2. Beyond the litany of constructs that are visually apparent in the Deng and Zhang model, *TPCEK* (Technological, Pedagogical, Content, and Ethical Knowledge) seems especially unwieldy because TPACK's existing seven constructs have already proven difficult to measure in isolation (Mouza et al., 2017; Schmid et al., 2021).

Figure 2.2

TPCEK Model



Note: From "Technological Pedagogical Content Ethical Knowledge (TPCEK): The Development of an Assessment Instrument for Preservice Teachers," by G. Deng and J. Zhang, 2023, *Computers & Education, 197*, p. 3. (https://doi.org/10.1016/j.compedu.2023.104740). ©2023 by Elsevier Ltd.

Nevertheless, Deng and Zhang (2023) found their survey to be a valid and reliable instrument in exploratory research with Chinese preservice teachers (N = 374). As with findings from European contexts (McGarr & Ó Gallchóir, 2020a, 2020b; Tondeur et al., 2021), American teacher educators ought to heed Hargreaves and O'Connor's (2018) caution against assuming that findings from a distinct social, political, and cultural context will be transferrable to a local setting. In terms of Deng and Zhang's (2023) findings, for example, ethical questions about technology integration in a Communist county may be quite different than the ethical questions facing educators in Western democracies. Furthermore, the impact that a Communist-led government might have on technology integration practices within an educational context is an archetypical example of what Falloon (2020) refers to as a “socio-cultural” (p. 2457) influence. These sorts of societal-level influences and outcomes also exemplify Kaufman’s (2000) framing of mega-level “results and consequences” (p. 24).

That said, Western influences pervade Deng and Zhang’s (2023) work. For example, Deng and Zhang’s self-efficacy survey prompts are anchored in Bandura’s (1977) theoretical premise that an individual’s confidence in a given domain can predict associated performances and motivation. These sorts of self-assessments of digital competencies, which are the basis of Deng and Zhang’s (2023) survey, can produce counterintuitive results. To be more specific, multiple studies (Kruger & Dunning, 1999; Schmid et al., 2021; Watson & Enderson, 2018) have found that more competent individuals score themselves more harshly than comparatively less competent individuals in certain domains, including TPACK. In what has come to be known as the *Dunning-Kruger Effect*, comparatively more competent individuals tend to underestimate their abilities, while comparatively less competent individuals have been found to do the opposite (Kruger & Dunning, 1999). Another methodological weakness of the Deng and Zhang (2023) survey is its usage *double-barreled* prompts such as “I can encourage students to commit to the benefit of all mankind and society by using their subject matter expertise in the future in my subject teaching” (p. 7). This sort of prompt is generally discouraged in survey research because it forces the simultaneous assessment of multiple distinct attributes (Choi & Pak, 2005; Fink, 2017).

Societal Factors

Despite questions about the transferability and validity of the Deng and Zhang (2023) instrument, there is merit to their research on the societal factors that can impact an educator’s technology integration choices (Bower, 2019; Falloon, 2020). Clearly, the educational landscape has drastically changed in response to COVID-19, with school systems around the world having invested heavily in digital technologies to accommodate pandemic-induced needs for distance- and hybridized-modes of education (EdWeek Research Center, 2022b; Teräs et al., 2020;

Trombly, 2020). Amidst this broader backdrop of a rapidly expanded market for educational technologies (EdWeek Research Center, 2022b; Han, 2022; Teräs et al., 2020), Falloon's (2020) caution, seems especially prescient. Published in March of 2020, shortly before the pandemic inspired a global shift toward increasingly digitized interactions, Falloon urged teacher educators to raise preservice teachers' awareness of the risks that digital technologies can pose to P-12 students.

Collective Wellbeing

The potential for digital technologies in educational settings to be harmful can be found in survey responses from inservice teachers (*N* = 888), 80% of whom reportedly noticed that student behavior worsened as a function of "screentime increases" (EdWeek Research Center, 2022a, p. 7). Furthermore, in a report for Human Rights Watch, Han (2022) found that 41 out of 73 internationally government-approved educational technology applications harvested data from children "for the sole purpose of advertising" (p. 24). For a specific example, Gleason and Heath (2021) found that Google Classroom, a common learning management system in P-12 settings, harvested what appears to be an abundance of personal data from P-12 students during the fall of 2020 when schools became more reliant on digital technologies as a response to the pandemic. To counteract such trends, ISTE's (2020) Educator Standards state that practitioners should be able to "Mentor students in safe, legal and ethical practices with digital tools" (2.3c) and model ways to "protect student data privacy" (2.3.d).

Unfortunately, according to Lee and Han's (2022) findings, preservice teachers are not likely to take ethical considerations such as those pertaining to P-12 students' wellbeing or data privacy into account when selecting digital technologies. For further background, Lee and Han's research examined the educational technology application choices of preservice teachers' (*N* = 20) as well as their criteria for choosing specific applications. Although many of the evaluations (*n* = 71) in Lee and Han's (2022) study showed that micro-level factors such as hands-on experiences as an instructor (27%) or practicum experiences as an observer (13%) influenced preservice teachers' decision-making, the study did not report any evidence to suggest that participants accounted for the ways in which educational technology applications might subject P-12 students to potential harms or privacy intrusions.

Of greater promise, qualitative data collected by Jung et al. (2020) in the form of interviews, document analyses, and responses to hypothetical prompts found that preservice teachers (*N* = 14) were inclined to account for sociocultural factors that can impact technology integration choices "when they were prompted by either information in the case itself or their own relevant past experiences" (p. 1007). In a more theoretical piece, Dawson et al. (2022) recommended that teacher educators prepare preservice teachers to teach P-12 students about cybersecurity. Dawson et al. also reported preliminary findings that suggested preservice teachers seeking elementary certification "went from thinking the topic was somewhat irrelevant for elementary students to thinking it was an important (and fun) topic to integrate across the curriculum" (p. 283). In light of these recent studies showing that it can be worthwhile to train preservice teachers to think about technology integration more holistically, Falloon's (2020) framework and the aforementioned ISTE (2020) Educator Standards seem to be reasonable starting points for teacher educators who are looking to scaffold an introduction to the ethical issues that pertain to technology integration.

Macro-Level Curricular Planning and Assessment

Planning Around a Vision

The International Society for Technology in Education (ISTE), which is seen as the "peak global body" (Bower, 2017, p. 4) within the field of educational technology recommends that educational leaders work collaboratively with diverse stakeholders to craft a contextually relevant and unifying vision for technology integration (ISTE, n.d.; 2020). In order to "advance a shared vision" (ISTE, 2020, 2.2.a) for developing technology integration skills within an educator preparation provider (EPP), teacher educators have long recommended that program leaders work collaboratively with college education faculty and supervisors of practicum experiences to support consistent messaging (Foulger et al., 2019; Thomas et al., 2013; Yadav & Lachney, 2022). In Tondeur et al.'s (2012) meta-ethnography, "*cooperation within and between institutions* [*sic*]" (p. 4) was found to be an essential macro-level condition that aided in the development of preservice teachers' digital competencies according to six out of 19 qualitative studies. In other empirical studies, this sort of macro-level coordination around a shared vision for technology integration has been found to correlate with measurable improvements in preservice teachers' digital competencies (Buss et al., 2018; Foulger et al., 2019; Graham et al., 2009).

Given that 67.6% (*n* = 756) of teacher educators from accredited EPPs in the United States report "that technology is integrated across the curriculum" (Voithofer & Nelson, 2021, p. 319) in teacher preparatory coursework, coordinated vision-setting seems essential in order to establish program-wide "criteria for measuring success" (ISTE, n.d., para. 5). Such criteria can be used to guide curricular programming on college campuses (Foulger et al., 2019; Kimmons et al., 2020; Mouza et al., 2017) and also to assess preservice teaching performances in practicum settings (Graham et al., 2009; McGarr & Ó Gallchóir, 2020a). Along these lines, the literature suggests that deliberate coordination between teacher educators and the P-12 professionals who supervise practicum experiences helps standardize expectations for technology integration (Foulger et al., 2019; Graham et al., 2009; Thomas & Trainin, 2019).

McGarr and Ó Gallchóir's (2020a) research in an Irish setting shows what can happen when the expectations on a university campus do not align with the expectations of evaluators in practicum settings. To elaborate, education course instructors at this Irish university emphasized a "student-centred [*sic*]" (p. 6) approach to digital pedagogy. This emphasis on the university's campus was apparently not clearly communicated to the practicum observers (*N* = 96) who were charged with evaluating instruction delivered by preservice teachers in practicum settings (McGarr & Ó Gallchóir, 2020a). Relatedly, McGarr and Ó Gallchóir's review of 429 lesson observation forms found that the practicum evaluators either entirely omitted commentary about technology integration (*n* = 307) or provided feedback through a teacher-centric lens (*n* = 122). In terms of teacher-centeredness (Kopcha et al., 2020; Warner et al., 2018), McGarr and Ó Gallchóir (2020a) found that the limited amount of feedback these preservice teachers received pertaining to technology integration focused primarily on ways that the preservice teachers used PowerPoint slides. After follow-up interviews with 10 of these practicum evaluators, McGarr and Ó Gallchóir concluded that the evaluators were evidently not familiar with "student-centred [*sic*] strategies" (p.8).

Similarly, other researchers have found vast differences in terms of the ways that practitioners both on college campuses and in P-12 settings frame successful technology integration (Graham et al., 2009; Voithofer & Nelson, 2021). To focus briefly on common views on college campuses, according to survey responses from teacher educators (*n* = 525) representing a variety of accredited EPPs across the United States, 67.1% "at least somewhat agreed that they align their courses to the ISTE standards" (Voithofer & Nelson, 2021, p. 321). Given the student-centered emphasis of ISTE's (2020, 2021) standards, this suggests that a relatively progressive approach to digital pedagogy influences the curricular plans of many teacher educators. Despite this trend, "scholarly research focusing specifically on the ISTE standards is uncommon" (Voithofer et al., 2019, p. 1433). Instead, many educational researchers and teacher educators rely upon Mishra and Koehler's (2006) TPACK framework to assess what an educator *knows* about teaching with technology rather than an educator's enacted technology integration practices or broader based digital competencies (Cherner & Mitchell, 2021; Falloon, 2020; Voithofer & Nelson, 2021).

TPACK

While Bower (2017) stresses that TPACK aims to be pedagogically "agnostic" (p. 18), Cherner and Mitchell (2021) argue that the TPACK framework is largely teacher-centric because its three-way Venn Diagram focuses on an educator's knowledge base and does not account for ways in which learners engage with digital technologies. Tangible examples of the teacher-centricity of TPACK are apparent in all of the framework's seven constructs, which include various combinations of the acronym such as technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK) (Cherner & Mitchell, 2021; Mishra & Koehler, 2006). These various TPACK constructs are frequently used by teacher educators to establish criteria for assessing preservice teachers' longitudinal development within an EPP (Buss et al., 2018; Mouza et al., 2017; A. Thomas & Trainin, 2019). That said, Voithofer and Nelson (2021) found that 62% of teacher educators (n = 754) "either did not know about TPACK or did not adopt" (p. 322) the framework in their practices.

Although many teacher educators seem to be unaware of the TPACK framework (Voithofer & Nelson, 2021), it is common in the literature for EPPs to use TPACK to establish a universal language for describing specific aspects of a preservice teacher's digital competencies (see, e.g., Foulger et al., 2019; Mouza et al., 2017; A. Thomas & Trainin, 2019). These EPPs measure TPACK's constructs using surveys, with an instrument developed by Schmidt et al. (2009) being the most widely used (Bower, 2017; Mouza et al., 2017). As a case in point, Mouza et al. (2017) found consistent gains in pre- and post-course survey measures of TPACK self-efficacy for preservice teachers (N = 120) enrolled in two standalone educational technology courses—one offered to freshmen and the second offered to juniors and seniors. In this same Mouza et al. longitudinal study, "statistically significant declines" (p. 15) in TPACK self-efficacy were also evident in the interim periods (typically two to three years) when these preservice teachers were not enrolled in a standalone technology integration course.

Rather than relying on standalone technology integration courses to develop preservice teachers' digital competencies, Foulger et al. (2019) credited a program-wide curricular orientation around the TPACK framework with improvements in preservice teachers' TPACK across seven cohorts at Arizona State University. In this setting, it is telling that Foulger et al. regret that their initial vision for technology integration was "short-sighted" (p. 82). In explaining their initial transition to *technology-infused* curricular programming, Foulger et al. lamented that during their first five years, these teacher educators failed to account for the importance of making coordinated plans with inservice teachers in surrounding P-12 practicum settings. To address this deficiency, the Arizona State University program's leadership intentionally became more inclusive in sharing and enacting their TPACK-driven vision with their P-12 practicum partners beginning with the sixth year of this technology-infused curricular initiative (Foulger et al., 2019). These adjustments correlated with measurable improvements in preservice teachers' TPACK self-efficacy and more favorable qualitative accounts of practicum experiences within this Arizona State setting (Buss et al., 2018; Foulger et al., 2019).

Micro-Level Factors

Individual Experiences within an EPP

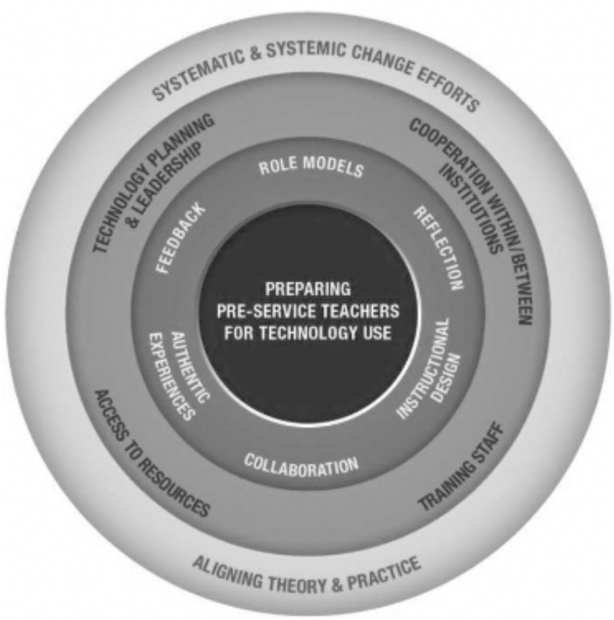
In transitioning from the macro to the micro level, Tondeur et al.'s (2012) SQD model (see Figure 2.3) is helpful for scoping the seemingly infinite number of potential micro-level factors that can affect the development of a preservice teacher's technology integration skills. Following a meta-ethnographic analysis of qualitative research studies (*n* = 19), Tondeur et al. identified the following six factors as having a generative effect on preservice teachers' development of this skillset:

- formative and evaluative feedback,
- peer collaboration,
- opportunities to learn about instructional design,
- role models (e.g., teacher educators),
- authentic experiences to teach with digital technologies, and
- reflection.

These strategies shaped the major constructs of Tondeur et al.'s (2016) SQD survey instrument and lend structure to the subsequent review of micro-level influences that remain salient themes in the extant literature. Knezek et al. (2023) found the SQD survey instrument to be a valid and reliable measure of preservice teachers' perceptions that these six strategies "were and were not being addressed" (Knezek et al., 2023, p. 9) by their EPPs. Thus, the SQD survey enables a six-point Likert-scale assessment of an EPP's efficacy in preparing preservice teachers "to integrate technology into classroom activities" (Tondeur et al., 2016, p. 133). Though data from the SQD survey can identify trends within a particular course, cohort, or an EPP, it has also proven useful for supporting analysis at the individual-level (Christensen & Trevisan, 2023; Tondeur et al., 2021).

Figure 2.3

The Synthesis of Qualitative Data Model



Note: From "Preparing Pre-service Teachers to Integrate Technology in Education: A Synthesis of Qualitative Evidence," by J. Tondeur, J. van Braak, G. Sang, J. Voogt, P. Fisser, and A. Ottenbreit-Leftwich, *Computers & Education,* 2012, *59*, p. 8 (https://doi.org/10.1016/j.compedu.2011.10.009). ©2012 by Elsevier Ltd.

Feedback. To initially focus on Tondeur et al.'s (2012; 2016) feedback construct, as previously described in McGarr and Ó Gallchóir's (2020a) Irish setting, the type of feedback preservice teachers receive can vary based upon the degree that macro-level expectations align with micro-level assessments. This was also found to be the case in a study at Brigham Young University (Graham et al., 2009). Graham et al. found that clarifying this EPP's emphasis on encouraging "active, student-centered uses of technology as opposed to teacher-only uses of technology" (p. 43) correlated with a 26% increase in digital technology usage by P-12 students and a 15% decrease in teacher-centric instances of technology integration in classrooms led by preservice teachers (*n* = 99). One way that expectations were clarified in the Graham et al. (2009) setting was by changing the language on Teacher Work Sample portfolio rubrics to expressly state that technology should be used to support P-12 student "higher level thinking activities" (p. 54). Graham et al. concluded that working collaboratively with field experience supervisors to promote reliable interpretations of the program's criteria for assessing these portfolios was the "primary factor" (p. 52) that drove an increase in student-centered (Hughes et al., 2020; Kimmons et al., 2020) technology integration practices amongst these preservice teachers.

Collaboration. Although much of the relevant literature frames feedback in an evaluative sense (Graham et al., 2009; Harris et al., 2010; McGarr & Ó Gallchóir, 2020a), preservice teachers can also offer feedback to one another when they have opportunities to collaborate (Christensen & Trevisan, 2023; Xu & Stefaniak, 2023). For example, Xu and Stefaniak (2023) found that preservice teachers provided one another with "constant and iterative feedback" (p. 9) when working collaboratively. To further illustrate, when tasked with figuring out how to use Marvelapp to design prototypes of instructional materials, qualitative data showed that many preservice teachers (*N* = 45) at an EPP in the southeastern United States found that the opportunity to work collaboratively had a generative effect on their learning (Xu & Stefaniak, 2023). On the other hand, Xu and Stefaniak also found qualitative evidence that several preservice teachers perceived group collaboration to be a source of frustration. Varying reactions to opportunities for collaboration were also found in the Toundeur et al. (2021) study, wherein preservice teachers with comparatively favorable attitudes toward digital technologies "were more likely to feel positively about working collaboratively when using digital technologies" (p. 6).

Instructional Design. Just as the Xu and Stefaniak (2023) study illustrates how there can be overlap between the SQD model's feedback and collaboration constructs (Tondeur et al., 2012, 2016), Xu an Stefaniak's (2023) work with preservice teachers enrolled in a standalone educational technology course also found that the opportunity to receive feedback and collaborate with their peers "influenced pre-service teachers' instructional design decision-making for technology integration" (p. 9). This qualitative finding by Xu and Stefaniak is further substantiated by participant responses on a 7-point Likert-scale survey prompt. On the relevant prompt, Xu and Stefaniak report that most preservice teachers agreed (M = 6.07, SD = 0.81) that collaborating with their peers led to improved decision making in their design of digital prototypes. Although it is difficult to isolate measures of effectiveness for specific instructional strategies using Xu and Stefaniak's work, findings from a comparable study by Christensen and Trevisan (2023) indicate that an emphasis on instructional design in a standalone educational technology course can be a highly effective strategy for improving preservice teachers' digital competencies.

In the Christensen and Trevisan (2023) setting, the SQD survey instrument (Tondeur et al., 2016) was used to compare six separate semesters' worth of pre- and post-course data from preservice teacher (N = 187) respondents. Although Christensen and Trevisan found that the instructional strategies used by teacher educators in a standalone educational technology course produced large effect sizes across all six SQD constructs, the data indicated that improvement in the instructional design construct had the largest effect size (ES = 1.75). This finding, along with conclusions from other studies involving stand-alone educational technology courses (e.g., Amador et al., 2015; Xu & Stefaniak, 2023), supports Tondeur et al.'s (2012) earlier conclusion that scaffolding opportunities to learn about instructional design is a valid strategy for improving the development of preservice teachers' digital competencies.

Role Models. In addition to feedback, collaboration, and instructional design, the SQD model also emphasizes the importance of teacher educators as role models (Tondeur et al., 2012). Subsequent research (Englehardt & Brown, 2019; Nelson & Hawk, 2020; Nelson & Voithofer, 2022) also showed that inservice teachers in practicum settings can have an outsized influence on the development of preservice teachers' digital competencies. For example, Nelson and Hawk's (2020) survey research with preservice teachers (*n* = 146) found that respondents who frequently witnessed student-centered (Hughes et al., 2020; Kimmons et al., 2020) approaches to digital pedagogy reported stronger intentions to enact practices that are reflective of "an active, constructivist paradigm" (p. 10). It is also noteworthy that preservice teachers who frequently saw inservice teachers flounder with student-centered digital pedagogy reported greater reluctancy to enact such practices in the future (Nelson & Hawk, 2020).

Relatedly, Polly et al. (2020) used survey data from preservice teachers (*N* = 89) to compare the modeling of technology integration in practicum settings versus modeling on college campuses. Overall, two relevant trends were identified in the Polly et al. study. Firstly, teacher educators were found to be more likely to model technology integration that involved higher-order thinking (e.g., project-based activities) than their inservice teacher counterparts. Secondly, the frequency of instances in which teacher educators incorporated these student-centered (Jonassen, 1996; Kimmons et al., 2020; Salomon et al., 1991) approaches to technology integration increased as preservice teachers progressed through different levels within the EPP. In short, Polly et al. (2020) found that teacher educators were more likely to incorporate digital technologies for activities that were more project-based toward the latter phases of an EPP.

In terms of the work that is done on college campuses to cultivate digital competencies, both the Buss et al. (2018) and Xu and Stefaniak (2023) studies should also inform the way that teacher educators introduce preservice teachers to novel digital technologies. In the Buss et al. (2018) study, preservice teachers (*n* = 30) reported finding that while being required to use novel digital technologies was helpful, a common sentiment that emerged from interviews is that the preservice teachers would have preferred explicit instructional guidance that explained how they might deploy these digital technologies as an instructor.

Similarly, when learning to use Marvelapp in an educational technology course, some preservice teachers in the Xu and Stefaniak (2023) study reported feeling “overwhelmed” (p. 8) by the novel digital technology. Although Marvelapp has a built-in generic tutorial, data collected from preservice teachers’ journals in the Xu and Stefaniak study showed that participants would have preferred a more personalized, step-by-step “*tutorial on the tool*” (p. 8, emphasis in original). As with many examples of student-centered digital pedagogy (Cherner & Curry, 2017; Walsh-Moorman et al., 2020; Zheng et al., 2020), the Marvelapp task in the Xu and Stefaniak (2023) study shows how learning to use an unfamiliar digital technology while grappling with novel content increases the degree of element interactivity (Sweller, 1994). According to Sweller, increasing the number of elements involved in a task inherently strains learners’ cognitive loads.

Authentic Experiences. In addition to thinking about how technology integration is modeled in education courses on college campuses, research suggests that longitudinal planning within EPPs should also scaffold opportunities for preservice teachers to use digital technologies as both a learner and an instructor (A. Thomas & Trainin, 2019; Tondeur et al., 2012, 2016). When considering the various digital technologies that might be applicable to teaching and learning, Polly et al.’s (2023) survey responses from both inservice (n = 45) and preservice teachers (n = 60) could be instructive for teacher educators because the data indicate that the degree that specific digital technologies were perceived as being helpful for an educator’s own learning predicted whether an educator intended to use the same specific digital technologies in their teaching practices. In looking at data collected from both preservice and inservice teachers (N = 105), there was overwhelming agreement that collaborative tools (e.g., Dropbox or the Google Suite) and learning management systems (e.g., Canvas or Google

Classroom) were perceived as being of the greatest benefit for teaching and learning. There was also overall agreement among the two subgroups that podcasts and social media were the least beneficial digital technologies for teaching and learning (Polly et al., 2023).

Longitudinal Progression. Generally speaking, there is a pattern wherein novice educators progress from *self-absorption* toward an eventual consideration of how their teaching practices appear to impact P-12 student learning (Conway & Clark, 2003; Fuller, 1969; Hughes et al., 2020). As mentioned previously, Hughes et al. (2020) found that inservice teachers tended to focus more on student learning outcomes associated with technology-mediated learning as compared to preservice teachers. As this relates to Heath and Segal's (2021) study of preservice teachers, the researchers concluded that the participants in their study "rarely" (p. 5) progressed beyond focusing on their own instructional practices. In other words, Heath and Segal found that these preservice teachers, who had little prior experience in practicum settings, showed little regard for the ways in which their technology integration choices would impact learning outcomes.

The assertion that preservice teachers' technology integration skills improve as they gain more experience afield is consistent with findings from other studies (Cherner & Curry, 2017; Polly et al., 2020; Wekerle & Kollar, 2022). To flesh out one example, the Polly et al. (2020) study included *less experienced* preservice teachers (*n* = 21) that were more than a year away from beginning their student teaching placements, *somewhat experienced* preservice teachers (*n* = 36) that were scheduled to begin student teaching within a year, and a group or *experienced* preservice teachers (*n* = 32) that had recently finished student teaching. In terms of analyzing data according to instances of technology integration frequency by cohort, the less experienced group reported 5 instances, the somewhat experienced group reported 45 instances, and the experienced group reported 50 instances. The Polly et al. data also show that preservice teachers progressively became more inclined to engage P-12 students in hands-on ways that could be classified as creative according to the PICRAT matrix (Kimmons et al.,

2020) as they gained more experience in practicum settings. Thus, it seems that preservice teachers incorporate digital technologies in their instructional practices more often, and in increasingly student-centered (Hughes et al., 2020; Kimmons et al., 2020) ways at least partly as a function of experience in P-12 settings (Cherner & Curry, 2017; Polly et al., 2020).

Reflection. Christensen and Trevisan's (2023) research with the SQD survey instrument (Tondeur et al., 2016) also found that growth in preservice teachers' digital competencies correlated with authentic experiences (*ES* = 1.43), but a slightly more profound improvement appeared to be linked to providing opportunities for critical reflection (*ES* = 1.49). Again, there is an inherent overlap between all six SQD constructs as preservice teachers often reflect on the technology integration practices that are demonstrated by role models and on their own experiences using digital technologies as learners or instructors (Howard et al., 2021; Lee & Han, 2022). Nevertheless, Christensen and Trevisan (2023) found that the reflection construct trailed only the instructional design (*ES* = 1.75) and feedback (*ES* = 1.59) SQD constructs in terms of being linked to growth in digital competencies (per Tondeur et al., 2016). Each of the effect sizes in the Christensen and Trevisan (2023) study, with the exception of the role model (*ES* = 1.06) construct, can be considered *large* because they are greater than 1.20 (Ravid, 2020).

In a comparable study, instructors of another standalone educational technology course also required preservice teachers (*N* = 34) to reflect on their practices by responding to a series of prompts after they completed six technology integration performance tasks (Amador et al., 2015). These reflection prompts encouraged preservice teachers to consider how their technology integration choices may have impacted P-12 student understandings of content, their own usage of digital technologies as instructors, and potential barriers they might anticipate as well as ways to overcome these barriers to technology integration. In the Amador et al. setting, preservice teachers had been explicitly taught to use the RAT framework developed by Hughes et al. (2006) but they were not prompted to use terms like replace, amplify, or transform in their written reflections.

Researchers in the Amador et al. (2015) study then used the RAT framework to qualitatively code preservice teachers' reflective "thought chunks" (p. 95). Amador et al. hypothesized "that the way a preservice teacher thought about technology in the classroom would impact their self-assessed competence of technology integration" (p. 96). In other words, the researchers thought that they would be able to identify a relationship between the degree to which preservice teachers' reflections showed evidence of replacement, amplification, or transformation and correlative growth in preservice teachers' digital competencies (Amador et al., 2015). However, pre- and post-course survey data did not reveal any significant relationships between the ways in which "preservice teachers were conceptualizing technology and their self-assessment of technology integration competence" (p. 103). It is worth noting that the self-assessment survey in the Amador et al. (2015) study was developed by the researchers.

Thus, there are important distinctions in the survey methodologies and the findings of the Amador et al. (2015) and Christensen and Trevisan (2023) studies. For one, the Christensen and Trevisan (2023) study used the SQD instrument, which has been subjected to a more rigorous validation process (see, e.g., Knezek et al., 2023; Tondeur et al., 2016) than the Amador et al. (2015) survey. It's also noteworthy that the Amador et al. (2015) survey positioned preservice teachers as judges of their own knowledge, which is a research method of questionable validity (Kruger & Dunning, 1999; Schmid et al., 2021; Watson & Enderson, 2018).

For contrast, Christensen and Trevisan's (2023) usage of the SQD survey instrument (Tondeur et al., 2016) instead collected data from preservice teachers' accounts of their learning experiences within a given EPP. While this Tondeur et al. (2016) instrument relies on data from perceptions of learning experiences rather than self-assessments of knowledge, it is worth noting that both Knezak et al. (2023) and Tondeur et al. (2021) found that individual respondents from within the same institution often have disparate perceptions about the practices their EPPs used to develop digital competencies. Nonetheless, the instructional interventions described in the Christensen and Trevisan (2023) study produced quantitative evidence of significant improvements in preservice teachers' opportunities to develop digital competencies whereas the Amador et al. (2015) study uncovered "no relationship between how preservice teachers consider technology and their self-assessment of technology competency" (p. 104). As with the more widely used Schmidt et al. (2009) instrument, surveys that prompt preservice teachers to self-assess their TPACK (Schmid et al., 2021; Watson & Enderson, 2018) may have less validity than surveys that prompt preservice teachers to report on the instructional practices within an institution (Christensen & Trevisan, 2023; Knezek et al., 2023; Tondeur et al., 2016).

Micro-Level Dispositions

Objectivity Toward Digital Technologies. Beyond a collection of experiences (Tondeur et al., 2012), knowledge (Mishra & Koehler, 2006) and skills (Kimmons et al., 2020), Falloon's (2020) teacher digital competency framework emphasizes the importance of cultivating a disposition of objectivity toward digital technologies within teacher preparation programming. This sort of objectivity is congruent with Krutka et al.'s (2020) *technoskepticism* in that Falloon (2020) suggests that teacher preparation programming should strive to strike a balance between ensuring that preservice teachers are willing to try new digital technologies while also training preservice teachers to understand that there may be "legal and ethical considerations, personal and societal impacts and effects" (p. 2456) associated with their technology integration choices.

Influences on Micro-Level Dispositions. Given what is known about the overreach of many educational technology applications (Han, 2022), and the ways in which educators' technology integration choices can mirror broader societal inequities (Hughes & Read, 2018; Rafalow, 2018), Falloon's (2020) argument that digitally competent educators should be able to make ethical choices pertaining to digital technologies is well-substantiated. As an example, with regard to the intersection of technology integration and inequity, Heath and Segal's (2021) finding that approaches to technology integration were affected by preservice teachers' racialized and sociocultural biases is consistent with findings from research involving inservice teachers (Hughes & Read, 2018; Rafalow, 2018). Heath and Segal's (2021) conclusion that the preservice teachers in their study seemed "(unwittingly) committed to using technology as a tool to uphold whiteness" (p. 8) supports the argument that classroom-level inequities pertaining to technology-mediated learning often align with societal inequities (Andrade Johnson, 2020; Bower, 2019; Rafalow, 2018).

To further illustrate this notion, in Heath and Segal's (2021) study, preservice teachers (N = 17) that were recently accepted into an EPP and were just beginning their practicum experiences in a "racially and socio-economically diverse" (p. 3) middle school perceived themselves as being in a precarious position. These preservice teachers were found to be relatively uncomfortable in their new classroom roles and were also reluctant to allow middle school students to have a high degree of *agency* with digital technologies (per Hughes et al., 2020; Kohler et al., 2022). In terms of classroom technology integration, agency involves allowing students to have autonomy with digital technologies and opportunities for digital creativity (Hughes et al., 2020; Kohler et al., 2022). Rather than facilitating opportunities for students to have agency with digital technologies, Heath and Segal (2021) concluded that these preservice teachers, 82% of whom identified as White, commonly perceived a middle school classroom climate of "silence and compliance" (p. 5) as an indicator of their own effectiveness as educators. Such insights were gleaned through Heath and Segal's (2021) analysis of participants' reflections, video recorded lessons, and interview comments.

In terms of macro-level influences on an educator's disposition, symptoms of technocentric thinking have been found to influence macro-level policy making (Tondeur et al., 2012), such as when institutional leaders require preservice teachers (A. Thomas & Trainin,

2019) or inservice teachers (Kohler et al., 2022) to use digital technologies in their lessons. Such technocentric requirements presume that digital technologies will improve learning outcomes (Bower, 2019; Papert, 1987), rather than training preservice teachers to think strategically and holistically about their decisions (Falloon, 2020; Kopcha et al., 2020).

Technology Integration Practices

Student- versus Teacher-Centered Digital Pedagogy

With regard to the ways in which scholarly literature informs this capstone inquiry, it is worth reminding readers that this capstone report places a heavy emphasis on student-centered (CAST, 2018; Kimmons et al., 2020) technology integration due to the Marbury EPP's institutional obligation to train preservice teachers to enact the decidedly student-centered ISTE (2020, 2021) standards. This obligation necessitates finding consistent ways to distinguish between student- and teacher-centered digital pedagogical practices (Kopcha et al., 2020; Warner et al., 2018). In making this distinction, Warner et al.'s (2018) theoretical piece casts teacher-centered practices in a negative light, asserting that "student learning actually suffers" (p. 6) when teachers incorporate digital technologies into lectures or other forms of "rote learning" (p. 6). On the other hand, Kopcha et al. (2020) approaches teacher-centered digital pedagogy more objectively in describing a theoretical model pertaining to the decision-making processes involved with a teacher's technology integration choices. Rather than describing teacher-centered practices disparagingly, Kopcha et al. address the practical reasons why a teacher may opt to deploy teacher-centered practices and note that such practices can be used "to enhance learning" (p. 740). This capstone report cites both Warner et al. (2018) and Kopcha et al. (2020) to signal an effort to determine whether a teacher or their students are the primary users of digital technologies during instruction. This report also focuses primarily on the following characteristics of student-centered digital pedagogy: accommodating diverse learning needs (CAST, 2018), enacting innovative pedagogy (Hughes et al., 2006; Kimmons et al., 2020), facilitating hands-on digital and cognitive engagement (Hughes et al., 2020; Kimmons et al., 2020), fostering higher-order thinking (Jonassen, 1996; Kimmons et al., 2020; Salomon et al., 1991), and empowering students with agency over the learning process (Hughes et al., 2020; Kohler et al., 2022).

Student-Centered Vignette

In order to illustrate what student-centered digital pedagogy (Jonassen, 1996; Kimmons et al., 2020; Salomon et al., 1991) can look like, the following vignette describes an example of ways in which an inservice teacher leveraged digital technologies to elicit higher-order thinking (Kimmons et al., 2022; Walsh-Moorman et al., 2020). In this example from an “affluent” (Walsh-Moorman et al., 2020, p. 29) middle school, an inservice teacher showed students how to make screencast videos wherein students recorded visual representations of their online maneuvers while they simultaneously narrated think-alouds. In these screencast narrations, students described using specific web browsing heuristics that are commonly deployed by professional fact checkers to authenticate online claims (Walsh-Moorman et al., 2020; Wineburg & McGrew, 2017). These students’ finished screencasts were then inserted into multimedia research presentations about the Holocaust (Walsh-Moorman et al., 2020). After reading Walsh-Moorman et al.’s (2020) account, I deduced that these particular student-centered (Jonassen, 1996; Kimmons et al., 2022; Salomon et al., 1991) tasks required students to engage in both evaluative and creative thinking, which are considered to be the two highest levels of cognition according to Bloom’s Revised Taxonomy (Krathwohl, 2002). I also determined that the tasks in the Walsh-Moorman et al. (2020) vignette reach the *creative-transformative* realm of the PICRAT matrix because students created cognitively complex digital artifacts and pursued a learning goal that would not be reasonably replicable without digital technologies (Kimmons et al., 2020).

Norms in P-12 Settings

ISTE (2020, 2021) encourages educators to design these sorts of cognitively complex tasks but most instances of classroom technology integration do not require higher-order thinking (Hughes & Read, 2018; Karchmer-Klein & Konishi, 2021; Polly et al., 2020). To demonstrate this point, survey responses from K-8 inservice teachers (N = 50) who were recent graduates of a large, mid-Atlantic EPP indicated that most of their classroom technology integration instances involved hands-on opportunities for students to play educational games, read online books, and locate information online (Karchmer-Klein & Konishi, 2021). Although the aforementioned activities in the Karchmer-Klein and Konishi study put digital technologies in the hands of P-12 students, the activities that were most commonly used in these inservice teachers' classrooms do not exemplify student-centered practices because these tasks do not clearly involve higher-order thinking (Jonassen, 1996; Kimmons et al., 2020; Salomon et al., 1991). Nevertheless, framed in terms of Kimmons et al.'s (2020) student-focused PIC axis, playing games, reading online books, and locating information can each be classified as *interactive* because they provide students with opportunities to interact directly with educational content.

Whereas a limitation of the Karchmer-Klein and Konishi (2021) study is that it relied on self-reports, the survey respondents in the Polly et al. (2020) study provided an account of what preservice teachers (N = 89) witnessed inservice teachers doing while observing in practicum settings. After coding open-ended descriptions (*n* = 85) of the observed technology integration practices of these inservice teachers, Polly et al. found that 91.76% (n =78) of the technology integration instances could be categorized as involving lower-order thinking according to Bloom's Revised Taxonomy (Krathwohl, 2002). In the Polly et al. (2020) study, the most common category for digital technology usage in inservice teachers' classrooms was "practice activities and games (20 instances, 23.53%)" (p. 256). As with the majority of the instances in the Karchmer-Klein and Konishi (2021) study, most of the instances in the Polly et al. (2020) study can be categorized within the *interactive* realm of Kimmons et al.'s (2020) PIC axis because the digital technologies presumably enabled learners to interact directly with content.

Applying PICRAT Codes. Similarly, the Borup et al. (2022) study found that when asked to describe improvements that inservice teachers (*N* = 77) in an online K-12 charter school made to their courses, the majority of reported changes (69%) sought to improve the ways that students interacted with content. When asked to categorize these changes (*n* = 115) using Kimmons et al.'s (2020) PICRAT matrix, 61% (*n* = 70) of the descriptions in the Borup et al. (2022) study fell in the middle of PICRAT's nine-category matrix at the *interactive-amplification* level. This means that these course changes gave K-12 students more hands-on opportunities for technology-mediated learning and were perceived as improving instructional efficiency or learning outcomes (Bower, 2019; Kimmons et al., 2020). When analyzing this data in terms of cognitive complexity via Kimmons et al.'s (2020) PIC axis, less than 2% (*n* = 2) of the responses fell within the passive realm, whereas 79% (*n* = 91) fell within the interactive realm, and 19% (*n* = 22) of the responses fell within the creative realm (Borup et al., 2022). It is worth noting that the inservice teachers in the Borup et al. sample had participated in a training with the PICRAT matrix and that their self-categorizations were reviewed by one of the researchers to ensure accuracy. Although Borup et al.'s (2022) usage of the PICRAT matrix enables taxonomizing specific instances of technology integration according to varying degrees of student-centeredness (Jonassen, 1996; Kimmons et al., 2020; Salomon et al., 1991), the Borup et al. (2022) study is not the best representation of educational norms because the data comes from educators' self-reports in a virtual charter school setting and focuses on instructional changes to support improvement.

Disparities in Digital Pedagogy

For a more objective and representative sample of what technology integration looks like in public P-12 contexts, Welsh and Harmes' (2018) research in a large school district in the southeastern United States is instructive. Based on 322 observations of 202 inservice teachers' technology integration practices, Welsh and Harmes found that there were pronounced differences in terms of the ways that P-12 students used digital technologies at schools with federal Title I versus Non-Title I status. Title I schools are defined as “having high percentages of children from low-income families” (USDE, 2018, para. 1). In aggregate, Welsh and Harmes (2018) found that 44% of the technology integration observations (*n* = 88) at Title I schools were coded as being “strongly teacher directed” (p. 1082) as opposed to 18% (*n* = 22) of the observations at Non-Title I schools. These *teacher-directed* practices in the Welsh and Harmes study are synonymous with the concept of teacher-centered digital pedagogy in that students passively receive information presented by teachers (Kopcha et al., 2020; Warner et al., 2018). Passively receiving information is generally associated with lower-order cognition for students (Kimmons et al., 2022; Kopcha et al., 2020). While the Welsh and Harmes (2018) data indicated that Non-Title I schools are more likely to deploy teacher-centered approaches to digital pedagogy (Kopcha et al., 2020; Warner et al., 2018), it is noteworthy that there were relatively few instances of digital technology use that appeared to elicit higher-order thinking in either Non-Title I or Title I schools (Welsh & Harmes, 2018).

Reframing with PICRAT. Observers coded the technology integration instances in the Welsh and Harmes (2018) study using a framework known as the *Technology Integration Matrix* (TIM) (FCIT, 2019), which is a five-by-five grid that is comparable to Kimmons et al.’s (2020) three-by-three PICRAT matrix. Although the TIM is inherently more fine-grained than PICRAT, it is possible to frame some of Welsh and Harmes’ (2018) data using the more broad-based PICRAT codes (Kimmons et al. 2020). For example, the data in the preceding paragraph showed that students from Title I schools are more likely to be positioned as passive recipients of information than their Non-Title I counterparts, which qualifies as *active-entry* on the TIM (Welsh & Harmes, 2018). Such instances are congruent with Kimmons et al.’s (2020) standard for *passive-replaces*. In short, whether framed in terms of the TIM (FCIT, 2019) or PICRAT (Kimmons et al., 2020), Welsh and Harmes’ (2018) findings suggest that the least sophisticated usages of digital technologies are more likely to occur in Title I, as compared to Non-Title I, schools.

Just as the Welsh and Harmes (2018) study collected data via independent observers, another vantagepoint of what technology integration looks like is represented in Hughes and Read's (2018) survey research with sixth- and seventh-grade students (*N* = 1,544) who attended four middle schools in the southwestern United States. To summarize a prevailing trend in the Hughes and Read data, "all the students at all four schools reported that their teachers used technology more than they did" (p. 22). This finding, as with the discrepant approaches to digital pedagogy reported by Welsh and Harmes (2018) in Title I and Non-Title I schools, is not necessarily problematic because explicit instruction with digital technologies can be a precursor to eventual student-centered activities that involve higher-order thinking (Belland et al., 2015; Kim et al., 2022; Kimmons et al., 2020). When framed in terms of Kimmons et al.'s (2020) PICRAT matrix, although *creative* and *transformative* instances of technology integration represent a desirable goal state for technology integration, "each square in the matrix is a positive technology application" (p. 192). That said, especially in light of findings (Heath & Segal, 2021; Rafalow, 2018) that suggest that an educator's technology integration choices can be symptomatic of discriminatory thinking, it seems worthwhile to investigate the potential interplay between learners' demographic characteristics and educators' technology integration practices (Andrade Johnson, 2020; Jung et al., 2020).

Student Demographics. When examining disparities in digital pedagogical practices, it is worth noting Hughes and Read's (2018) finding that student respondents (*n* = 580) from two middle schools "with higher economically disadvantaged student populations reported less technology use for independent projects or research activities" (p. 25) than respondents (*n* = 964) from two comparatively more affluent middle schools. In other words, students from more affluent families were more likely to have opportunities to engage in what Kimmons et al. (2020) would classify as *creative* instances of technology integration. The implication that student-centered technology integration (Jonassen, 1996; Kimmons et al., 2020; Salomon et al., 1991) is more likely to occur in P-12 settings that are predominantly affluent is consistent with the extant literature (Andrade Johnson, 2020; Rafalow, 2018; Welsh & Harmes, 2018).

Rafalow's (2018) ethnographic account of three California middle schools provides further evidence to suggest that teachers' technology integration choices can be influenced by student demographics. Based upon over 600 hours of firsthand observations, formal interviews, and informal statements, Rafalow (2018, 2020) found that teachers at a predominantly wealthy and White (74%) private middle school showed a strong inclination toward incorporating students' interests in games like Minecraft or social media into classroom instruction. Such practices, as with other examples in which these private school students were encouraged to create digital artifacts, exemplify a student-centered approach to digital pedagogy (Jonassen, 1996; Kimmons et al., 2020; Salomon et al., 1991). On the other hand, Rafalow (2018) also found that students at one of the public middle schools, which had a predominantly Asian-American (60%) student body, were widely regarded with distrust by a predominantly White faculty. This distrust corresponded with seemingly excessive amounts of surveillance of students' digital interactions.

At another public middle school, Rafalow (2018) found that another predominantly White faculty, which served a predominantly Hispanic (80%) student body, seemed to perceive that their students were destined to become members of the "working-class" (p. 1441). Along with this widely shared perception amongst this second public school's faculty, Rafalow found that these predominantly White teachers "constructed their lessons in ways that impart technology skills they believed were valuable for working-class jobs" (p. 1441). Therefore, students at this predominantly Hispanic middle school had relatively little digital freedom or opportunities to create digital artifacts (Rafalow, 2018). Thus, framed in terms of the PICRAT matrix, Rafalow's (2018) study showed that predominantly affluent and White students attending a private middle school were more likely to use digital technologies in ways that meet Kimmons et al.'s (2020) standard for *creative-transformative* technology integration as compared to the students attending public middle schools who were more likely to belong to historically marginalized groups.

Early Grades

There is a dearth of literature about student-centered (CAST, 2018; Kimmons et al., 2020) technology integration in the early grades (i.e., prekindergarten through second grade), although Lauricella and Jacobson (2022) noted that first grade students appeared more cognitively engaged and better behaved when working with new and unfamiliar digital applications. Two of the new and unfamiliar applications mentioned in the Lauricella and Jacobson study, iMovie and PicCollage, can both be used in creative and transformative ways (per Kimmons et al., 2020). Lauricella and Jacobson's (2022) observations of eight first-grade classrooms found that 6- to 7-year old students were also more prone to distraction and misbehavior when teachers regularly assigned drill-and-practice (e.g., IXL) digital applications. Although six schools of varying demographic compositions were represented in the Lauricella and Jacobson study, the researchers did not link data pertaining to students' race or socioeconomic status to specific technology integration practices or norms.

Technology Integration Norms for Preservice Teachers

Enacted Practices. Generally speaking, the enacted digital pedagogical practices of preservice teachers mirror the practices of their inservice teacher mentors (Heath & Segal, 2021; Nelson & Hawk, 2020; Nelson & Voithofer, 2022) but preservice teachers are typically less likely to enact student-centered technology integration than are inservice teachers (Hughes et al., 2020; Wekerle & Kollar, 2022). Along these lines, it is relatively uncommon for lessons designed by preservice teachers to deploy digital technologies in ways that are particularly transformative (Amador et al., 2015) or innovative (Cherner & Curry, 2017). To assess the degree that preservice teachers' technology integration practices are innovative, Puentedura's (2014) *SAMR* model is a commonly cited framework (Cherner & Curry, 2017; Falloon, 2020).

SAMR taxonomizes classroom technology integration according to whether digitized tasks *substitute* for, *augment*, *modify*, or *redefine* traditional learning tasks.

SAMR versus RAT. Puentedura (2014) also groups the substitution and augmentation categories into what the author refers to as *enhancement.* Enhancement is roughly equivalent to what Hughes et al. (2006) term *amplification*, in that teaching or learning outcomes are thought to be improved via specific usages of digital technologies. Beyond this enhancement grouping, Puentedura (2014) also groups the modification and redefinition categories into what he calls *transformation*. Here, transformation is directly equivalent to Hughes et al.'s (2006) *transforms* in that both terms describe a classroom "experience that cannot be replicated using analog technology" (Cherner & Mitchell, 2021, p. 93). Although SAMR supports a slightly more fine-grained distinction between various types of transformative technology integration than the RAT model, Kimmons et al. (2020) argue that distinctions between SAMR's four levels "are unclear" (p. 182). Kimmons et al. further assert, based upon the authors' work as teacher educators, that making this more fine-grained distinction does not seem to be "fruitful" (p. 179) for educators. Nonetheless, SAMR, RAT, and PICRAT each serve a similar purpose in that they are "tools for identifying how edtech is used in the classroom" (Cherner & Mitchell, 2021, p. 100).

Technology Integration Skills. Cherner and Curry (2017) used the SAMR framework to qualitatively code preservice teachers' (*N* = 15) lesson plans, instructional observations, and questionnaire responses over the course of one college semester. After analyzing 129 total instances of technology integration, Cherner and Curry (2017) found 42 instances of digital technologies being used for substitution, 50 for augmentation, 22 for modification, and 5 for redefinition. In aggregate, the 15 preservice teachers' technology integration skills became more innovative over the course of four checkpoints during the semester. When taken in consideration with other research involving preservice teachers (Polly et al., 2020; Wekerle & Kollar, 2022), the relative rarity of using digital technologies to redefine learning tasks in the Cherner and Curry (2017) study suggests that it may be unreasonable to expect preservice teachers to frequently enact highly innovative or transformative technology integration practices, especially if they have relatively little experience afield.

Self-Reported Practices. As evident in Cherner and Curry's (2017) study, instances of using digital technologies to support higher-order cognition are relatively infrequent in lessons designed by preservice teachers (Hughes & Read, 2018; Polly et al., 2020; Wekerle & Kollar, 2022). Polly et al. (2020) found that when comparing open-ended self-report survey responses from three different cohorts at a large EPP in the southeastern United States, 85% of the instances of technology integration that were described in preservice teachers' (*N* = 89) lesson plans corresponded with the bottom half of Bloom's Revised Taxonomy (Krathwohl, 2002). Therefore, the vast majority of instances described in the Polly et al. study do not exemplify student-centered learning because they do not involve higher order cognition (Jonassen, 1996; Kimmons et al., 2020; Salomon et al., 1991). With significantly less frequency, Polly et al. (2020) found P-12 students engaged in cognitively challenging instances of technology integration such as conducting research (*n* = 6), participating in simulations (*n* = 2), and creating projects (*n* = 7). It is also noteworthy that these instances of using digital technologies to elicit higher-order cognition were more common for preservice teachers who had spent more time in practicum settings (Polly et al., 2020).

Polly et al. (2023) arrived at similar conclusions based on comparisons of inservice teachers' (*n* = 45) and preservice teachers' (*n* = 60) survey responses. Using instrumentation that primarily consisted of 4-point Likert-scales, Polly et al.'s survey asked each group to assess the degree that specific digital technologies were perceived as being conducive to their own learning alongside the degree that they were likely to use the same digital technologies in their instructional practices. Overall, Polly et al. concluded that inservice teachers "rated project- and product-related technologies, such as video creation/editing higher than pre-service teachers" (p. 42). Polly et al. (2023) noted that this finding showed that inservice teachers appeared more likely to operationalize the student-centered ISTE (2021) standards than preservice teachers.

Polly et al.’s (2023) finding that it is relatively rare for preservice teachers to use digital technologies in ways that are highly innovative or transformative is consistent with other studies (Amador et al., 2015; Cherner & Curry, 2017).

Lesson Plans. Much as Cherner and Curry (2017) used the SAMR model to gauge the sophistication of classroom technology innovation, Amador et al. (2015) used Hughes et al.'s (2006) *RAT* model to categorize preservice teachers’ (*N* = 34) written reflections about lesson designs according to the degree that digital technologies *replace*, *amplify*, or *transform* traditional instructional practices. Based on data collected in this standalone educational technology course, Amador et al. (2015) found that “almost all preservice teachers employed amplification and almost all did not use transformation” (Amador et al., 2015, p. 99). Congruent with the findings from Heath and Segal (2021) and Hughes et al. (2020), Amador et al. (2015) reported that the preservice teachers in their study rarely made comments that showed regard for ways in which their instructional decisions might impact student learning. Rather, the preservice teachers in the Amador et al. study seemed to be more absorbed with self-assessing their own technological proficiency.

Discussion

Student Demographics as a Mega-Level Factor

Despite the societal and demographic dynamics at play in Heath and Segal’s (2021) qualitative case study, it seems that the researchers may have overstated the role that racialization played in affecting their participants’ technology integration choices. Although other studies (see, e.g., Chang-Bacon, 2021; Matias, 2016) similarly found that preservice teachers tend to perpetuate White, middle class norms, Heath and Segal (2021) offer a limited amount of evidence to substantiate their claim that preservice teachers’ assumptions about race influenced their technology integration choices. To be clear, Heath and Segal found that the preservice teachers in their study either omitted references to students’ race or used “coded language to discuss race and diversity in the classroom” (p. 5) in interviews and reflections. Heath and Segal conclude that this lack of explicit acknowledgement of the role that race played in affecting preservice teachers' interactions with students invariably reinforced a culture of "white supremacy" (p. 7).

Although the sociocultural influences (Bower, 2019; Falloon, 2020) of racial dynamics in the Heath and Segal (2021) study may have impacted their participants' technology integration choices, Heath and Segal seem to discount an important micro-level variable that is emphasized in Tondeur et al.'s (2012) Synthesis of Qualitative Data model. In short, Heath and Segal (2021) place little emphasis on the influence that authentic experiences (per Tondeur et al., 2012) in practicum settings can have on preservice teachers' technology integration choices. Thus, Heath and Segal (2021) may have attributed sociocultural influences to what other researchers, such as Polly et al. (2020), have found to be common symptoms of having had relatively little experience afield in practicum settings.

TPACK and Macro-Level Assessments

Although Mishra and Koehler's (2006) TPACK assesses knowledge at the micro level, the literature shows that it is common to assess aggregate TPACK measures to monitor the efficacy of an EPP's programming (e.g., Foulger et al., 2019; Mouza et al. 2017; Thomas & Trainin, 2019). That said, a widely acknowledged limitation of much of the research pertaining to preservice teachers' TPACK is that the constructs are often measured using self-reports and perceptions and therefore may not be accurate representations of enacted practices (Foulger et al., 2019; Nelson & Voithofer, 2022; A. Thomas & Trainin, 2019). Schmid et al.'s (2021) study sheds further light on the limitations of these TPACK-based surveys. Note that Schmid et al.'s (2020, 2021) work should not be confused with the work of Schmidt et al. (2009) despite the similarity in the lead authors' names.

Schmid et al. (2020, 2021) found that their TPACK-based survey instrument was a poor predictor of digital technology use in preservice teachers' (*N* = 173) lesson plan design. The Schmid et al. (2021) study used a TPACK-based survey that was validated by Schmid et al.

(2020) and essentially shortened the more comprehensive and widely adopted Schmidt et al. (2009) instrument. When comparing the Schmid et al. (2020) instrument's results with corresponding preservice teachers' lesson plans, Schmid et al. (2021) did not identify any statistically significant correlations. In other words, the preservice teachers with self-reportedly higher levels of TPACK self-efficacy in this Swiss context were no more likely to include plans for digital technology usage in their lesson plans than were their counterparts with self-reportedly lower TPACK self-efficacy.

Improving Micro-Level Experiences

In terms of improving micro level programming within an EPP, further discussion is warranted on the Polly et al. (2023) findings. Although both the preservice and inservice teacher subgroups in the Polly et al. (2023) study indicated that they were not inclined to use podcasts or social media for teaching or professional learning, it is worth considering whether teacher educators should scaffold meaningful opportunities for preservice teachers to teach and learn with podcasts and social media, because these media forms were found to be helpful for educators in other studies (Carpenter et al., 2017; Hughes et al., 2020). After all, part of the work of cultivating digital competencies within an EPP involves introducing preservice teachers to ways in which digital technologies might support transformative approaches to their own teaching and learning (Amador et al., 2015; Hughes et al., 2006; Kimmons et al., 2020). For example, Xu and Stefaniak (2023) found that although preservice teachers may initially be reluctant to use an unfamiliar application like Marvelapp, engaging with the digital technology provides an opportunity for growth. Beyond using unfamiliar digital technologies as learners, preservice teachers' digital competencies seem to improve as a function of opportunities to gain experience using digital technologies as an instructor (Cherner & Curry, 2017; Polly et al., 2020).

Relatedly, given the measurable improvements that resulted from Christensen and Trevisan's (2023) instructional interventions, it may be worthwhile for teacher educators to replicate some aspects of Christensen and Trevisan's standalone educational technology course's syllabus. For example, in this course, preservice teachers were required to use Kimmons et al.'s (2020) PICRAT matrix to reflect upon the various ways in which technology integration figured into their lesson plans. Such experiences seem likely to translate to higher marks on SQD survey prompts such as "I was given the chance to reflect on the role of ICT [Information and Communications Technologies] in education" (Tondeur et al., 2016, p. 138).

Student-Centered versus Student Outcomes

Although I presented the Walsh-Moorman et al. (2020) vignette previously as a tangible example of student-centered digital pedagogy (Jonassen, 1996; Kimmons et al., 2020; Salomon et al., 1991), it is important to note that the activities the vignette describes (e.g., evaluating sources while recording screencasts) involve a high degree of *element interactivity* (Sweller, 1994). As the number of elements, or components involved with a learning task increase, students with little prior knowledge or experience face an increased strain on their cognitive loads. For example, in addition to learning novel content about the Holocaust and source evaluation, students in the Walsh-Moorman et al. (2020) setting who were unfamiliar with screencasting were simultaneously forced to grapple with learning new technological skills. This sort of cognitive complexity typifies the student-centered pedagogy that ISTE (2020, 2021) champions. Critics of this *discovery-oriented* (open-ended) approach argue that increasing the degree of element interactivity can impede student learning outcomes (Clark & Feldon, 2014; Mayer, 2004; Sweller, 2021). Indeed, the literature (see, e.g., Belland et al., 2015; Kalyuga et al., 1998; Zheng et al., 2020) shows that comparatively *lower academic achievers*, or students with little prior knowledge in a given domain, benefit from having greater amounts of structure in a learning environment.

Potential Hindrances Associated with Student-Centered Digital Pedagogy

To further illustrate potential challenges posed by element interactivity (Sweller, 1994), Zheng et al. (2020) described the following task as being a "typical" (p. 6) representation of a project-based activity in an English Language Arts class: “Use either Glogster or Prezi for your presentation. For your attention grabber, use a type of media within your presentation such as Penzu, Bubbl.us, Vimeo, Storybird, Xtranormal, Voki, Tiki Toki, etc.” (p. 6). As these instructions to students show, beyond requiring an application of disciplinary content knowledge, students completing this sort of project also needed to demonstrate proficiency with at least two educational technology applications, which inherently increases the element interactivity involved with this specific project (per Sweller, 1994).

Along these lines, Zheng et al. (2020) concluded that online English Language Arts courses that featured “project-based assignments and more higher-level knowledge activities benefitted *most* [emphasis added] students’ learning” (p. 9). The operative word “most” is significant because the 116 students who were taking these online courses for *credit-recovery purposes* (students who had previously failed the course) did not experience similarly beneficial learning outcomes as compared to their counterparts ($N = 919$) in courses with a heavy emphasis on “higher-level knowledge activities” (p. 9). Zheng et al. (2020) concluded that these “higher-level knowledge activities may not be helpful to credit-recovery students, or even affect their learning negatively” (p. 9). Zheng et al.’s (2020) metric for assessing online courses partly based upon their “balance of higher-level knowledge activities to lower-level ones” (p. 6) is congruent with other scholarship that frames higher-order cognition as a characteristic of student-centered digital pedagogy (Kimmons et al., 2020; Kopcha et al., 2020).

Like the Zheng et al. (2020) example, other studies have found that providing relatively unstructured learning environments can put lower achieving or less technologically proficient students at a relative disadvantage (Belland et al., 2015; Kalyuga et al., 1998; Watkins, 1997). As with the Walsh-Moorman et al. (2020) and Zheng et al. (2020) examples, it is also worth highlighting the complex degree of element interactivity (Sweller, 1994) in a technology integration instance that Cherner and Curry (2017) coded as meeting Puentedura’s (2014) standard for *redefinition*. In this example from a high school social studies classroom, one preservice teacher “assigned students the task of writing and recording an original song that incorporated the political platform of a 2016 presidential candidate and then [required students to] create a music video for their song” (Cherner & Curry, 2017, p. 278). In addition to conforming to ISTE’s (2021) expectations for engaging P-12 students in project-based activities that require higher-order cognition, these student-produced campaign videos also involved a high degree of real-world authenticity (per Darling-Aduana, 2021). While this sort of digital artifact creation aligns with ISTE’s (2020, 2021) conception of student-centered digital pedagogy, it is unclear in Cherner and Curry’s (2017) study whether these P-12 students had sufficient prior disciplinary content knowledge or requisite technological proficiency to optimize learning outcomes (Bower, 2019; Falloon, 2020; Kalyuga et al., 1998).

Student-Centered Differentiation

Per ISTE’s (2020) conception of student-centered technology integration, differentiated usages of digital technologies should “accommodate learner differences and needs” (2.5.a). Along the lines of differentiation, Belland et al. (2015) found that students with lower levels of prior academic achievement (n = 14) benefitted more from *computer-based scaffolding* than students with higher levels of prior academic achievement (n = 22). As with analog scaffolding methods in education (Wood et al., 1976), computer-based scaffolds help students acquire knowledge and skills that would otherwise be just beyond their grasp (Belland, 2017; Reiser, 2004). As a case in point, students in Belland et al.’s (2015) rural middle school setting with comparatively lower prior science grades benefitted more than their higher achieving peers from computer-based scaffolds that helped the students assemble “evidence-based arguments” (p. 330).

Learner Characteristics. Thus, the assumption that it is problematic when students receive disparate forms of digital pedagogy (Andrade Johnson, 2020; Rafalow, 2018) can be naïve (Belland et al., 2015; Sweller, 2021; Zheng et al., 2020). As mentioned earlier, students who are comparatively lower achievers are thought to benefit from having a more highly structured learning environment (Belland et al., 2015; Kalyuga et al., 1998; Zheng et al., 2020). That said, educators should take care to avoid conflating demographic characteristics, such as socioeconomic status or ethnicity, with assumptions about academic achievement (Berry, 2005; Gillborn, 2015; Watkins, 1997). It is important to distinguish between specific types of learner characteristics to avoid the common tendency to *essentialize* people from historically marginalized or specific socioeconomic groups by assuming that they will achieve at a predetermined level (Carr, 2016; Love, 2004). To bear this out, Belland et al.'s (2015) research did not find statistically significant differences in responses to their computer-based scaffolding intervention that could be connected to socioeconomic status (as determined by federal eligibility for free- and reduced-lunch).

Racialization of Technology Integration. The Kohler et al. (2022) study provides further evidence that P-12 student demographic characteristics can be associated with disparities in digital pedagogical approaches (Hughes & Read, 2018; Rafalow, 2020; Welsh & Harmes, 2018). In comparing trends from open-ended survey responses (n = 825) from six different school districts, Kohler et al. (2022) found that "as the percentage of students who identify as Black or Hispanic at a school increased, teachers were more likely to define success in terms of how frequently a technology was used, as opposed to defining success in terms of the impact on teaching and learning" (p. 16). These data may have been skewed by a policy in one district with the largest percentage of Black and Hispanic students (79%) that "tied student and teacher incentives to technology usage rates, which likely influenced how these teachers defined technology implementation success" (p. 13). This sort of policy, which gauges successful technology-mediated learning in terms of frequency of digital technology use, is technocentric and does not encourage educators to think holistically about P-12 student outcomes associated with specific technology integration choices (Bower, 2019; Falloon, 2020; Papert, 1987).

Evaluating Outcomes. With regard to P-12 student learning outcomes, it is also important to highlight nuanced differences in the teacher-centric descriptions of both the preservice and inservice populations in the Hughes et al. (2020) study. For example, Hughes et al. found that, even within descriptions of "teacher hands-on and learner hands-off use of technologies" (p. 555), inservice teachers were more focused on learning outcomes whereas preservice teachers focused on improving their own presentations or holding P-12 students' attention. When evaluating instructional practices, Coe (2013) warns against using the appearance of P-12 student engagement and classroom orderliness as indicators of success because, although they are easily observed, these metrics are "poor proxies for learning" (p. xiii).

Instead, separate survey responses from educational technology domain experts (Lai et al., 2022) and inservice teachers (Kohler et al., 2022) indicate that both of these groups largely agreed that P-12 student *learning outcomes* is the most worthy construct for evaluating the efficacy of technology-mediated learning (Bower, 2019). In the Lai et al. (2022) study, the single survey prompt that received the highest ratings from domain experts (N = 48) was "Using technology has led to a better learning performance in the subject" (p. 749). Based upon 5-point Likert-scale responses, 92% of domain experts indicated that this prompt was either "Relevant" or "Highly Relevant" (Lai et al., 2022, p. 747) when evaluating the efficacy of digital technologies. Lai et al. limited their population to domain experts by soliciting responses only from authors who had been published in *Computers & Education*, the top academic educational technology journal according to Google Scholar Metrics (2023).

Similarly, with a sample that is more representative of P-12 practitioners (n = 825), Kohler et al. (2022) found that when asked to define "successful education technology implementation" (p. 5), the most frequent construct in open-ended definitions from 41.9% of P-12 teachers (n = 346) centered on whether "the technology *enhances student learning outcomes/achievement*" (p. 10). Thus, the Kohler et al. (2022) study is consistent with trends in the literature (Hughes et al., 2020; Lai et al., 2022; Wekerle & Kollar, 2022) that show that educators' thinking about technology integration becomes more aligned with domain experts as they gain more experience afield.

Chapter Summary

To summarize, the literature indicates that although it is a goal for many EPPs to prepare preservice teachers to enact student-centered digital pedagogy (Kimmons et al., 2020; McGarr & Ó Gallchóir, 2020a; Voithofer & Nelson, 2021), several authors advocate for broadening this emphasis on what preservice teachers *do*, in terms of their technology integration practices, to encompass a more panoramic consideration of what preservice teachers *understand*, in terms of digital competencies (Falloon, 2020; Sprague et al., 2022; Yadav & Lachney, 2022). The literature also shows that this is a challenging pivot because it is easier to identify research-based approaches for assessing preservice teachers' technology integration skills (see, e.g., Cherner & Curry, 2017; Kimmons et al., 2020; Polly et al., 2020) and TPACK (see, e.g., Schmidt et al., 2009) than it is to find valid and reliable measures of preservice teachers' dispositions toward techno-ethical quandaries (Deng & Zhang, 2023; Jung et al., 2020).

In terms of informing the answer to this capstone inquiry's first research question, the literature (Hughes & Read, 2018; Karchmer-Klein & Konishi, 2021; Polly et al., 2020) shows that it is relatively uncommon for classroom technology integration to be student-centered (CAST, 2018; Kimmons et al., 2020). In general, it seems that preservice teachers are more likely to enact teacher-centered (Kopcha et al., 2020; Warner et al., 2018) approaches to digital pedagogy as compared to their inservice counterparts (Hughes et al., 2020; Wekerle & Kollar, 2022). In terms of troubling trends, it also seems that student-centered technology integration (Jonassen, 1996; Kimmons et al., 2020; Salomon et al., 1991) is more likely to occur in classrooms that are populated by affluent, White students (Hughes & Read, 2018; Rafalow, 2018; Welsh & Harmes, 2018). Given these problematic findings, it is promising that preservice teachers' technology integration choices and practices become increasingly sophisticated as they gain experience in practicum settings (Cherner & Curry, 2017; Polly et al., 2020; Wekerle & Kollar, 2022).

In addition to exploring technology integration practices, which constitute a micro-level product (per Kaufman, 2000), the literature helped me realize that in answering my second research question, there are several recent studies (Christensen & Trevisan, 2023; Knezak et al., 2023; Xu & Stefaniak, 2023) which suggest that Tondeur et al.'s (2012; 2016) six micro-level constructs for framing micro-level experiences continue to be relevant. Similarly, Tondeur et al.'s (2012) macro-level finding that cooperation "*within and between institutions* [*sic*]" (p. 7) can affect the development of preservice teachers' digital competencies is also supported by more recent scholarship (Buss et al., 2018; Foulger et al., 2019; Thomas & Trainin, 2019). However, within the literature pertaining to developing digital competencies within an EPP, most of the calls (Falloon, 2020; McDonagh et al., 2021) for developing an awareness of ways in which an educator's technology integration choices might have a societal impact per Kaufman's (2000) mega-level framing remain largely theoretical.

In short, this literature review led me toward a variety of qualitative and survey-based methodologies (see, e.g., Amador et al., 2015; Cherner & Curry, 2017; Christensen & Trevisan, 2023) that enabled me to ground the inquiry design in the following chapter using prior research and relatively recently developed theories (see, e.g., Bower, 2019; Falloon, 2020; Kimmons et al., 2020). For one specific example, the process of reviewing the literature helped me realize that Tondeur et al.'s (2016) Synthesis of Qualitative Data survey instrument would lend a previously validated (Christensen & Trevisan, 2023; Knezek et al., 2023) means of quantifying micro-level experiences that can have a generative effect on the development of digital competencies within an EPP. Findings from this sort of research-based instrument, as with much of the information in this literature review, can be used to improve the way that Marbury College's EPP cultivates skilled technology integrationists and digitally competent educators.

CHAPTER 3: METHODS

Purpose and Research Questions

The purpose of this case study was to assess the technology integration practices of Marbury College's preservice teachers and to explore factors that participants identified as influencing these instructional choices. Methodologically, this inquiry relied primarily upon qualitative data collection, coding, and analytic techniques to support thick and rich accounts of individual variability within micro-level experiences (Cherner & Curry, 2017; Merriam & Tisdell, 2015). This inquiry also utilized descriptive statistics to characterize trends at the cohort and institutional levels based upon data collected from 10 participants who belonged to the Marbury College educator preparation provider's (EPP) Class of 2024 ('24, *n* = 5) and Class of 2025 ('25, *n* = 5) cohorts. Interviews and observational field notes enabled a further exploration of *mega-level* factors (per Kaufman, 2000) that influenced these preservice teachers' technology integration choices. Aligning this external focus on societal implications with *macro-level* internal efforts to continuously improve preservice teachers' digital competencies is consistent with the stated mission of Marbury's EPP and the program leadership's goal of maintaining "Full accreditation" status with the Council for the Accreditation of Educator Preparation (CAEP, 2020a; Kaufman, 2000). In order to support improved *micro-level* technology integration practices in Rural County Schools classrooms that host Marbury's preservice teachers, I plan to share findings from this inquiry with the EPP's leadership (Bower, 2019; The Carnegie Project, 2022; Tight, 2017).

Consistent with my conceptual framework (refer back to Figure 1.3), the instrumentation for this study reflects a basis in research (see, e.g., Falloon, 2020; Kimmons et al., 2020; Tondeur et al, 2016). More specifically, Kimmons et al.'s (2020) PICRAT framework supported a systematic categorization of various instances in which Marbury's preservice teachers used digital technologies with students in field experience settings. Kaufman's (2000) Organizational Elements Model was also useful for framing various mega-, macro-, and micro-level influences that Marbury's preservice teachers identified as affecting their technology integration choices. My conceptual framework, which sorts classroom technology integration instances, influences, and implications, underpins the following research questions that drove this inquiry:

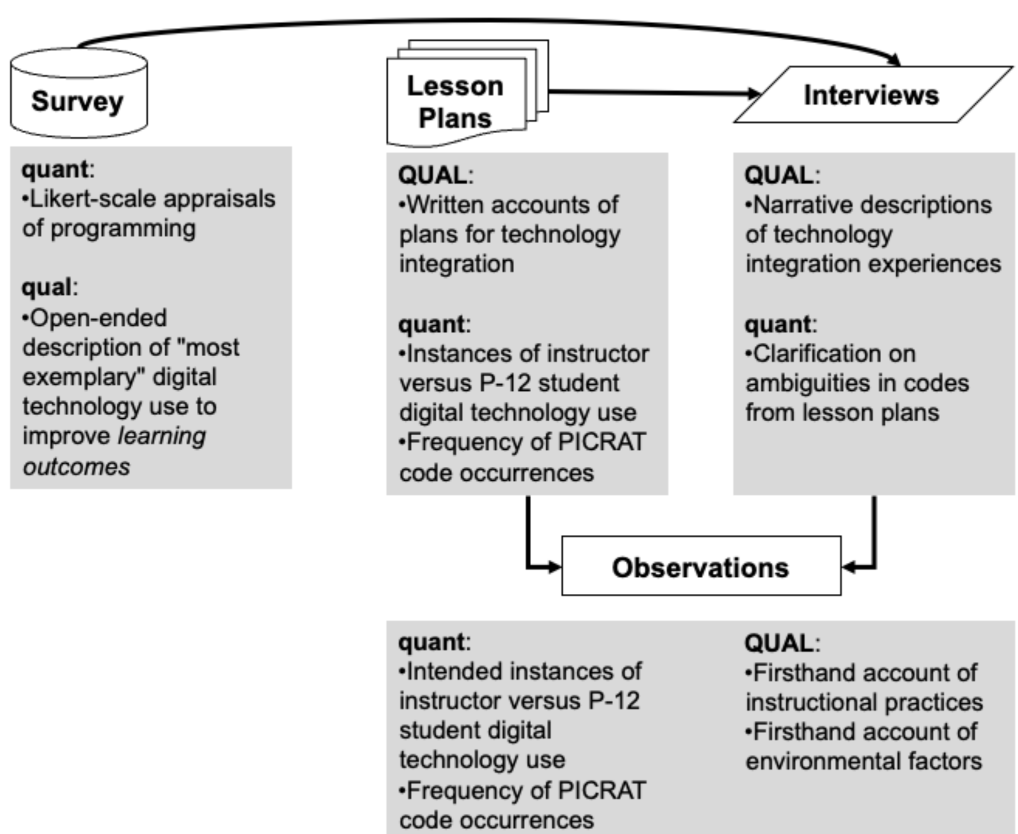
***RQ1*:** In what ways do Marbury College's preservice teachers use digital technologies with students in field experience settings?

RQ2: What factors do Marbury College's preservice teachers identify as having an influence on their technology integration choices?

Inquiry Design

Figure 3.1

Inquiry Design



Note: Uppercase *QUAL* signifies greater prioritization within the largely qualitative inquiry design than the lowercase abbreviations for *quantitative* and *qualitative* data per Plano Clark and Ivankova's (2017) recommendations.

This inquiry *intersected* a largely qualitative case study design with survey methodology (Creswell & Creswell, 2018; Hancock et al., 2021; Swanborn, 2010). The inquiry's intersecting design (see Figure 3.1) enabled a consideration of multiple forms of logic, but relied primarily on qualitative methodologies and assumptions (Hancock et al., 2021; Plano Clark & Ivankova, 2017). To elaborate, case studies typically probe informants' lived experiences within a bounded context (Hancock et al., 2021; Swanborn, 2010; Tight, 2017) whereas survey methodology can be useful for systematically and reliably quantifying respondents' aggregate data (Swanborn, 2010). Thus, using the two methodologies in tandem can enhance research rigor, with case studies fleshing out a survey's more skeletal overview of a situation (Swanborn, 2010; Tight, 2017).

To be more explicit about this study's quantitative measures, this inquiry utilized descriptive statistics to report *exploratory* findings but did not attempt to definitively discover the sorts of causal links that would accompany an *explanatory* study (Bazeley, 2018; Hancock et al., 2021). That said, data was collected from participants in four different ways to support robust triangulation: the Technology Integration Experiences Survey, lesson plans, interviews, and observations. A comparable sort of triangulation (Carter et al., 2015) between questionnaire, lesson plan, and observational data was used in Cherner and Curry's (2017) case study that also focused on the technology integration practices of preservice teachers.

Setting

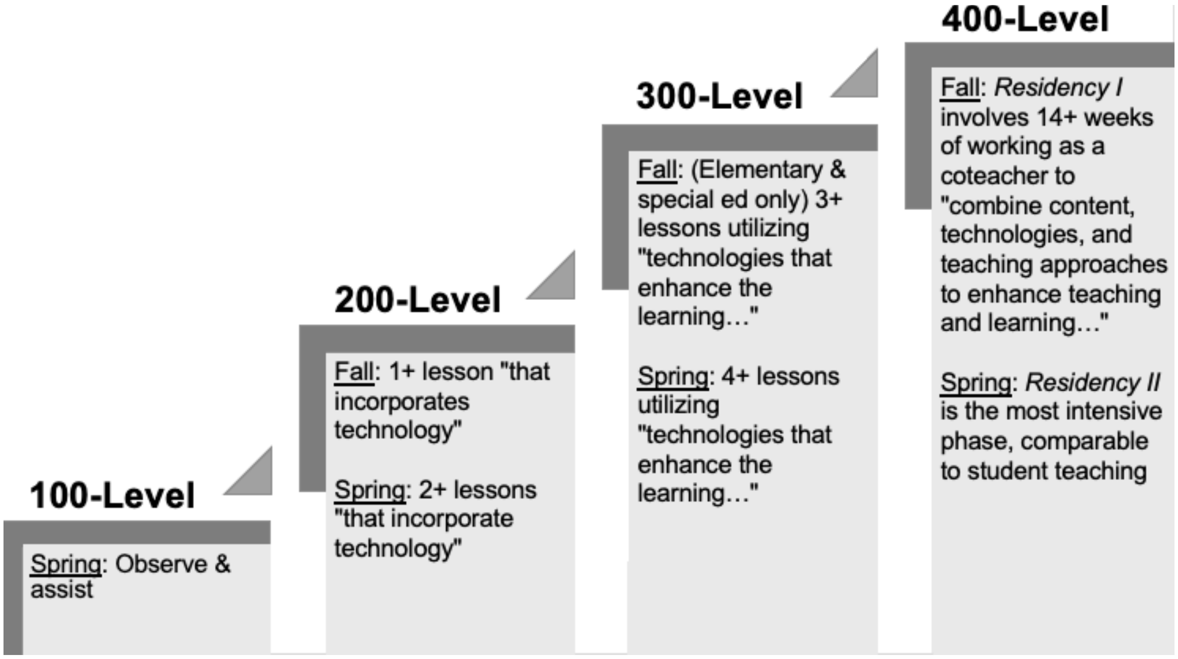
Marbury College is a private, four-year liberal arts institution of higher education that typically enrolls between 650 and 800 students in a relatively rural part of West Virginia. During the fall semester of 2023, Marbury's EPP consisted of 33 preservice teachers who planned to graduate in 2024 (n = 5), 2025 (n = 9), 2026 (n = 10), and 2027 (n = 9). The Marbury EPP currently employs two full-time education professors, referred to in this study as Professor Delta, and Professor Zeta, along with one part-time professor (Professor Alpha) and several adjunct instructors. There has been a great deal of turnover within the Marbury education faculty in the past few years, with Professor Alpha (a former department chair) transitioning to a part-time role as a Marbury education instructor and Professor Beta (a former department chair) resigning from her position at the college. Professor Zeta (hired in 2022) is the current education department chair and Professor Delta (hired in 2023) succeeded Professor Alpha as the program's coordinator of field experience placements during the fall of 2023.

These placements extend beyond Marbury College's campus and involve dozens of *cooperating teachers* and five professional development school (PDS) *liaisons.* Cooperating teachers and PDS liaisons are full-time Rural County Schools employees who also receive stipends from Marbury in exchange for services to the EPP. Cooperating teachers serve both as mentors and evaluators for Marbury's preservice teachers in field experience settings. PDS liaisons collaborate with their cooperating teacher colleagues and Marbury's education professors to arrange these field experience placements. PDS liaisons also attend monthly meetings with Marbury's education professors to ensure that various stakeholders have a voice in shaping programmatic improvements within Marbury's EPP per CAEP's (2020a) requirements.

It is also noteworthy that the program's field experiences typically occur in one of five PDS schools (three elementary schools, one middle school, and one high school). Each of these schools is situated in the Rural County Schools public school district. The elementary schools all receive Title I funding but the middle and high school do not (WVDE, n.d.). This is a noteworthy demographic variable because schools with "high percentages of children from low-income families" (USDE, 2018, para. 1) receive Title I funds. Relatedly, according to United States Census (2021) data, 24.1% of households in Rural County did not have a "broadband Internet subscription" between 2017 and 2021. Finally, to round out an account of local demographics, Rural County's population is overwhelmingly White, at greater than 93% according to U.S. Census (2021) data.

Figure 3.2

Field Experience Progression



In terms of programming that centers on developing digital competencies, most of Marbury's preservice teachers take EDUC 120: Instructional Technology during the spring semester of their freshman or sophomore year and then are expected to use digital technologies with P-12 students in field experiences over their subsequent years in the program (see Figure 3.2). According to language in the 2023-2024 Marbury College course catalog, the program's preservice teachers are expected to progress from planning lessons "that incorporate technology" (p. 60) during their 200-level placements toward eventually leveraging technology to "enhance teaching and learning" (p. 61) during their 400-level fall semester placements. As Marbury's preservice teachers advance through 200-, 300-, and 400-level field experiences, they also take on progressively increased amounts of responsibility as instructors, eventually assuming the role of *coteacher* during the fall semester of their fourth year. During the 2020-2021 academic year, Marbury's EPP began emphasizing a coteaching model for field experiences, wherein instructional responsibilities are meant to be shared between preservice and inservice teachers.

In terms of other recent changes within the EPP's programming, the fall semester of 2023 was the first time that Marbury's education department offered EDUC 220: Technology Integration for Diverse Learners. Professor Zeta taught this course in its inaugural semester while this research study was unfolding. The Marbury EPP currently requires only special education majors to take this second standalone technology integration course.

It is also relevant to this study that the EPP has had a *technology integration mandate* at least since the MacKinnon et al. accreditation team audited the program in 2018. MacKinnon et al. noted this requirement that Marbury's preservice teachers integrate digital technologies into their written lesson plans in their *Formative Feedback Report*. Evidence of a program-wide technology integration mandate also appears in one criterion on the EPP's Lesson Plan Evaluation rubric. This rubric's criterion for technology integration assesses whether a lesson "plan delivers content in a 21st century context using technology" but offers no further specifics.

A technology integration mandate is also evident in prompts on the program's older and newer lesson plan templates. The program's newer template (adopted in spring 2023) prompts Marbury's preservice teachers to differentiate between *teacher* and *student* technology usage. The newer template does this by reminding Marbury's preservice teachers to include a *"rationale if students do not use digital tools*" and later prompts them to "*Highlight technology integration in yellow.*" In addition to the teacher-use versus student-use technology integration prompt, Professor Zeta later modified the newer template to prompt Marbury's preservice teachers to reflect on whether they utilized CAST's (2018) Universal Design for Learning Guidelines.

Participants and Sampling

Participants for this inquiry were recruited during the fall semester of 2023 from groups of preservice teachers enrolled in the Marbury College EPP's Class of 2024 and Class of 2025 (see Table 3.1) cohorts. Although 12 preservice teachers initially agreed to participate in the study, the total population of participants in this study winnowed to 10 because two participants participated in only the survey phase of data collection. This study only reports data from the 10 participants who completed a survey, provided a lesson plan, and took part in an interview. From among these 10, four participants (i.e., Mariyah, Sally, Terence, and Clara) also participated in formal observations.

During fall 2023, the Class of 2024 cohort participated in field experiences through EDUC 480L: Residency I. Meanwhile, the Class of 2025 cohort participated in field experiences through EDUC 395L: Field-Based Experience IV. Participants who were enrolled in 100- and 200-level field experiences during fall 2023 were excluded from this study because they had a comparatively limited amount of experience in the program and were not yet significantly involved in planning or delivering instruction to P-12 students. By contrast, Marbury's preservice teachers in the program's third year (Class of 2025) are required to plan and teach a minimum of three lessons and therefore could provide evidence of ways in which they used digital technologies with P-12 students during field experiences. Their field experiences, as part of the lab class EDUC 395L, required members of the Class of 2025 cohort to spend at least 25 hours in P-12 settings during the fall semester of 2023.

Table 3.1

Study Participants

Pseudonym	Cohort	Gender Identity	Race	Certification Pathway	Data
Daniel	2024	Man	White	Elementary	Survey Lesson Plan Interview
Isabel	2024	Woman	White	Secondary Math & Special Education	Survey Lesson Plan Interview
Kimberly	2024	Woman	White	Physical Education/Health	Survey Lesson Plan Interview
Mariyah	2024	Woman	White	Elementary	Survey Lesson Plan Interview Observation
Terence	2024	Man	Black	Special Education	Survey Lesson Plan Interview Observation
Anya	2025	Woman	White	Special Education	Survey Lesson Plan Interview
Clara	2025	Woman	White	Elementary & Special Education	Survey Lesson Plan Interview Observation
Nancy	2025	Woman	White	Elementary	Survey Lesson Plan Interview
Sally	2025	Woman	White	Elementary	Survey Lesson Plan Interview Observation
Tessa	2025	Woman	White	Special Education	Survey Lesson Plan Interview

Recruitment and Consent

In terms of recruitment, I arranged with Professor Alpha to meet with students enrolled in EDUC 395L and EDUC 480L on Marbury College's campus in mid-September to verbally explain the study, review the electronic consent form, and answer questions. Prior to meeting with these prospective participants, I sent a brief recruitment email with a link to the study's electronic consent form (see Appendix B) and the subsequent Technology Integration Experiences Survey (see Appendix C). Per Institutional Review Board protocol, I then sent follow-up recruitment emails to prospective participants who had not yet agreed to participate in the study approximately 24-hours after meeting with each cohort on Marbury College's campus and then sent another email one week later. Participants were given a two-week window to decide to enroll in the study. Consent was obtained electronically using secure Qualtrics software.

Data Collection

Technology Integration Experiences Survey

Data collection began with the Technology Integration Experiences Survey immediately after participants granted electronic consent to enroll in the study. Participants took approximately 15- to 20-minutes to complete the online survey in Qualtrics, responding to questions about basic demographic data (e.g., gender, racial/ethnic identity), one open-ended written response, and 24 Likert-scale prompts. The open-ended response, which is directly relevant to this study's first research question, invited participants to "describe the most exemplary way in which you have used digital technologies to improve PK-12 student *learning outcomes* in a field experience setting" (see Appendix C, Item 7). The emphasis on *learning outcomes* draws attention to what experts and practitioners within the field have identified as the single most important construct to use when evaluating educational technologies (Kohler et al., 2022; Lai et al., 2022).

This open-ended prompt also responds to the observation by MacKinnon et al. (2018) that it was unclear how Marbury's preservice teachers "perform in creating opportunities for students to use technology to enhance learning" (p. 36) by providing an opportunity for each respondent to describe their perceived most exemplary instance of classroom technology integration to date. As has been found in other relevant studies (see, e.g., Hughes et al., 2020; Kohler et al., 2022; Wekerle & Kollar, 2022), an educator's own account of what constitutes successful technology integration can provide insights into their disposition toward digital pedagogy.

Likert-Scale Responses

I adapted the 24 Likert-scale prompts in this survey from Tondeur et al.'s (2016) Synthesis of Qualitative Data (SQD) instrument. Prior studies have found that the SQD survey instrument is a valid and reliable means of assessing preservice teachers' perceptions of their micro-level experiences developing digital competencies within an EPP (Christensen & Trevisan, 2023; Knezek et al., 2023; Tondeur et al., 2016). Tondeur et al.'s (2016) survey measures six constructs via four prompts per construct. Each of these items invites participants to assess micro-level experiences that Tondeur et al. (2012) identified as being impactful strategies for helping preservice teachers develop digital competencies. These constructs include role modeling, reflection, instructional design, collaboration, authentic experiences, and feedback (Tondeur et al., 2012, 2016).

Although the Schmidt et al. (2009) instrument is more widely cited in the literature than the SQD instrument (Tondeur et al., 2016), the SQD instrument is more relevant to this capstone inquiry because it focuses on preservice teachers' accounts of lived experiences as participants in an EPP. To illustrate the contrast between the two surveys, stems in the Schmidt et al. (2009) instrument typically begin with phrases like "I know how to…" (p. 145) and "I can…" (p. 145) whereas stems in the SQD instrument begin with phrases like "I was given…" (Tondeur et al., 2016, p. 138) and "I was encouraged to…" (p. 138). In short, rather than gauging preservice teachers' self-efficacy with respect to TPACK (Bandura, 1977; Schmidt et al., 2009), the SQD survey gauges preservice teachers' perceptions about their technology Integration experiences within an EPP (Tondeur et al., 2016).

In terms of adapting the SQD instrument, it is important to note that I did not think that the original instrument's use of the term "ICT" (Tondeur et al., 2016, p. 138) would resonate with participants in my local setting. *ICT* is an acronym for information and communications technology that is commonly used by European teacher educators and researchers (see, e.g., McDonagh et al., 2021; McGarr & Ó Gallchóir, 2020) but is not frequently used in conversations in the contexts that surround Marbury based upon my experiences. Therefore, in places where ICT appears in the Tondeur et al. (2016) instrument, I substituted the phrase *digital technology* to borrow a term that is commonly found in the relevant literature (Bower, 2019; Falloon, 2020). Professor Zeta (personal communication, April 25, 2023), who is the current chairperson for the education department at Marbury College, agreed that this was a logical adaptation for our local setting. To minimize confusion over the term for respondents, I added a definition of *digital technology* that appeared for survey respondents via a hover-over feature within the online Qualtrics software. The definition states: "digital technology is defined as a digital tool (e.g., Chromebook or Promethean Board) that can support classroom teaching and/or learning" (Appendix C, item numbers 8-31).

Other Datasets

In addition to using the Technology Integration Experiences Survey, I also obtained data through lesson plans, interviews, and observations (Creswell & Creswell, 2018; Plano Clark & Ivankova, 2017). As mentioned previously, two prospective participants' survey data were removed from this study because they only participated in the survey phase of data collection. Providing only one source of data (i.e., survey) prevented triangulation between multiple sources for these two individuals (Carter et al., 2014; Creswell & Creswell, 2018), therefore I removed these two from the population of participants in order to improve the internal validity of this study. Other than the Likert-scale survey data, each of this study's data sources elicited primarily qualitative data, much of which I transformed into descriptive summary statistics (Bazeley, 2018; Creswell & Creswell, 2018). Although I collected quantitative and qualitative data "at roughly the same time" (Creswell & Creswell, p. 15) during each phase of this study, there was also a *sequential* element to this inquiry's design. For example, the initial data that I collected from the survey and lesson plans informed my development of semi-structured interview questions (Hancock & Algozzine, 2016; Ivankova et al., 2006).

Lesson Plans

After participants were enrolled in the study and completed the Technology Integration Experiences Survey, I contacted them again via their Marbury College email accounts to invite each of them to share one written lesson plan. This contact consisted of an email requesting that participants reply with an attachment containing their chosen lesson plan file. The email further specified that the lesson plan should be from a lesson that they had already taught or would teach soon with P-12 students during the fall semester of 2023. If participants had already taught multiple lessons by this point in the semester, then I encouraged them to choose the lesson plan that featured what they perceived to be their most exemplary instances of technology integration.

When I received these lesson plans by email, I color coded technology integration instances that were reported in each document (see Document Analysis Protocol in Appendix D). These color codes required me to interpret whether instructors and/or students engaged with digital technologies in hands-on ways in a given instance (Hughes et al., 2020; Schmid et al., 2021). Based on the phrasing in the lesson plans, I inferred whether the primary intended user was either the P-12 students, the instructor(s), or both (students and instructors) using a methodology that is comparable to Schmid et al.'s (2021) and Hughes et al.'s (2020). I then transferred these data into a Digital Technology Use Log in Microsoft Excel and recorded memos when it was unclear who the primary intended user was for a given technology integration instance. I later assigned PICRAT-based codes (per Kimmons et al., 2020) when applicable to these instances. As a form of *member checking* (Merriam & Tisdell, 2015), I also customized interview questions as needed to clarify ambiguities in written lesson plans and probe further about reported technology integration instances.

Interviews

To reiterate, I customized follow-up *semi-structured interview* (Hancock & Algozzine, 2016) questions based upon data obtained from the Technology Integration Experiences Survey and the participants' lesson plans. These questions enabled me to systematically and reliably tailor interview questions (Cherner & Curry, 2017; Tight, 2017). For example, per the Interview Protocol in Appendix E, I asked follow-up questions pertaining to open-ended survey responses and Likert-scale responses that indicated particularly strong reactions to specific survey prompts. With regard to lesson plans, I asked follow-up questions about the technology integration instances that were ambiguous or exemplary. I also asked questions that were directly responsive to the extant literature and my conceptual framework to learn more about ways in which participants used digital technologies with P-12 students and to inquire further about the factors that participants identified as influencing their technology integration choices. I used the final prompt on the interview protocol as a means of recruiting a convenience sample of participants who would be willing to participate in the observation phase of data collection.

Appendix F shows that there was some variability in terms of the questions that I asked each participant. Although the interviews followed the same basic routine, I made decisions in real-time about specific questions to omit for specific participants in order to abide by my pledge to keep interviews between 30- to 45-minutes in length. For example, I asked six participants specific questions pertaining to Kimmons et al.'s (2020) PICRAT matrix to follow-up on survey responses and to clarify ambiguities in their lesson plan data. Because several participants seemed unfamiliar with the PICRAT matrix, I omitted this particular prompt with four participants (i.e., Kimberly, Terence, Sally, and Nancy). I found that it was more time-efficient to ask these participants specific questions about technology integration in their lesson plan data and then apply PICRAT-based codes after the interviews based upon their responses.

Observations

The first two interviewees in each cohort that I asked to participate in formal observations (n = 4) each agreed to allow me to observe them teaching one lesson in a field experience placement. Whereas open-ended survey, lesson plan, and interview data elicited self-reports of participants' technology integration practices, observational data enabled me to capture firsthand accounts of these four participants' enacted instructional practices. These observations were particularly useful for generating data to answer the first research question and enabled me to triangulate technology integration instances as described in participants' self-reports with what I saw firsthand. This triangulation was important because observations enable data collection from an alternative, and potentially more objective vantagepoint, than can be gleaned from self-reports (Carter et al., 2014; Hancock et al., 2021; Mertens & Wilson, 2019). Observational data, which I collected per the protocol in Appendix G, was also useful for making inductive discoveries about specific settings (Hatch, 2002).

Data Analysis

Table 3.2 provides an overview of how I triangulated data using multiple sources (Carter et al., 2014) to answer each research question. For example, open-ended survey prompts were compared against lesson plan and interview data to answer the first research question, which pertains to how participants used digital technologies with P-12 students in field experience settings. For the four participants (i.e., Mariyah, Sally, Terence, and Clara) who were formally observed, I was also able to compare their self-reported technology integration practices against the enacted practices that I observed firsthand in the field. The 24 Likert-scale prompts on the Technology Integration Experience Survey were also compared against interview data to answer the second research question, which explored the factors that participants identified as having an influence on their technology integration choices. Lesson plans, interviews, and observations were also useful for extracting primarily qualitative data to support more robust responses to the second research question.

Most of the data obtained from the sources listed in Table 3.2 is qualitative, although the Likert-scale data is quantitative. Technology integration *instances* were also quantified after they were converted from qualitative sources (i.e., lesson plans and observational data). In this study, an instance can be defined as a way in which a digital technology mediates P-12 classroom learning (Bower, 2019; Cherner & Curry, 2017; Kimmons et al., 2020).

Table 3.2

Triangulation Between Multiple Data Sources

Method	Research Question	Data Analysis	Compared Against
Open-Ended Survey Prompt	RQ1	qual	Lesson Plans, Interviews, & Observations
24 Likert-Scale Prompts	RQ2	quant	Interviews
Lesson Plans	RQ1 RQ2	QUAL & quant	Interviews, Open-Ended Survey Prompt, & Observations
Interviews	RQ1 RQ2	QUAL & quant	Open-Ended & Likert-Scale Survey Prompts, Lesson Plans, & Observations
Observations	RQ1 RQ2	QUAL & quant	Open-Ended Survey Prompt, Lesson Plans, Interviews

Note: Uppercase *QUAL* signifies greater prioritization within the largely qualitative inquiry design than the lowercase abbreviations for *quantitative* and *qualitative* data per Plano Clark and Ivankova's (2017) recommendations.

Digital Technology Use with P-12 Students

In answering the first research question, which pertains to the ways in which Marbury College’s preservice teachers used digital technologies with P-12 students, I needed to iteratively interpret and transform qualitative data (Bazeley, 2013, 2018). Thus, I needed to make sense of interview transcriptions and textual accounts of technology integration instances that were described in open-ended survey responses, lesson plans, interviews, and observational field notes (Amador et al., 2015; Cherner & Curry, 2017; Hughes et al., 2020). In addition to maintaining records of these instances, I also deployed a systematic method for managing my own *field notes, bracketing, memos*, *coding*, and *data sorting* (Bazeley, 2013). These qualitative methods are explained as follows:

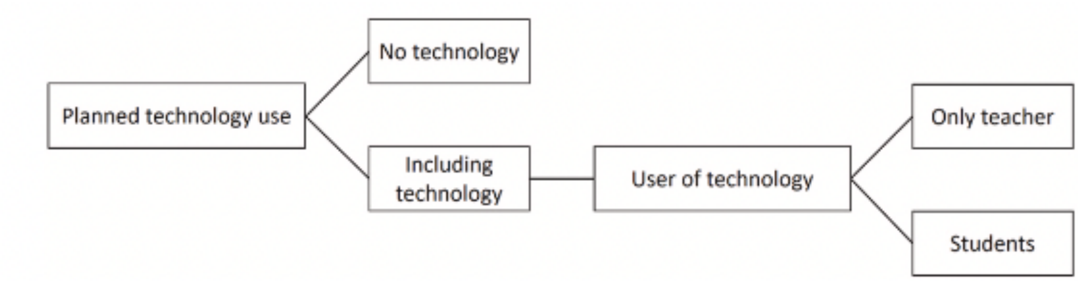
- Field notes are real-time written records "on the behavior and activities of individuals at the research site" (Creswell & Creswell, 2018, p. 186).
- Bracketing enables researchers to maintain a record of real-time subjective interpretations that go beyond verbatim accounts of what was said or observed (Hatch, 2002).
- Memo making involves documenting a researcher's thoughts "outside the heated, hyper-focused moments of data collection" (Weaver-Hightower, 2019, p. 11).
- Coding involves assigning a word or short phrase to succinctly describe a salient data segment (Saldaña, 2016).
- Data sorting enables qualitative researchers to analyze, summarize, and interpret patterns in various data sets (Bazeley, 2013).

I collected field notes during observations. During these observations, and also with interviews, I used bracketing to distinguish between that which I could objectively observe and my own subjective interpretations of events and conversations (Hatch, 2002; Weaver-Hightower, 2019). I also made memos and coded data in Microsoft Excel following initial stages of each form of data collection (Saldaña, 2016, Weaver-Hightower, 2019). I then systematically managed, sorted, and analyzed these data using Excel spreadsheets (Bazeley, 2013). Excel's affordances are compatible with each of the previously described processes and enable qualitative researchers to efficiently recognize "patterns and themes" (Patton, 2014, p. 540) across diverse datasets.

To elaborate, I deployed Bazeley's (2018) method of translating raw data into segments for *preliminary interpretation.* Thus, as a starting point for analysis, I initially coded technology integration instances by identifying the hands-on user(s) of a digital technology within a data segment (Hughes et al., 2020; Schmid et al., 2021). I obtained these qualitative data from this study's open-ended survey responses, lesson plans, interviews, and observations. This method of differentiating between student and instructor hands-on engagement with digital technologies adapted Schmid et al.'s coding scheme (see Figure 3.3) by incorporating Hughes et al.'s (2020) "hands-on" (p. 558) language for coding these data to differentiate between student- and teacher-centered technology integration instances (Kopcha et al., 2020; Warner et al., 2018). In short, when participants were the sole users of digital technologies while serving as instructors, I considered the instance to be teacher-centered (Hughes et al., 2020; Kopcha et al., 2020). This initial sorting of data did not enable me to capture the degree that P-12 students had *agency* (autonomy and creative control) with digital technologies (Hughes et al., 2020; Kohler et al., 2022). Put differently, this initial data-sorting step helped me identify teacher-centered technology integration instances (Kopcha et al., 2020; Warner et al., 2018), but did not enable me to identify student-centered instances (CAST, 2018; Kimmons et al., 2020).

Figure 3.3

Schmid et al. (2021) Coding Scheme



Note: From "Self-reported Technological Pedagogical Content Knowledge (TPACK) of Pre-service Teachers in Relation to Digital Technology Use in Lesson Plans," by M. Schmid, E. Brianza, and D. Petko, 2020, *Computers in Human Behavior*, *115*, p. 4 (https://doi.org/10.1016/j.chb.2020.106586). CC BY 4.0.

In keeping with my conceptual framework, I then used the coding algorithm in the PICRAT Flow Chart (see Appendix H) to support a more nuanced and taxonomized account of the degree that technology integration instances were student-centered (Hughes et al., 2006; Kimmons et al., 2020). This PICRAT-based coding scheme is comparable to the way in which Cherner and Curry (2017) taxonomized the technology integration instances of preservice teachers using Puentedura's (2014) SAMR model. However, rather than using SAMR, I converted data segments into nine PICRAT (Kimmons et al., 2020) codes that are reported in Chapter 4 via descriptive statistics.

Although my data collection methods and population are similar to other studies with preservice teachers (see, e.g., Cherner & Curry, 2017; Polly et al., 2020), my classification of technology integration instances according to PICRAT codes is more directly comparable to Borup et al.'s (2022) methodology. Borup et al. used PICRAT codes to identify trends in data from inservice teachers' (*N* = 77) open-ended survey responses. Such data translation is inherently reductive and risks oversimplifying or misinterpreting actual practices (Bazeley, 2013, 2018).

To mitigate such risks, I engaged in member checking (Merriam & Tisdell, 2015) during interviews and applied a variety of *a priori* and *in vivo* codes using my Qualitative Codebook (see Appendix I). The *a priori* codes helped me make analytic connections between raw qualitative data and terminology that I found during my prior review of the literature. Beyond these predetermined codes, I also looked for *in vivo* codes and any other codes or themes that emerged inductively during the data collection and analyses phases. *In vivo* codes utilize "words or phrases used by participants as labels for codes to capture the essence of what the participants are saying in their own terms" (Bazely, 2013, p. 166). My qualitative coding scheme (Saldaña, 2016) helped me systematically describe and categorize various technology integration instances (e.g., Kimmons et al., 2020) and the factors that influenced participants' technology integration choices (e.g., Falloon, 2020; Tondeur et al., 2012).

During each phase of data collection, I compared findings both within and between the Class of 2024 and Class of 2025 cohorts. I did this largely by relying upon descriptive statistics to determine whether trends could be identified within cohorts and/or in aggregate at the macro level. These sorts of analyses and reporting are comparable to Polly et al.'s (2020) research involving multiple cohorts of preservice teachers enrolled in a single EPP. The goal of these analytical processes is to be able to report both qualitative and quantitative findings about the ways in which Marbury College's preservice teachers use digital technologies with P-12 students in field experiences.

Influential Factors Identified by Participants

In addition to applying codes pertaining to technology integration instances at the micro level, I also coded raw data in Excel spreadsheets based upon other macro- and mega-level influences that were identified in each data set (Bazeley, 2013; Kaufman, 2000). Beyond micro-level factors, the literature suggests that macro- (Tondeur et al., 2012) and mega-level factors (Falloon, 2020; Jung et al., 2020; Kaufman, 2000) may also affect preservice teachers' technology integration choices. Therefore, I needed to probe beyond participants' instructional practices in order to answer the second research question, which inquires about factors that participants identify as influencing their technology integration choices. Qualitative data pertinent to this second research question emerged from participant lesson plans, interviews, and observations.

Quantitative data that are also pertinent to the second research question also emerged from the Technology Integration Experiences Survey. Along these lines, I used descriptive statistics to summarize findings from the 24 Likert-scale items I adapted from Tondeur et al.'s (2016) SQD instrument. More specifically, for each of Tondeur et al.'s six survey constructs, I summarized the means, medians, modes, and standard deviations within each cohort and in aggregate for all respondents. Based upon interview data, I later determined it would be informative to compare Likert-scale survey data from four participants who were enrolled in

EDUC 220: Technology Integration for Diverse Learners during the fall semester of 2023 versus their six counterparts who were not enrolled in the course. Again, I used descriptive statistics to make these comparisons.

To triangulate between datasets, I also compared data from the SQD-adapted (Tondeur et al., 2016) Likert-scale prompts with data that emerged from the open-ended survey prompt, lesson plans, interviews, and observations (Swanborn, 2010; Tight, 2017). This sort of triangulation (Merriam & Tisdell, 2015) was critical because Tondeur et al. (2021) found that the SQD instrument can produce vastly different accounts of micro-level experiences within a single institution. Thus, in trying to determine which factors participants identified as affecting their technology integration choices, I discovered several micro-, macro-, and mega-level trends (Kaufman, 2000; Tondeur et al., 2012, 2016).

Synthesis

Throughout the data collection and analysis process, I continually explored the interplay between findings pertaining to both the first and second research questions (Bazeley, 2018). In other words, as I gained a clearer understanding of the technology integration norms within the Class of 2024 and Class of 2025 cohorts, I iteratively searched for possible connections between the factors that participants identified as affecting their technology integration choices and their instructional practices. I also sorted printouts of the coded qualitative data manually to gain a tactile feel for the data (Bazeley, 2013; Saldaña, 2016). This enabled me to group codes into categories which were then useful for summarizing broad themes that became evident in the qualitative data (Saldaña, 2016).

Bazeley (2018) recommends this secondary level of processing after a preliminary interpretation phase to see if patterns emerge either deductively or inductively. Yet, because my inquiry was exploratory in nature, I stopped short of attempting to make definitive claims about causality (Hancock et al., 2021). Nonetheless, by sharing findings about participants' technology integration practices alongside participants' accounts of factors that reportedly affect these practices, I attempted to synthesize answers to the research questions in a manner that supports improved teaching practices, and ultimately learning outcomes, at the mega, macro, and micro levels (Kaufman, 2000; The Carnegie Project, 2022; Tight, 2017).

Limitations and Delimitations

Due to *limitations* associated with relying primarily on self-reports and *delimitations* imposed by the scope of this inquiry, it is important to acknowledge that the findings I set forth in Chapter 4 support a less-than-perfect assessment of what was happening in this context during the fall semester of 2023 (Hancock et al., 2021; Weaver-Hightower, 2019). To elaborate, self-reported accounts in surveys and interviews can be skewed by a participant's desire to furnish *socially desirable* responses (Choi & Pak, 2005; Shifflet & Weilbacher, 2015). In order to counter participant tendencies to exaggerate or describe only their most exemplary practices (an inherent limitation of this study), this study also invited participants to share experiences in which digital technologies seemed to hinder teaching or learning (see, e.g., Amador et al., 2015; Englehardt & Brown, 2019).

A delimitation of this study is that it was necessary to obtain a convenience rather than a *purposive* sample for observations (Merriam & Tisdell, 2015). A purposive sample would have been beneficial because I would have liked to observe participants whose lesson plans and interview data suggested that they could serve as exemplars for their respective cohorts. That said, scheduling logistics made this impractical because there were vast discrepancies in the dates in which participants fulfilled their field experience requirements. It was not plausible for me to wait until all lesson plan and interview data could be obtained prior to making arrangements to conduct observations.

Another delimitation of this study is that the inquiry was less focused on exploring ineffective technology integration practices within the Class of 2024 and Class of 2025 cohorts during the fall semester of 2023. Despite my personal interest in technoskepticism (Krutka et al., 2020), I made the decision to focus more so on inviting participants to share their most exemplary practices to determine whether MacKinnon et al.'s (2018) assessment of the program remains valid as of the fall of 2023. As stated previously, in CAEP's 2018 audit, MacKinnon et al. (2018) found that it was unclear how the program's preservice teachers "perform in creating opportunities for students to use technology to enhance learning" (p. 36).

I also felt that participants would be more willing to share their perceived most exemplary technology integration practices as opposed to what they perceive to be their most ineffective practices. As a final delimitation of this study, it is worth noting that I chose to complete the data collection process during the fall semester of 2023. This delimitation in time and scope prevented me from making a longitudinal study or capturing an account of what fourth-year preservice teachers do during their final and most intensive spring semester while enrolled in Marbury's EPP.

Positionality Statement

For further reflexivity (Weaver-Hightower, 2019), it is important to disclose that I am employed as an adjunct education instructor at Marbury College. As such, I am presently teaching my sixth iteration of EDUC 312: Teaching Social Studies during the spring semester of 2024 at Marbury. Two participants from the Class of 2024 cohort were former students in my EDUC 312 class, and five participants from the Class of 2025 cohort are presently enrolled in EDUC 312. Particularly for members of the Class of 2025 cohort, an unspoken pressure may have made them feel compelled to participate in this study (Check & Schutt, 2017). To acknowledge this ethical liability, my recruitment protocol explained to prospective participants that they would not be penalized for opting out of participation in this study. Moving forward, I need to honor this promise as a professional and make a conscious effort to avoid favoring or discriminating against any individual on the basis of whether or not they participated in this study (Belzer & Ryan, 2013).

In terms of positionality, my own evolving pedagogical views are also worth making explicit (Check & Schutt, 2017). Philosophically, my background as a social studies educator contributes to my own initial inclinations toward student-centered pedagogy (Dewey, 1916; NCSS, 2013). The National Council for the Social Studies (2013) encourages social studies teachers to adopt inquiry-based approaches to instruction and I enjoyed facilitating these kinds of open-ended activities throughout my career as a high school teacher.

After I left the high school classroom and transitioned into my doctoral studies, I quickly became attracted to Jonassen's (1996) idea that computers could serve as *mindtools* that further cognition and spur creative innovations in teaching and learning. As mentioned in Chapter 1, my interest in student-centered digital pedagogy (Jonassen, 1996; Kimmons et al., 2020; Salomon et al., 1991) also affected the way I initially approached the problem of practice that is the focus of this study. In short, I saw myself as a champion of student-centered digital pedagogy and felt that it was my role to prepare preservice teachers to enact the sorts of practices described by the ISTE (2020, 2021) standards.

As I entered the latter phases of my doctoral studies, I took several instructional design courses that helped me learn to appreciate the benefits of more explicit instructional practices (Rosenshine, 2012; Watkins, 1997). In terms of how this intersected with my role as a parent, after having successfully taught two of my own children to read using Engelmann et al.'s (1983) highly scripted programming, I came to recognize the merit of *Direct Instruction* (Magliaro et al., 2005). Quite the opposite of Jonassen's (1997) open-ended approach to instruction, Magliaro et al. (2005) argue in favor of using digital technologies to design highly structured learning environments. I also developed an appreciation for the amount of research and iteration that often informs the development of instructional practices that become replicable at scale (Engelmann et al., 1983; Magliaro et al., 2005). Through these experiences, I eventually came to see that teacher-centered (Kopcha et al., 2020; Warner et al., 2018) technology integration practices can lighten cognitive loads for students who struggle academically by reducing element interactivity (Clark & Feldon, 2014; Sweller, 1994; Zheng et al., 2020). Rather than championing relatively romantic views of student-centered digital pedagogy (Jonassen, 1996;

Salomon et al., 1991), my own views on the subject are now more technoskeptical (Krutka et al., 2020) and pedagogically neutral (Harris et al., 2010).

In retrospect, my evolving views on pedagogy have surely affected my role as a researcher in this capstone inquiry (Merriam & Tisdell, 2015). That said, rather than blindly donning a student-centered lens (Dewey, 1916; Jonassen, 1996; Salomon et al., 1991), as I was once inclined to do, I feel that I now have a better sense of when teacher-centered (Kopcha et al., 2020; Warner et al., 2018) technology integration practices might be optimal (e.g., when teaching basic skills in the early grades). Thus, although I remain an imperfect instrument as a researcher (Farrow et al., 2020; Merriam & Tisdell, 2015), I believe that I view this problem of practice with greater objectivity now than I did when I first began exploring these topics in the fall of 2020.

Credibility

According to Bazeley (2018), "interpretation is the lynchpin of decisions made and processes used at *every* [*sic*] stage of the research process" (p. 56). Therefore, as mentioned previously in regard to this study's limitations, it is important to acknowledge that there may be fault with my interpretation of participants' technology integration practices and the factors that participants identify as affecting those practices (Merriam & Tisdell, 2015). Accordingly, in order to be systematic in my methodology and enhance the credibility of this study, I maintained an audit trail via memos and bracketing to explain my decision-making processes at various junctures (Bazeley, 2018). For example, as noted earlier, memos and bracketing delineate between my subjective interpretations and that which can be empirically observed with greater objectivity (Hatch, 2002; Weaver-Hightower, 2019). Finally, as illustrated by my conceptual framework (see Figure 1.3), my methodologies are grounded with a basis in research (see, e.g., Borup et al., 2022; Cherner & Curry, 2017; Tondeur et al., 2016) and tempered by my familiarity with this local setting (Belzer & Ryan, 2013; Check & Schutt, 2017).

Chapter Summary

In this chapter, I described the overarching design of this inquiry, the local setting, sampling techniques, participants, data collection methods, plans for analyzing data to answer both research questions, and my own positionality as a researcher. In terms of design, this inquiry intersected a case study design with survey methodology to discover the ways in which members of the Marbury EPP's Class of 2024 and Class of 2025 cohorts planned to use, actually used, and reported using digital technologies with P-12 students in field experience settings (Creswell & Creswell, 2018; Hancock et al., 2021; Tight, 2017). In addition to investigating and taxonomizing technology integration instances (Kimmons et al., 2020), this inquiry also explored mega-, macro-, and micro-level factors that participants identified as having an influence on their technology integration choices (Kaufman, 2000; Tondeur et al., 2012). This approach aligns with my conceptual framework in that it supports synthesis of technology integration instances and the factors that shape participants' digital competencies (Falloon, 2020). The data I collected and analyzed according to the protocols and methodologies described in this chapter informed the findings that I report in Chapter 4.

CHAPTER 4: FINDINGS

This case study assessed the ways in which 10 preservice teachers enrolled in Marbury College's educator preparation provider (EPP) used digital technologies with P-12 students in field experience settings during the fall semester of 2023. This study also explored the factors that participants identified as having an influence on their technology integration choices. Mindful of the Marbury EPP's mission to comply with the Council for the Accreditation of Educator Preparation's (2020a) standards, to develop digitally competent graduates, and to prioritize P-12 student outcomes, two questions drove this capstone inquiry:

RQ1**:** In what ways do Marbury College's preservice teachers use digital technologies with students in field experience settings?

RQ2: What factors do Marbury College's preservice teachers identify as having an influence on their technology integration choices?

The instrumentation that I adapted and developed for this study enabled me to answer these questions in a systematic way that tightly aligned with my conceptual framework. This means that I initially parsed technology integration *instances* according to whether participants chose to keep digital technologies in their own hands, as instructors, or provided hands-on opportunities for students to use devices. To systematically account for technology integration instances, I reviewed lesson plans to find written descriptions of ways in which each participant intended to use digital technologies during instruction (see Document Analysis Protocol in Appendix D). In these lesson plans, I counted each expressed intention to use technology in a specific way as a separate instance. Similarly, during formal observations (n = 4), I counted technology integration instances as separate occurrences if there was an obvious transition from one discrete usage to another (see Observation Protocol in Appendix E). For example, if a participant transitioned from using a Promethean Board to illustrate one subtraction strategy to using the same Promethean Board to illustrate a second subtraction strategy, I counted two separate technology integration instances. After analyzing survey, interview, lesson plan, and observational data, I arrived at the following findings:

- Finding 1. Participants' technology integration practices tend to position P-12 students as passive receivers of digital learning content.
- Finding 2: Participant concerns about technology overuse seem to influence their technology integration choices.
- Finding 3: Participants report ambiguous expectations for technology integration within the Marbury EPP.
- Finding 4: Participants indicate that support for making informed technology integration choices varies within the EPP.

Finding 1 pertains to the first research question while the latter three findings pertain to the second research question. The next two sections ground each of these findings using a basis in evidence.

Digital Technology Use with P-12 Students

In being responsive to the first research question, this section focuses primarily on characterizing typical technology integration practices for this population of 10 participants. In order to characterize norms, this research study quantified technology integration instances that were evident in qualitative data obtained from participants' lesson plans and observational field notes. Participants also shared self-reports of their typical instructional practices during interviews and identified their "most exemplary" technology integration practices in open-ended survey responses. Whereas the vast majority of data pertaining to typical practices show that participants tended to position P-12 students as passive receivers of digital learning content, some parts of the following section also describe deviations from this norm. Put differently, the following section approaches the first research question by focusing primarily on typical technology integration practices but also reports on a few comparatively unusual and exemplary practices (per Kimmons et al., 2020).

Finding 1. Participants' Technology Integration Practices Tend to Position P-12 Students as Passive Receivers of Digital Learning Content.

Most of the evidence that substantiates this research study's first finding that participants' technology integration practices tend to position P-12 students as passive receivers of digital learning content was found in data obtained from lesson plans, observations, and interviews (see Table 4.1). When sorted along Kimmons et al.'s (2020) *PIC* axis, 85% of the technology integration instances that were evident in lesson plan data and observational field notes called for students to receive digital learning "content passively" (p. 185) as opposed to using digital technologies to interact ("I") or create ("C). These technology integration instances are compatible with interview data showing that 6 out of 10 interviewees reported that they used digital technologies more than their students during lessons they taught. Finally, when asked to self-report their "most exemplary" technology integration practices in field experience settings, 2 out of 10 participants' open-ended survey responses described using digital technologies in ways that also positioned students as passive receivers of digital learning content. That two participants' "most exemplary" practices align with Kimmons et al.'s (2020) *passive* realm suggests that these participants had not used digital technologies with students in *interactive* or *creative* ways.

Table 4.1

Overview of Evidentiary Support to Substantiate Finding 1

Data Source	Sample	Summary of Data
Lesson Plans	(*n* = 10)	• 37 out of 43 technology integration instances classified as *passive* student engagement with technology (per Kimmons et al., 2020).
Observations	(*n* = 4)	• 37 out of 44 technology integration instances classified as *passive* student engagement with technology (per Kimmons et al., 2020).
Interviews	(*n* = 10)	• 6 out of 10 interviewees reported that they used digital technologies *more than the students they teach* while serving as instructors.
Open-Ended Survey Response	(*n* = 10)	• 2 out of 10 respondents described passive student engagement with digital technology (per Kimmons et al., 2020) as being their *most exemplary* technology integration practice.

Lesson Plan Data

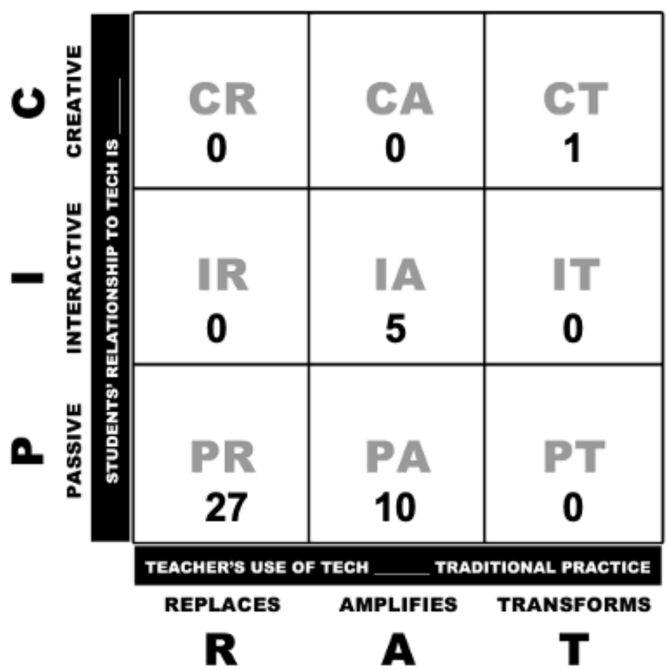
A total of 37 out of 43 technology integration instances that were evident in lesson plan data align with Kimmons et al.'s (2020) criteria for *passive* technology integration. These 37 instances were further sorted into 27 instances that align with Kimmons et al.'s criteria for *passive-replaces* (PR) and 10 instances that align with their criteria for *passive-amplifies* (PA). As discussed in Chapter 2, whereas Kimmons et al.'s *PIC* axis enables sorting technology integration instances according to whether students engage with digital learning content in passive, interactive, or creative ways, the RAT axis borrows from Hughes et al.'s (2006) model to assess whether technology integration instances replace, amplify, or transform traditional classroom practices. Kimmons et al.'s (2020) PIC axis is the primary focus for Finding 1, but the RAT axis helps gauge the degree that technology integration is innovative (Hughes et al., 2006) and enables a more nuanced representation of ways in which participants used digital technologies with students during the fall semester of 2023.

Of the 27 instances in participants' lesson plans coded as "PR", nine involved Clara's ('25), Daniel's ('24), Isabel's ('24), and Mariyah's ('24) use of the countdown timer feature on

Promethean Boards. In a comparable tenth PR instance, Mariyah used her mobile phone as a countdown timer. These 10 instances involving digitized countdown timers align with Kimmons et al.'s (2020) criteria for passive-replacement because P-12 students did not have hands-on engagement with learning content (thus the "P" rating) and digital timers replicated the functionality of analog clocks (thus the "R" rating). In two other instances receiving "PR" codes, Kimberly ('24) used her mobile phone to transmit music via Bluetooth speakers as part of a physical education lesson plan. These latter two instances did not provide students with hands-on digital engagement with learning content and could be replicated via a "lower tech" (Kimmons et al., p. 189) radio or compact-disc player (thus the "PR" rating).

Figure 4.1

Technology Integration Instances in Lesson Plans



Note. These instances were evident in lesson plans submitted by 10 participants. The PICRAT matrix is adapted from *Royce Kimmons: Understanding Digital Participation Divides*, by R. Kimmons, n.d., (http://roycekimmons.com/technologies/picrat). CC BY 3.0.

The other 15 instances coded as "PR" involved Daniel's ('24), Nancy's ('25), Sally's ('25), and Terence's ('24) plans to use Elmos, Chromebooks, and Promethean Boards to present textual or numeric information to students. For example, Nancy's lesson plan stated: "Once all students have their books open to page 243, instruct them to follow along while you read the story on the Elmo." Like the other "PR" examples, Nancy's plan positioned students as passive receivers of digital learning content and her usage of the Elmo replicated the functionality of traditional classroom practices (e.g., reading aloud from a book).

All 10 of the instances that were classified as passive-amplifies (PA) (per Kimmons et al., 2020) involved showing YouTube videos germane to lessons submitted by Anya ('24), Clara ('25), Tessa ('25), and Terence ('24). Showing videos without prompting hands-on, digital engagement with learning content constitutes a passive approach to technology integration (thus the "P" rating) per Kimmons et al.'s framework. At the same time, Anya said that showing videos was a useful preteaching strategy for her sixth- and seventh-grade special education science classes that seemed to improve learning outcomes by providing students with:

> …a nice visual of how they were supposed to move the slinky to create the wave and, like, be able to see it in slow motion [moves hand like a wave]. Also, because it slowed the video down for those students who need to see it move slower to see all the parts of the wave and see how it actually was working before they tried it on their own.

Thus, Anya's videos apparently *amplified* her teaching practice (per Hughes et al., 2006) by helping to illustrate a visual concept (thus the "A" rating).

In other technology integration instances involving YouTube that were evident in lesson plans, Terence and Clara shared music videos as part of their respective lessons on similes and opinionated writing. In Tessa's case, her written plan for using a kid-friendly YouTube video about animal classification expressly stated that she was going to enable "subtitles on the videos" for "learners with hearing problems." In interviews, Clarence and Tessa both indicated that their use of videos as a visual aid was meant to enhance student motivation whereas Anya and Tessa both said YouTube videos helped them better illustrate a concept. Thus, interview comments by these four participants substantiated the “A” rating (per Hughes et al., 2006) for 10 separate YouTube instances. That only 10 of the 37 instances in Kimmons et al.’s (2020) passive realm moved beyond passive-replacement to the passive-amplifies category suggests that participants tended to use digital technologies to replicate traditional classroom practices.

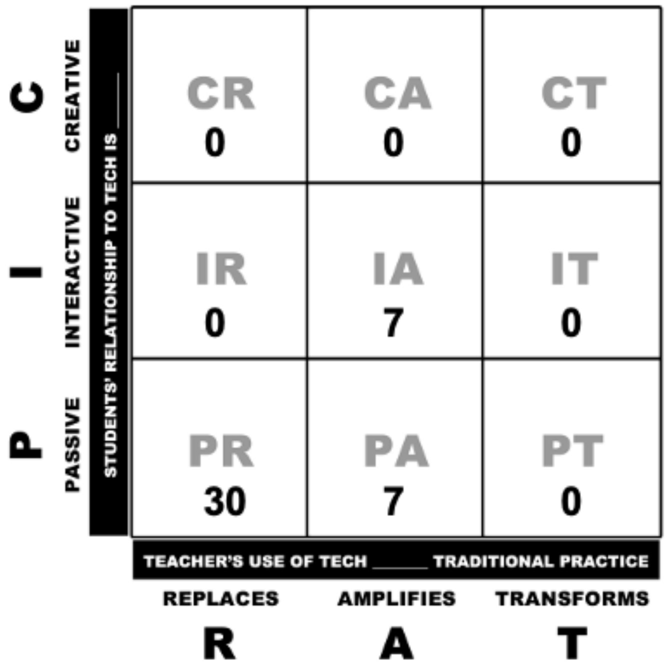
Observational Data

Although observational data were obtained from only 4 of this study’s 10 participants, the technology integration instances that were evident in observational field notes illustrate a similar trend to the lesson plan data when sorted into PICRAT’s (Kimmons et al., 2020) categories (see Figure 4.2). The four participants who were observed (Mariyah, Sally, Terence, and Clara) positioned P-12 students as passive receivers of digital learning content in 37 out of 44 technology integration instances that were evident in observational field notes (see Figure 4.2). Thus, observational data help corroborate this research study’s first finding that participants’ technology integration practices tended to position P-12 students as passive receivers of digital learning content. Formal observations were included as part of this research design in order to triangulate between lesson plans and self-reported practices by providing an alternative firsthand perspective (Carter et al., 2014; Hatch, 2002).

It is noteworthy that observational data reflect participants’ enacted instructional practices rather than specific P-12 student behaviors per this research study’s Institutional Review Board-approved Observational Protocol (see Appendix G). More pointedly, observational data reflect participants’ actions, written instructions, spoken instructions, and audible comments to students. Thus, these data illustrate the various ways in which participants either used digital technologies themselves or directed students to do so during a total of four lessons. Although most of the observed technology integration instances were coded as “passive” (per Kimmons et al., 2020), the following summaries of each formal observation show that Mariyah and Sally were both more inclined to position students as passive receivers of digital learning content than Terence and Clara.

Figure 4.2

Technology Integration Instances in Observational Data



Note. These instances were evident in observational data pertaining to four participants. The PICRAT matrix is adapted from *Royce Kimmons: Understanding Digital Participation Divides*, by R. Kimmons, n.d., (http://roycekimmons.com/technologies/picrat). CC BY 3.0.

Mariyah's Lesson*.* During her formal observation, Mariyah ('24) was the sole user of digital technology throughout a 55-minute first-grade math lesson. She instructed students to follow along with the lesson and demonstrate their progress on handheld analog whiteboards. In terms of technology integration, Mariyah made steady use of a Promethean Board to provide explicit instruction on how to apply four different subtraction strategies. Per protocol for categorizing technology integration instances that were evident in observational field notes using Kimmons et al.'s (2020) PICRAT matrix (see Appendix G), 16 separate instances were coded as "passive-replaces" (PR) and six additional instances were coded as "passive-amplifies" (PA). All but two of Mariyah's 22 technology integration instances involved her use of a digitized pen to write subtraction problems or to demonstrate how to apply specific strategies to solve the problems on a Promethean Board. The other two PR instances involved displaying an image of two people holding five puppies on the Promethean Board as students entered the classroom (one "PR" instance) and Mariyah posing questions about the image to start the day's lesson (a separate "PR" instance).

During a particular segment of the lesson after Mariyah wrote "17-9" as a subtraction problem on the Promethean Board for students to solve individually, her cooperating teacher audibly expressed concern that students might confuse the letter "P" with the number "9." In response to this feedback, Mariyah used the Promethean Board to demonstrate how to write the number "9" rather than the letter "P." After writing the example of what not to do (writing the letter "P"), Mariyah quickly pushed the Promethean Board's "undo" button to remove the nonexample from the students' field of view. This instance was coded as "PA" (per Kimmons et al., 2020) because the efficiency with which Mariyah was able to cleanly erase the nonexample and continue her explanation would be difficult to replicate with traditional classroom tools such as a chalkboard or dry-erase board.

Similarly, Mariyah's other five technology integration instances that were coded as amplifying rather than replacing traditional classroom practices (thus receiving the "PA" rather than the "PR" code) involved one other instance in which she used the Promethean Board's "undo" button and four rapid instructional transitions in which she instantly erased previously covered instructional content. Although instructors can quickly erase material on analog chalkboards and dry-erase boards, Mariyah's usage of the Promethean Board enabled her to instantly and completely erase and transition between concepts with noticeably better efficiency and erasure than would be expected with analog tools. This digitized capability enabled Mariyah to present a single concept at a time on a visual display that was free from extraneous clutter. Although this appeared to amplify her instructional practices (per Hughes et al., 2006), the lesson provided zero opportunities for students to have hands-on engagement with digital learning content.

Sally's Lesson. Like Mariyah ('24), Sally ('25) was the sole user of digital technologies throughout her 43-minute English Language Arts lesson on themes. In Sally's lesson, observational field notes show that there were seven technology integration instances in which Sally used an Elmo document camera that was paired with this third-grade classroom's Promethean Board. The document camera captured a visual proxy of stapled papers that Sally referred to as "guided notes." This paper packet complemented a prior lesson Sally had recently taught about Shell Silverstein's *The Giving Tree*. Although Sally solicited input from students as she wrote information in her copy of the packet via a green analog pen, the lesson did not provide students with hands-on opportunities to engage with digital technologies. Rather, Sally directed students to follow along with instruction in analog form by recording notes in their own paper packets.

Consistent with the method used to tally technology integration instances in the other three observations, instructional transitions between topics, strategies, or examples were counted as separate instances when digital technologies were used during Sally's formal observation. For example, during Sally's lesson, her Elmo-projected examples of themes (e.g., wants versus needs) were recorded as a single technology integration instance that was clearly distinguishable from her Elmo-projected demonstration of filling in blanks with the following underlined words: "An inference you make about a text based off of clues." In total, there were eight separate technology integration instances recorded in observational field notes during Sally's lesson that aligned with Kimmons et al.'s (2020) PR category.

Toward the end of Sally's lesson, she toggled away from the Elmo document camera to pair a laptop computer with the classroom's Promethean Board. This enabled Sally to play a YouTube video of celebrity Keith Carradine reading *The Giving Tree* aloud. This technology integration instance seemed to *amplify* rather than *replace* traditional classroom practices (per

Hughes et al., 2006) because Sally enabled the video's subtitles and the video contained snippets of animation and music that would not be reasonably possible for a classroom teacher to replicate (thus receiving a "PA" rather than a "PR" code). Although an argument could be made that the activity might have been more beneficial if Sally had performed the read-aloud herself, the "PA" code (representing a single technology integration instance) assessed Sally's observable usage of digital technologies rather than any apparent effect the YouTube video may or may not have had on her third-grade students. To recap, each of the nine technology integration instances that were evident during Sally's lesson positioned students as passive receivers of digital learning content (per Kimmons et al., 2020).

Terence's Lesson. Whereas observational field notes recorded during Mariyah's ('24) and Sally's ('25) lessons are consistent with this study's first finding, Terence ('24) provided sixth-grade students in a special education English Language Arts class with five hands-on opportunities (coded as "IA") to interact with digital technologies during an observation of a 44-minute lesson (Kimmons et al., 2020). Thus, Terence's observed practices seem to deviate from his peers'. To elaborate, after a 10-minute introductory review pertaining to what this class had already learned about similes, Terence then devoted 30 minutes to an activity in which he instructed students to craft a presentation in Google Slides that demonstrated their knowledge about similes. This latter activity accounted for five separate "IA" instances because students interacted with digital learning content (thus the "I") and the Google Slides platform enabled them to combine words and pictures more efficiently than would be reasonably replicable with analog tools (thus the "A").

Terence's usage of the Promethean Board also accounted for three instances that were coded as "PR" (per Kimmons et al., 2020). In these three instances, Terence used the Promethean Board as a medium to display examples of similes that he read aloud (the initial "PR" instance) before labeling key parts of a simile using an electronic pen (a second "PR" instance) and then finally showing students an example of what he expected them to do in their own Google Slides presentations (a third “PR” instance). The subsequent five technology integration instances that were coded as “IA” each involved separate instructions from Terence to the entire class or audible instructions to specific students. For example, seven minutes after instructing students to open their Google Slides presentations (a single “IA” instance), Terence could be overheard explaining how to use a Chromebook’s keyboard combination of “ctrl + z” to “undo” a mistake (a second “IA” instance). The remaining three “IA” instances were separately recorded while Terence circulated around the classroom to help students and monitor their progress.

Clara’s Lesson*.* Like Terence (’24), Clara (’25) also provided students with hands-on opportunities to use their Chromebooks during her formal observation, but three out of five of Clara’s observed technology integration instances help substantiate this study’s first finding that participant technology integration practices are more likely to position P-12 students as passive receivers of digital learning content. In order to accurately represent Clara’s observation, it is important to mention that although she budgeted 45 minutes to teach this lesson, her cooperating teacher took longer than expected to wrap up a preceding lesson with the same group of fourth-grade students. Therefore, Clara was left with 18 minutes to deliver an English Language Arts lesson having to do with new vocabulary words. During this abbreviated time frame, observational field notes show that two of the technology integration instances receiving “PR” codes in Clara’s lesson involved the use of a Promethean Board’s countdown timer. Later in this lesson, it became evident that the Google Doc Clara intended to share via the fourth-grade class’s Google Classroom account was not accessible for at least one student. In response to this unforeseen glitch, Clara directed one student to look on a peer’s computer. In light of this real-time instructional decision, at least one student missed out on an opportunity for hands-on interaction (Kimmons et al., 2020) with digitized learning content (thus the third “PR” code).

During the lesson, Clara's comments to students suggested that working with peers in a shared Google Doc was not part of this fourth-grade classroom's normal routine. For example, after directing students to access the file, Clara said, "This is called a 'shared document,' so we'll be able to see each other's sentences." In response to apparent confusion one minute later, Clara then said, "Do you guys see the different colors [of type in the Google Doc]? That mean's someone's already in there." These comments by Clara were coded as two separate "IA" instances because they both involved responses to students who were instructed to interact with digital learning content (thus the "I") and the peer-to-peer digitized interactions would be difficult to replicate efficiently with analog classroom tools (thus the "A"). Toward the end of the lesson, Clara asked, "Did you guys like the shared Doc?", which again suggested that this was an unfamiliar technology integration practice in this particular setting.

Interview Data

When asked in interviews who uses technology more in a typical lesson that they teach, 6 out of 10 participants indicated that they were typically more likely than their P-12 students to do so (see Table 4.2 "***Instructor Use***" comments). For example, when asked who uses technology more in a typical lesson, Anya said: "Probably me, because I'm the one actually using the computer and the Promethean Board to pull up everything and they're just more—observing what the technology has to offer [rather] than actually using it." Anya's comment is congruent with Kimmons et al.'s (2020) criteria for *passive* student engagement with digital technology. More broadly, comments by the five other participants who indicated that "***Instructor Use***" was the norm during their field experience lessons also help substantiate this research study's first finding. Conversely, Table 4.2 shows that Terence ('24) was the only interviewee who said that his students were more likely to use digital technologies more often than he was as their instructor (labeled "***Student Use***"). Thus, a majority of participant responses to this question about typical technology integration practices help substantiate this study's first finding by showing that P-12 students were not typically provided with hands-on opportunities to use digital technologies during lessons that participants taught.

To round out the self-reported interview data pertaining to participants' typical technology integration practices, Clara ('25), Tessa ('25), and Mariyah ('24) indicated that whether they or their students were more likely to have hands-on engagement with digital technologies was *situationally dependent* (labeled as such in Table 4.2). To elaborate, Clara and Tessa both said that they used technology more than their fourth- and eighth-grade students in their respective fall 2023 placements but each of these two participants also stated that the opposite had been true in prior placements. When working with students in prekindergarten and kindergarten, Clara said that it was common for students to complete hands-on activities with Promethean Boards such as using their finger to physically drag learning content such as days of the week. However, in her current placement, Clara indicated that she typically used technology more than her students. In Tessa's case, she indicated that students in a prior second grade (special education) placement used technology such as iPads and the internet more than she did as their teacher. However, in a recent lesson, Tessa said that she used technology more than her students.

In a third account labeled "***Situationally Dependent***" (refer to Table 4.2), Mariyah said that P-12 student and instructor technology usage was "about equal" in her fall 2023 placement. For further context, Mariyah also said that most of her own technology integration practices tended to be at the "passive-replaces" (Mariyah's words) level excepting when her students used their Chromebooks for i-Ready. Thus, although Terence's comment and the three interviewees who gave responses labeled "***Situationally Dependent***" in Table 4.2 represent some deviation from the norm, interview data overall helps confirm this study's first finding by showing that "***Instructor Use"*** of digital technologies is the prevailing trend among this population of preservice teachers when delivering instruction in field experience settings.

Table 4.2

Interview Responses to Question about Typical Tech Use

Participant	Fall 2023 Placement	Who Typically Uses Technology More?
Daniel ('24)	6th Grade (Math)	***Instructor Use****:* "Typically me."
Isabel ('24)	8th Grade (Math)	***Instructor Use****:* "Definitely me."
Kimberly ('24)	HS Phys. Educ.	***Instructor Use****:* "Where I'm at now, about the extent of what they have is a Bluetooth speaker" [later described using this device as an instructor to play music].
Anya ('25)	6th & 7th Grade (Science/ Sp. Ed.)	***Instructor Use****:* "Probably me, because I'm one actually using the computer and the Promethean Board to pull up everything and they're just more—observing what the technology has to offer [rather] than actually using it."
Nancy ('25)	5th Grade	***Instructor Use****:* "So, like the ones that *I've* done, I tried…to make it so that *I* use it more. I don't want them to get on the Chromebooks…"
Sally ('25)	3rd Grade	***Instructor Use****:* "Instructor for sure."
Terence ('24)	6th Grade (ELA/Sp. Ed.)	***Student Use****:* "I think the students, because usually, in the lessons, it's mostly them either researching something on the computer or just using their computer in general."
Clara ('25)	4th Grade	***Situationally Dependent****:* "…myself, currently. in the classroom that I'm in. But, if I pivot back to the earlier placements that I had in early elementary, I would say the students because they're the one actually manipulating the technology that we're using as a class…"
Tessa ('25)	8th Grade (Science/ Sp. Ed.)	***Situationally Dependent****: "...*The lesson plan for the science that I just did, *I* used technology more than the students did…But the classroom I was in last year—I honestly think that the students used the internet a lot more than I did as a teacher..."
Mariyah ('24)	1st Grade	***Situationally Dependent****:* "I feel like it's kind of equal because when it comes to i-Ready, I feel like the students are on it more. But the instructors, we don't necessarily use the Promethean Board a whole lot."

Open-Ended Survey Data. Although a majority of respondents described some sort of "***Student Use***" of digital technologies in open-ended survey data (see Table 4.3), it is telling that Kimberly's ('24) and Nancy's ('25) self-reported best practices for technology integration each described "***Instructor Use***" of digital technologies. To be more specific, when asked to describe "the most exemplary way in which you have used digital technology to improve PK-12 student *learning outcomes* in a field experience setting," Kimberly and Nancy both described examples in which they themselves used digital technologies and positioned their students as passive receivers of learning content. Kimberly's self-reported "most exemplary" technology integration practice involved using Bluetooth speakers to play music for students in a high school physical education setting. In another survey response that aligns with Kimmons et al.'s (2020) *passive-replacement* category, Nancy's wrote that her *most exemplary* technology integration practice involved using "the Elmo or the promethean [*sic*]." Thus, considering that the open-ended survey data was designed to elicit each participant's self-reported best practices, Kimberly's and Nancy's written responses both suggest that neither of these participants had engaged in technology integration practices that moved beyond Kimmons et al.'s (2020) *passive* realm while serving as instructors in field experience settings.

Table 4.3

Open-Ended Survey Responses

Participant	Most Exemplary Technology Integration Per Survey Response
Kimberly ('24)	***Instructor Use**:* "…One piece of technology that I personally have found the most successful in the Physical Education classroom is an overhead Bluetooth speaker that projects music for the students."
Nancy ('25)	***Instructor Use**:* "…The one that I use the most would be the Elmo or the promethean."
Daniel ('24)	***Student & Instructor Use**:* "…I created a Holocaust Experience webquest that guided students through the timeframe in an interactive way that allowed them to engage with the material by creating a product while working in differentiated ways on their computer independently, and as a whole group using the Promethean board."
Isabel ('24)	***Student Use**:* "The most exemplary way that I used digital technology for my students was through a matching game that I created…"
Terence ('24)	***Student Use**:* "…I was able to increase student learning outcomes through an online app called Microsoft Excel. Students were able to survey other students around the class on random topics and create an online bar graph and pie chart by inputting the information into Excel."
Anya ('25)	***Student Use**:* "…In some of the older classrooms I've had the students use their personal technology to play along on digital games to help assess their knowledge of a subject and help them study for upcoming exams."
Clara ('25)	***Student Use**:* "…to provide alternative forms of assessment for students."
Tessa ('25)	***Student Use**:* "I have used technology when the students need to have busy work to do."
Mariyah ('24)	***Evades Prompt**:* "…I have noticed that K-1st grade students are able to enhance their reading and math skills via the iReady curriculum program…"
Sally ('25)	***Evades Prompt**:* "By using [technology] in the classroom, students have improved in many ways. Specifically due to having unlimited resources at their fingertips."

Triangulation Between Datasets

To make further sense of open-ended survey responses, it should be noted that the data in Table 4.3 are further removed from the typical instructional practices that actually occurred in fall 2023 placements than are the lesson plan, interview, and observational data. Whereas these latter three data sources explicitly inquired about what was happening in participants' fall 2023 placements, the language in the survey prompt left open the possibility that participants might describe practices that had occurred in prior semesters: "…describe the most exemplary way in which you have used digital technology to improve PK-12 student *learning outcomes* in a field experience setting" (refer to Appendix C for Technology Integration Experiences Survey). Indeed, follow-up interview questions pertaining to these survey responses showed that at least five of the survey responses described practices that had occurred prior to the fall semester of 2023. To be more specific, follow-up interview data showed that Daniel ('25), Isabel ('24), Terence ('24), Anya ('25), and Tessa ('25) each described technology integration practices that had occurred in prior field experience placements. Of the six participants whose survey responses were categorized as "***Student & Instructor Use***" or "***Student Use***" in Table 4.3, follow-up interview data revealed that only Clara's comment about using digital technologies to provide "alternative forms of assessment for students" (her words) was representative of a fall 2023 instructional practice. Whereas triangulating between Clara's ('25) survey and interview data helps flesh out relevant details about her technology integration practices, other comparisons between multiple datasets help affirm this research study's finding that participants' technology integration practices tended to position P-12 students as passive receivers of digital learning content during the fall semester of 2023. As summarized in Table 4.4, passive forms of technology integration constituted the norm according to a majority of lesson plan, observational, and interview data. Table 4.4 uses bold-faced "***Passive***" and "≅***Passive***" labels to respectively denote technology integration instances that were coded as "passive" or characterized in ways that seem congruent with the *passive* realm of Kimmons et al.'s (2020) PIC axis. In comparing multiple datasets, it is apparent that 8 out of 10 participants received multiple "***Passive***" and/or "≅***Passive***" labels in Table 4.4; in total, 21 out of 34 separate data sources were considered "***Passive***" and/or "≅***Passive***". In sum, other than the open-ended survey data, which reflects participants' self-reported "most exemplary" technology integration practices, most data sources in each dataset align with what Kimmons et al. refer to as *passive* student engagement with digital technologies.

Table 4.4

Comparing Multiple Datasets

Participant	Lesson Plan (Planned Instances)	Observation (Intended & Enacted Instances)	Interview (Typical Practices)	Open-Ended Survey ("Most Exemplary")
Daniel ('24)	*Mostly* ***Passive***: 7 PR, 1 IA		*Instructor Use (≅**Passive**)*	*Student & Instructor Use*
Isabel ('24)	*Mostly* ***Passive:*** 5 PR, 4 IA		*Instructor Use (≅**Passive**)*	*Student Use*
Kimberly ('24)	*All* ***Passive:*** 2 PR		*Instructor Use (≅**Passive**)*	*Instructor Use (≅**Passive**)*
Mariyah ('24)	*All* ***Passive:*** 6 PR	*All* ***Passive:*** 16 PR, 6 PA	*Situationally Dependent*	*Evades Prompt*
Terence ('24)	*All* ***Passive:*** 2 PR, 2 PA	*Mostly Interactive:* 3 PR, 5 IA	*Student Use*	*Student Use*
Anya ('25)	*All* ***Passive:*** 2 PA		*Instructor Use (≅**Passive**)*	*Student Use*
Clara ('25)	*Mostly* ***Passive:*** 2 PR, 2 PA, 1 CT	*Mostly* ***Passive:*** 3 PR, 2 IA	*Situationally Dependent*	*Student Use*
Nancy ('25)	*All* ***Passive:*** 2 PR		*Instructor Use (≅**Passive**)*	*Instructor Use (≅**Passive**)*
Sally ('25)	***Passive:*** 1 PR	*All* ***Passive:*** 8 PR, 1 PA	*Instructor Use (≅**Passive**)*	*Evades Prompt*
Tessa ('25)	*All* ***Passive:*** 4 PA		*Situationally Dependent*	*Student Use*

Exception to Finding 1

To provide a robust response to the first research question, which asks about the ways in which Marbury College's preservice teachers use digital technologies with P-12 students in field experience settings, it is also necessary to provide an account of practices that do not align with this study's first finding. In terms of practices that were reported or observed among this research study's participants, Clara's ('25) lesson plan contained the only instance in which P-12 students used digital technologies to *create* (per Kimmons et al., 2020) during the fall semester of 2023 (Daniel's open-ended survey response recounted practices from his Spring 2023 placement). Clara's written plan for content-related journaling satisfies Kimmons et al.'s (2020) criteria for creation because the activity culminated in a digital artifact that elicited higher-order thinking. This sort of journaling can be considered *creative* (thus the "C" rating) because students were expected to demonstrate their acquisition of knowledge by putting "elements together to…make an original product" (Krathwohl, 2002, p. 215). The activity also moves beyond Hughes et al.'s (2006) *replacement* category on the RAT taxonomy because Clara's written plan also listed an accommodation for "diverse learners" in this fourth-grade placement to use a speech-to-text Google extension.

In a follow-up interview, Clara said that the usage of this speech-to-text extension in her lesson plan aligned with Kimmons et al.'s (2020) *creative-amplifies* rather than the *creative-transforms* category for most students because the same learning goal could be achieved without any digital technologies (see PICRAT Flow Chart in Appendix H). Although the speech-to-text affordance significantly improved efficiency, it seems that students could inherently achieve the same learning goal via printed type or handwritten text (thus *amplification* per Hughes et al., 2006). However, for other students, Clara's interview comments suggest that the technology integration was *transformational* (Hughes et al., 2006; Kimmons et al., 2020). Although Clara did not classify this technology integration instance as reaching the creative-transforms standard, her following interview comment supports classifying this instance as *creative-transforms*:

> …when we're assessing a student's writing, they are always going to have a higher speaking vocabulary than they're going to have a written vocabulary. So, if I'm assessing what they have down…the speech-to-text is going to help them get a better grade because they're able to put those thoughts down; they just can't write them.

Based upon this comment, for fourth-grade students who struggled with spelling or typing, usage of this speech-to-text extension scaffolded the attainment of a learning goal that would not otherwise be reasonably possible. Per the Flow Chart in Appendix H, using technology in ways that expands the frontier of possibilities for student learning is *transformational* (Hughes et al., 2006; Kimmons et al., 2020). It is also relevant to note that ambiguity surrounding the classification of Clara's plan for using speech-to-text extensions was ultimately resolved using the Document Analysis Protocol (see Appendix D), which states "instances that straddle amplifies/transforms" are to be "coded as transforms."

Summary of Digital Technology Use in Field Experiences

In response to the first research question, it is evident that participants' technology integration practices typically align with Kimmons et al.'s (2020) passive-replacement and passive-amplifies categories. The fact that 74 out of 87 technology integration instances identified in lesson plan and observational data align with Kimmons et al.'s *passive* realm provides strong evidentiary support for Finding 1. Relatedly, triangulating (Carter et al., 2014) between multiple qualitative research methods (i.e., document analysis, interviews, and observations) confirmed that most participants were more inclined to use digital technologies such as Promethean Boards and Elmo document cameras to present information to students rather than to foster hands-on opportunities for P-12 students to *interact* or *create* via digital technologies (per Kimmons et al., 2020). Despite these norms, answering the first research question also showed that Terence ('24) and Clara ('25) were more inclined than their counterparts to design opportunities for their respective sixth- and fourth-grade students to use their Chromebooks in ways that were cognitively engaging and relatively innovative (per Kimmons et al., 2020). However, in general, participants' technology integration practices tended to position P-12 students as passive receivers of digital learning content.

Factors Influencing Participants' Technology Integration Choices

As with the first research question, the Technology Integration Experiences Survey was a useful starting point for answering the second research question, which explores factors that Marbury College's preservice teachers identified as having an influence on their technology integration choices. In particular, this survey's adaptation of 24 Likert-scale prompts from Tondeur et al.'s (2016) Synthesis of Qualitative Data instrument enabled a search for trends at the individual, cohort, and programmatic levels. Survey data also informed the development of customized semi-structured interview questions. In triangulating between four datasets (i.e., survey, lesson plan, interview, and observation), this study uncovered societal-, institutional-, and individual-level factors that apparently impacted the ways in which participants used digital technologies with P-12 students. Accordingly, in the section that follows, Finding 2 pertains partly to societal-level influences on participants' technology integration choices. Findings 3 and 4 connect more so with institutional-level influences. Finally, individual-level variability in experiences within the EPP are reported throughout this section.

Finding 2: Participant Concerns about Technology Overuse seem to Influence their Technology Integration Choices.

Interview data show that seven participants expressed concerns about technology overuse at home and/or at school. In terms of how these concerns seem to influence participants' technology integration choices, each participant quoted in Table 4.5 spoke directly or indirectly about the importance of limiting student *screen time*, or engagement with digital technologies, at school. Four participants also raised physical and mental health concerns associated with student technology overuse. In transitioning into this section that pertains to the second research question, it is important to note that whereas subheadings in the previous section focused on data sources (e.g., "***Lesson Plan Data***"), subheadings pertaining to Finding 2 are organized according to qualitative themes (e.g., "***Technology Overuse***"). The thematic subheadings are useful for substantiating Finding 2 because it emerged from primarily interview data rather than multiple data sources.

Technology Overuse

The center column of Table 4.5 sorts seven participants' stated concerns about technology overuse into two different categories (i.e., "***General Concern***," and "***At School***") while the right-hand column sets forth a quotation from each participant that conveys a belief in the importance of moderating technology use in their own practice. The alignment between these seven participants' stated concerns about students' overuse of technology on the one hand and their statements pertaining to limiting students' screen time in their own teaching practice on the other suggests that the two might be connected. As noted at the bottom of the table, three participants did not express concerns during their interviews about student technology overuse.

General Concern. Daniel ('24) and Mariyah's ('24) interview comments clearly reflect general concerns about technology overuse that pertain to students' lives outside of school (hence the "***General Concern***" labels in Table 4.5). When asked specifically whether his concern about technology overuse impacted Daniel's lesson planning, he said in two separate comments: "I think about it." For further context, Daniel also said that he, "doesn't plan—you know, an excessive amount of student-heavy technology usage." Daniel's comment about limiting "student-heavy technology usage" was congruent with the lesson plan data he shared for this study. His two references to thinking about technology overuse taken together with his statement about "an obligation" to limit student screen time further suggest that his general concerns about technology overuse may impact his technology integration choices.

Table 4.5

Interview Data Pertaining to Finding 2

Participant	Concern About Technology Overuse	Possible Influence on Technology Choices
Daniel ('24)	***General Concern:*** "I feel like, at home, that's ALL they do. And so, like sometimes, like—they just need to get off of it [technology]."	"…sometimes I feel like, almost as an obligation, to just limit that screen time a little bit."
Mariyah ('24)	***General Concern:*** "Outside of school, the impacts are like stranger danger, cyberbullying, and other mental health impacts via social media. I feel like those are just MAJOR issues with technology, especially in adolescents."	"I do agree, to an extent, that students shouldn't have, like, a whole bunch of screen time."
Kimberly ('24)	***General Concern:*** "So, for me, as a PE teacher, I think that technology is horrible in terms of sending it home with students or having them do it all day because it—it leads to a sedentary lifestyle."	"I think it's kind of counterproductive to have them do it [use technology] in a class where they finally get to be out of their seat, active, and engaged in something that's not a screen."
Anya ('25)	***General Concern:*** "My biggest thing with the whole thing of integrating so much technology into school now is—even whenever the students leave the school—what are they going home to do? Get back on technology."	"I'm just afraid of the overuse of technology…"
Sally ('25)	***General Concern:*** "I think overuse is a big thing. You may not, as an educator, you may not know what every child does when they go home…you almost don't wanna feed too much into something they're already doing at home…"	"I think as an educator, set strict boundaries for yourself on how much you're going to allow technology in your classroom."
Clara ('25)	***At School:*** "…they're required to do it [using technology] in math, science, social studies, reading, and it's the same thing and it gets boring and *I* [motions to self] get bored doing it. So, I can't expect them to not get bored."	"…that's why I tend to not jump for the technologies all the time—because, I think they appreciate something that's kind off of it."
Nancy ('25)	***At School:*** "…they [students] have to get—I think it's 45 minutes a week on i-Ready math and 45 minutes on i-Ready reading. So, they're in class, working on their Chromebooks for over an hour and a half a week. But in the day, they're still doing other things on their Chromebooks, so…they do A LOT on it.	"I don't want them to get on the Chromebooks…"

Note: Isabel ('24), Terence ('24), and Tessa ('25) did not express concerns about technology overuse during their interviews.

Mariyah also expressed general concerns about ways in which technology is used "outside of school" (her words), which corresponded with a relatively nuanced approach to regulating student screen time. For example, she identified problematic issues pertaining to "stranger danger, cyberbullying, and other mental health impacts via social media." In addition to identifying these digital dangers, Mariyah also spoke about the importance of students becoming technologically proficient:

> I do agree, to an extent, that students shouldn't have, like, a whole bunch of screen time. But at the same time, technology is used in your every—adult—day-to-day life, so it is important to understand how to use it.

In the above quote, Mariyah both acknowledged a need to help students become proficient technology users but also spoke to a need for teachers to limit student screen time. Although Mariyah's comment alluded to the idea that becoming technologically proficient can scaffold future success, she also indicated she was disinclined to foster opportunities for students in her fall 2023 placement to use their Chromebooks because first-grade students "have difficulty with using a keyboard on a laptop." Her other interview, lesson plan, and observational data (refer back to Table 4.4) suggest that she preferred to limit her first-grade students' usage of digital technologies to prescriptive programming such as i-Ready.

Kimberly's ('24), Anya's ('25), and Sally's ('25) general concerns about technology overuse also pertained to student wellbeing both at home and at school. These three participants separately expressed concerns about how an excessive amount of screen time at home interfered with P-12 student opportunities to be physically active. Although Kimberly's concerns are pertinent to her content area as a physical education major, Anya and Sally also specifically shared concerns about students having increasingly sedentary lifestyles. For example, Anya lamented that overusing technology was turning students into "robots" (her descriptor) who are less physically active than she remembers being at their age. In terms of the connection between the overuse of technology at home and at school, Anya said: "My biggest thing with the whole thing of integrating so much technology into school now is—even whenever the students leave the school—what are they going home to do? Get back on technology." This comment by Anya, as with Sally's statement about not wanting to "feed too much into something they're already doing at home," and Kimberly's concerns about "sedentary" lifestyles, each corresponded with other interview comments pertaining directly or indirectly to a perceived need to limit student screen time at school.

At School. Whereas five participants' interview comments touched upon technology overuse while students are at home, Clara ('25) and Nancy ('25) both made comments about technology overuse specifically at school (thus the "***At School***" label in Table 4.5). In Clara's case, she said "it gets boring" to use technology as much as students in her fall 2023 fourth-grade placement did. Clara followed up this comment by explaining: "that's why I tend to not jump for the technologies all the time—because I think they appreciate something that's kind of off of it." Relatedly, Nancy said that she deliberately limited student Chromebook usage during lessons that she planned because students in her fall 2023 fifth-grade placement were required to spend 90-minutes per week using a digital application called i-Ready. As with the other five participants who shared concerns about student technology overuse, Clara and Nancy both shared statements that suggest that such concerns made them more inclined to limit student screen time.

While much of the interview data pertaining to limiting screen time alludes to or directly references student Chromebook usage (e.g., Nancy said, "I don't want them to get on their Chromebooks…"), Sally ('25) made a comment that suggests a more generalized concern about overusing digital technologies at school. Sally said:

> There's usually a…projection of something 24/7 on every single [Promethean] board in every single school…I don't know if it's super beneficial to have them sitting...looking at one screen, going straight to another one, and then back again.

In addition to her concerns about an overabundance of digitized screens, Sally also said, “I think as an educator, set strict boundaries for yourself on how much you’re going to allow technology in your classroom.” She also talked about the importance of interspersing opportunities for students to move out of their seats and use manipulatives like fidget spinners to build in screen time breaks. Thus, Sally’s concerns about technology overuse at school seemed to correlate with her intentions to limit student screen time. For example, the written plan that Sally shared for this research study contained only one technology integration instance, which was coded *passive-replaces* (per Kimmons et al., 2020). Her other interview comments and my observational field notes also suggest that she rarely designed hands-on opportunities for students to use digital technologies during her field experience lessons.

Exception to Finding 2

Although most interviewees indicated that they were concerned about technology overuse and that they were inclined to deliberately limit students’ access to screens, Terence (’24) stands out as an exception to Finding 2. Although he acknowledged that cyberbullying and disparate at-home internet access could be problematic, Terence posited that such problems had largely been resolved:

> I think cyberbullying—and you know, not everyone having Wi-Fi, is one of my concerns—but I don’t think they’re big concerns because…we’re now kind of like—kind of solv[ing] those problems…and we’re doing a pretty good job, I think.

With regard to cyberbullying, Terence said that he thought this problem was not happening “as much” (in the fall semester of 2023) and that if students were “getting bullied, they know what to do.” In short, Terence said that students being bullied online knew to “close down” a given website and “tell somebody” if they needed help. Terence’s comment about Wi-Fi availability is also noteworthy because it aligns with his seemingly favorable disposition toward student technology usage. This disposition is evident in Terence’s other interview comments and my observational field notes. For example, his previously mentioned interview comments showed that he was the only interviewee that felt his students typically used technology more than he did in field experience placements. My observational field notes corroborated this self-reported tendency; as previously described, Terence's students used their Chromebooks for 30 minutes during the 44-minute lesson that I formally observed.

Finding 3: Participants Report Ambiguous Expectations for Technology Integration within the Marbury EPP.

The third finding that ambiguity surrounds expectations for technology integration within the Marbury educator preparation provider (EPP) emerged primarily from interview comments by six participants and from written lesson plans submitted by all 10 participants. These interview and lesson plan data show that unclear and/or inconsistent messages about programmatic expectations for technology integration are conveyed by Marbury's education instructors, supervising cooperating teachers, and program-wide templates that Marbury's preservice teachers use to write lesson plans. More specifically, interview comments by four participants (Anya, Nancy, Mariyah, and Isabel) suggest that a lack of clarity surrounding the program's mandate for technology integration in lesson plans seemed to influence their technology integration choices. Interview comments by Isabel, Clara, Anya, and Kimberly also suggest that technology integration expectations within Marbury's EPP (which encompasses Marbury's education courses and field experience placements) varies. Finally, participants' usage of two different lesson plan templates further suggests that the implementation of the program's newer lesson plan template is incomplete.

Technology Integration Mandate

Evidence of a program-wide mandate for Marbury's preservice teachers to integrate technology into each of their field experience lessons has been in place at least since MacKinnon et al. issued their *Formative Feedback Report* in 2018 but interview data suggest that this mandate is not well understood or consistently enforced. For example, according to Anya ('25): "…we were kind of just told from the start, 'well, you *have* to use technology in your lesson plan' but never given a good basis to say what *type* of technology…" In Anya's comment, it is evident that she was aware of the program-wide mandate for technology integration but did not feel that Marbury's education instructors communicated clear expectations for "what *type* of technology" constituted a "good" technology integration choice.

Nancy's ('25) interview comments also show that she was aware of the program-wide technology integration mandate, an awareness that apparently impacted her technology integration choice for the lesson plan she shared for this research study. When questioned about her technology integration choice for a fall 2023 fifth-grade read-aloud activity, Nancy explained that she included an Elmo document camera in her written plan because she felt compelled to satisfy the technology integration mandate. She also said, "I don't think I really would have needed to show them on the Elmo," implying that the document camera was unnecessary as an instructional tool. Although the Marbury 2023-2024 course catalog states that preservice teachers like Nancy who are enrolled in the fall semester of their junior year should utilize "technologies that enhance the teaching approaches for the lessons" (p. 60), Nancy's interview comments suggested that she was focused on using technology for its own sake rather than to *enhance* (per language in course descriptions) teaching and/or learning.

Mariyah's ('24) interview comment also show an awareness of the program-wide technology integration mandate. Like Nancy's seemingly perfunctory usage of an Emo document camera, Mariyah said in her interview that she included the Promethean Board's countdown timer feature in her written lesson plan "just to have a bit of a technology component… but I feel like it just would have been easier if I just stuck with a regular physical timer." It is worth mentioning that Mariyah's open-ended survey response showed that she was familiar with Kimmons et al.'s (2020) conception of ways in which technology can be used to theoretically improve teaching and learning. She began this survey response by stating: "Under the PICRAT model, the best way to enhance student understanding of content is to be within the 'transform/creative' section." Despite her apparent awareness of ways in which technology can be used to “enhance student understanding of content” (her words), Mariyah’s other comment about her reasoning for using a Promethean Board’s countdown timer suggests that she (like Nancy) included technology in her written lesson plan to comply with the program’s mandate rather than to improve teaching and/or learning.

Varying Expectations

While Anya (‘25), Nancy (‘25), and Mariyah (’24) each either referred to or alluded to a programmatic requirement to use technology in their lesson plans, Isabel (‘24) stated that she did not feel that this requirement extended beyond the coursework for EDUC 120: Instructional Technology. Isabel also said that, “for the past four years, I’ve been told…‘Not every lesson needs to have technology for the students’…” Nevertheless, Isabel said that she tried to design hands-on opportunities for students to use technology at least once per week even though she was unaware of a “set expectation” (her words) to use technology in specific ways or with any sort of regularity during field experiences. Relatedly, in describing how one professor navigated the technology integration criterion on the program’s rubric when grading lesson plans, Isabel said:

> …There's a part on the rubric that says, “do they use technology?” But, like when [Professor Beta] was here, she would—you know, if you didn't use technology in that lesson, and the lesson still flowed and worked, like, she just didn't give you those points. But they weren't, like, added to your final score…instead of being out of, like 100, or whatever, it'd be out of, like 96.

Based upon Isabel’s comment, Professor Beta allowed Marbury’s preservice teachers to opt out of the program’s technology integration mandate, provided “the lesson still flowed and worked.” Taken as a whole, Isabel’s interview comments highlight the ambiguity surrounding the Marbury EPP’s expectations for technology integration and suggest that her technology integration choices are not responsive to the program’s technology integration mandate.

On the other hand, Clara's interview comments, lesson plan submission, and open-ended survey data testify to ways in which one Marbury education instructor's expectations influenced her technology integration choices. As Clara stated in her interview, "Professor [Zeta]—when she got here—really implemented the Universal Design for Learning. So, essentially every class that I've had with Professor [Zeta] since she got here…had an emphasis on that." In terms of an apparent influence on Clara's technology integration choices, it is worth noting that Clara's written lesson plan described using adaptive technologies (i.e., enabling speech-to-text extensions) in a way that embodies CAST's (2018) Universal Design for Learning Guidelines. Relatedly, Clara's open-ended survey response stated that her most exemplary technology integration to date involved using adaptive technologies "to provide alternative forms of assessment for students." Thus, it seems that Professor Zeta's emphasis on CAST's Universal Design for Learning Guidelines may have made Clara more cognizant of ways in which she could leverage adaptive technologies to meet diverse learning needs. It is also noteworthy that Isabel's and Clara's interview data suggest that Professor Beta and Professor Zeta had differing expectations for technology integration.

In terms of other incongruencies within the Marbury EPP, Clara ('25), Anya ('25), and Kimberly ('24) also identified differences in the technology integration expectations that they encountered in field experience settings versus what Marbury's education instructors expected preservice teachers to include in their written plans. Neither Clara nor Anya seemed to feel that their cooperating teachers' technology integration expectations aligned with the program's technology integration mandate. For example, Anya said:

> …whenever I'm there [in field experience settings], and I'm discussing, I'm like, "Oh, I have to include technology." And I even had mentor teachers before be like, "Well, no, you don't have to…" And I'm like, "No, [the Marbury EPP] says I have to."

In short, Clara and Anya seemed think that the program's technology integration mandate was either not well understood or not valued by their cooperating teachers.

Relatedly, when asked to appraise how well the Marbury EPP’s expectations align with what is expected in field experience settings, Kimberly (’24) described a mismatch between Marbury’s expectations and the practical realities of her work teaching physical education:

> So, at my placement right now, I don't feel like they match at all. I think that their [the Marbury EPP’s] expectation, especially from the education department, is coming from teachers who have students seated all day. And they, most teachers at the school have a projector—but that's not the goal of PE class. So I think just for the education department to kind of look at PE majors through a different perspective because we're the same, but we're not the same…

As the only physical education major in this research study, Kimberly’s assessment about a mismatch between programmatic and field experience expectations for technology integration is unique. Thus, her comment seems partly pertinent to the inherent differences between the learning goals for physical education and those of more traditional academic disciplines. Kimberly’s fall 2023 placement was also atypical for participants in this research study because it took place in a Neighboring County High School physical education context that she said lacked devices such as Promethean Boards.

Multiple Lesson Plan Templates

Regarding other inconsistencies within Marbury’s EPP, four participants shared written lesson plans for this study that utilized the program’s newer lesson plan template and six participants shared plans that utilized the program’s older lesson plan template. Terence (’24), Clara (’25), Tessa (’25), and Anya (’25) each used the newer template, which prompts Marbury’s preservice teachers to differentiate between teacher and student technology usage. The older lesson plan template also prompts preservice teachers to highlight technology usage but does not prompt them to differentiate between teacher versus student technology usage. In terms of adherence to either template’s prompt to highlight technology usage, participants digitally highlighted technology usage in 5 out of the 10 submissions they shared for this research study. The participants' use of two different templates and their inconsistency in adhering to prompts in both templates (i.e., to highlight technology integration) provide additional indicators of the ambiguities that surround the Marbury EPP's technology integration expectations.

Finding 4: Participants Indicate that Support for Making Informed Technology Integration Choices Varies within the EPP.

In substantiating this study's fourth finding that support for making informed technology integration choices varies within Marbury's EPP, the following section is organized thematically to support ongoing triangulation between survey, interview, and observational data. Although Likert-scale survey data indicate that most participants felt that they need more help integrating technology into their field experience lessons, Likert-scale survey data also showed that the four participants enrolled in EDUC 220: Technology Integration for Diverse Learners were more likely to "agree" that the Marbury EPP'S curricular programming provided generative technology integration experiences (per Tondeur et al., 2012; 2016) as compared to their six counterparts who were not enrolled in EDUC 220. Interview data from the four participants enrolled in EDUC 220 corroborate the benefits of the course, while comments by five interviewees suggest that the EPP's minimum requirement of a single standalone technology integration course (i.e., EDUC 120: Educational Technology) is generally ill-timed and may leave Marbury's preservice teachers insufficiently prepared to make digitally competent choices. Interview and observational data also showed that participants received varying levels of support from their cooperating teachers while delivering instruction in field experience settings, which also seemed to impact their technology integration options.

Generative Experiences in EDUC 220

Likert-scale survey data from the four participants who were required to take two different standalone technology integration courses showed that they reported more favorably on the technology integration experiences they had within the Marbury EPP as compared to their six counterparts who took only one standalone technology integration course. Regarding the second research question, survey, lesson plan, and interview data suggest that enrollment in EDUC 220: Technology Integration for Diverse Learners may have had some influence on the technology integration choices of the four participants (Clara, Tessa, Anya, and Terence) enrolled in the course. Each of these four participants described ways in which EDUC 220 had been especially beneficial.

For example, Clara said: “[EDUC 220] is technically in the special education realm, but it relates to *all* of my students…I feel better prepared now using technology than I ever have before.” It is also noteworthy that when asked about a survey prompt relating to Tondeur et al.’s (2016) collaboration construct, which Clara rated lowest of the 24 Likert-scale prompts, Clara said in her interview that she wanted to “change my answer to that one now.” The prompt asks respondents to appraise their opportunities to collaborate with peers to “develop classroom-technology based lessons together” (see COL1 in Appendix J). After taking the survey in mid-September, Clara explained in her late-October interview that she had since engaged in this sort of collaboration per EDUC 220 coursework at least once weekly.

Like Clara, Tessa (‘25) also spoke about meaningful opportunities for collaboration in EDUC 220. In talking about these collaborative opportunities, Tessa remarked, “working with—my partner specifically, I've been able to, like, pinpoint what technology I want to use in the classrooms versus just going into classrooms and not really knowing what I'm supposed to be using as a teacher.” As a byproduct of these collaborations, Tessa said that her presentation-design skills in PowerPoint and Canva had improved. In terms of EDUC 220’s impact on Tessa’s technology integration choices, it is also noteworthy that in her lesson plan, Tessa expressly indicated that she would turn on *closed captioning* (converts speech-to-text) while sharing YouTube videos “for learners with hearing problems” in her fall 2023 eighth-grade science (special education) placement. Relatedly, and as previously mentioned, Clara’s lesson plan and interview data also showed that she used speech-to-text extensions to accommodate diverse learning needs in her fall 2023 fourth-grade placement. Per the course title and description in Marbury's 2023 course catalog, these sorts of accommodations by way of adaptive technologies reflect the central learning goals of EDUC 220: Technology Integration for Diverse Learners.

Like Clara and Tessa, Anya ('25) and Terence ('24) also described generative experiences in EDUC 220. Anya and Terence both said that the course had given them a better sense of current technologies that they could use with students. For example, Terence said:

> …that class is great because it teaches you different apps you can use and it teaches you how to use them. Where to go to find information and how to find information that would actually be, like, *good* for students…and, …[Professor Zeta] sent you along to research if apps are good yourself. So, you're like, you know, using rubrics and coming to the conclusion of—if you would use these apps in the classroom. So, it really gives you a whole 'nother understanding and kind of *thought process* [emphasis added] to go about—when you're seeing these or using it in the classroom or student teaching.

In this comment, Terence alludes to the transferability of what Professor Zeta teaches in EDUC 220. Based on this comment, it seems that the criteria preservice teachers used to evaluate digital applications in EDUC 220 were also useful for making informed choices in the field.

In light of the generative takeaways that the four participants enrolled in EDUC 220 described during interviews, their Likert-scale survey responses were compared at a construct level against means from the six participants not enrolled in EDUC 220 (see Table 4.7). In comparing overall differences between the means for these Synthesis of Qualitative Data-based prompts (Tondeur et al., 2016), the four participants enrolled in EDUC 220 were more likely to *agree* (M = 4.73, SD = 1.03) that the Marbury EPP provided generative technology integration experiences as compared to their six counterparts not enrolled in the course (M = 4.07, SD = 1.21). It was also evident that participants enrolled in EDUC 220 reported more favorable experiences within the EPP for each of Tondeur et al.'s (2016) six constructs. The largest differences in means between the two groups were evident at the construct level for prompts pertaining to authentic experiences (*MD* = 1.08) and collaboration (*MD* = 0.94). Although these data were obtained from a small population of participants, survey responses show that the six participants in this research study who were not enrolled in EDUC 220 were generally less likely to *agree* that Marbury's EPP provided them with generative experiences to develop digital competencies as compared to the four participants who were enrolled in EDUC 220.

Table 4.7

Comparing Likert-Scale Survey Data Based Upon Enrollment in EDUC 220

SQD Construct	Enrolled in EDUC 220		Not Enrolled		Mean Difference
	M	*SD*	*M*	*SD*	*MD*
Role Model	4.81	0.98	4.42	0.88	0.39
Reflection	4.50	1.41	4.13	1.15	0.37
Instructional Design	4.25	1.13	3.95	1.49	0.30
Collaboration	4.94	1.06	4	1.14	**0.94**
Authentic Experiences	5.25	0.58	4.17	1.13	**1.08**
Feedback	4.63	0.62	3.79	1.41	0.84
Overall	4.73	1.03	4.07	1.21	0.66

Note: *N* = 10 (*n* = 6 respondents not enrolled in EDUC 220; *n* = 4 respondents enrolled in EDUC 220)

EDUC 120. According to Marbury College's 2023-2024 course catalog, the most comprehensive focus on preparing Marbury's preservice teachers to integrate technology into lesson plans occurs in EDUC 120: Instructional Technology, which 8 out of 10 interviewees took as freshmen. Terence ('24) and Tessa ('25) both mentioned in their interviews that taking EDUC 120 as freshmen made it difficult to apply what they learned in the course during the more intensive phases of their field experiences (which occur during the program's third and fourth years). The timing of EDUC 120, particularly for those who took the course as freshmen, is also noteworthy considering that the following survey prompt elicited the lowest average scores (*M* = 3.30, *SD* = 1.34) amongst respondents: “I received a great deal of help developing digital technology-rich lessons and projects to use for my internship” (see Appendix J, Table I.1, DES4).

Along these lines, when specifically asked to suggest ways in which programming could better support the development of technology integration skills, Daniel (’24) and Tessa (’25) both indicated that Marbury’s EPP should require preservice teachers to take more than one technology integration course. For example, Daniel said, “Having it [EDUC 120] so early and kind of like a one and done thing…I definitely, definitely do not feel that one semester is sufficient.” Later in the interview, Daniel followed up on this theme by saying, “moral of the story is I think there should be more classes that the focus is edtech.” In explaining this suggestion, Daniel said that he felt it would be beneficial to have, “more time and exposure” to a wider variety of digital applications. As this relates to Daniel’s technology integration choices, Daniel indicated that he was not inclined to facilitate hands-on usage of a specific digital application with students (i.e., Canva) unless he felt that he, himself was proficient with the application. Although Daniel said he had been exposed to Canva through his Marbury education coursework, he did not feel proficient enough with the digital application to use Canva with P-12 students.

Tessa who, unlike Daniel, was enrolled in EDUC 220 during the fall semester of 2023, agreed that one semester’s worth of a standalone technology integration course seemed insufficient. Although Sally (’25) did not specifically say that it would be beneficial to have more technology integration courses, her interview comments indicated that she would like to have more formal training with specific digital applications, such as Microsoft Excel. She also said that Marbury’s programming would be improved if it provided more practice both “utilizing current technologies” and training preservice teachers on ways they could help their P-12 students become more technologically proficient. For example, Sally said she felt she needed more guidance teaching students, “how to Google safely.” Sally’s comments, taken together with other interview and survey data, suggest that Marbury’s preservice teachers perceive a need for further support with technology integration.

Cooperating Teachers

As with the opportunity to take a second standalone technology integration course, it seems that there were discrepancies in terms of the ways in which participants interacted with their cooperating teachers that may have influenced their technology integration choices. More pointedly, observational and interview data from six participants showed that there was varying fidelity to the Marbury EPP’s prescribed *coteaching* model during the fall semester of 2023. To elaborate, it seemed that while Terence’s (’24), Isabel’s (’24), Mariyah’s (’24), and Clara’s (’25) cooperating teachers were proactively involved with instruction during lessons that these four participants taught, Sally’s (’25) and Tessa’s (’25) cooperating teachers were apparently uninvolved with the instructional process during lessons that these latter two participants taught. It was also evident that having an *instructionally involved* cooperating teacher versus an *instructionally uninvolved* one influenced the technology integration practices of at least a few participants.

Instructionally Involved. Terence’s observational and interview data stand out as clear examples of ways in which having a cooperating teacher who is proactively involved as a coteacher seemed to have a generative impact on a participant’s technology integration practices. For context, during a formally observed lesson that Terence planned and taught in a sixth-grade English Language Arts (special education) classroom, his cooperating teacher was proactive in terms of facilitating student learning and troubleshooting when technical difficulties arose. For example, in one brief exchange, Terence’s cooperating teacher reminded him to push “Screen Share” to pair a laptop computer with a Promethean Board. This immediately helped Terence overcome a glitch that he had described encountering in a prior lesson during his interview.

According to Terence's interview, his cooperating teacher also helped him overcome this same technical difficulty in a prior lesson while he continued with instruction. In describing the cooperative effort, Terence said, "I let her fix it [the technology] while I was like, you know, had the students' attention." Although this technological glitch prevented Terence from sharing a YouTube video with the first of four classes he taught on a day prior to his formal observation, the help he received from his cooperating teacher made it possible to eventually able to pair the devices and he successfully shared the video with three subsequent classes. In short, support from Terence's cooperating teacher seemed directly connected to the successful enactment of Terence's written plans for technology integration on at least two separate days.

Whereas it was apparent during Terence's formal observation that his cooperating teacher helped troubleshoot when Terence and his students encountered technological glitches, Isabel's ('24) cooperating teacher reportedly leveraged digital technologies to help manage students' digital behaviors. In Isabel's interview, she said that her cooperating teacher monitored student activity on their Chromebooks during her Desmos-based math lesson. Isabel indicated that having her cooperating teacher monitor "all of the kids' screens" seemed to help keep students on task. As with Terence, Isabel's interview data suggests that having a proactively involved cooperating teacher enabled her to more successfully enact her written plans for technology integration.

During formal observations, it was also evident that Mariyah's ('24) and Clara's ('25) cooperating teachers were actively involved with instruction. For example, while Mariyah used a Promethean Board during her first-grade subtraction lesson, her cooperating teacher made occasional comments to students pertaining to the lesson and provided Mariyah with real-time feedback about student progress. In Clara's fourth-grade placement, her cooperating teacher assumed more of a supervisory stance but appeared to be attuned both to Clara's instruction and to fourth-grade students' needs while they worked within a shared Google Doc. Although it is not possible to establish causal links between the involvement of cooperating teachers and the technology integration choices of participants given the data available, it was apparent that having cooperating teachers who were proactively involved with the instructional process corresponded with an ability to successfully enact written plans for technology integration for at least Terence, Isabel, Mariyah, and Clara.

Instructionally Uninvolved. Observational and interview data also showed that Sally's ('25) and Tessa's ('25) cooperating teachers opted for a more hands-off approach during lessons that these two participants planned and taught. For example, during an observation of a third-grade English Language Arts lesson, it was evident that Sally's cooperating teacher gave Sally full autonomy over instruction. More specifically, Sally's cooperating teacher worked independently at her own desk in the back of the room while Sally led students through a guided notes activity. Such autonomy neither seemed to impair Sally's ability to lead the class nor her ability to use digital technologies during her lesson on themes.

Tessa ('25) is another example of a participant with a cooperating teacher who was reportedly uninvolved with the instructional process. Tessa ('25) indicated in her interview that her own technology integration practices would be improved if she had experienced more opportunities to work collaboratively with her cooperating teachers. Tessa reported that her previous and present cooperating teachers did not seem to understand that "coteaching is both of us working together." Tessa also said that the lack of assistance she received from her cooperating teachers impacted her technology integration proficiency:

> I struggle with [technology integration], only because I don't know how the classroom works and I don't know, like, how to work at their technology, specifically. Um, if they were to help me, it would be different because they could monitor the [Promethean] board or help turn the board on and I could be teaching the class as they're helping get things together.

Tessa's reported lack of support stands in stark opposition to the more constructive partnership Terence seemed to share with his cooperating teacher. In other words, the sort of technological support that Tessa reportedly lacked was evident in Terence's previously described interview and observational data.

Again, it is not possible to establish causal links, but it is worth reiterating that the two participants (i.e., Terence and Clara) with the most exemplary technology integration instances per lesson plan and observational data worked with cooperating teachers who were proactively involved with instruction. Tessa and Clarence also seemed to benefit from being enrolled in EDUC 220: Technology Integration for Diverse Learners. At the same time, the two participants (i.e., Sally and Tessa) who worked with cooperating teachers who were apparently uninvolved with instruction did not evidently plan for their students to move beyond passive engagement with digital technologies (per lesson plan and observational data). For example, Sally's only technology integration instance in the lesson plan she shared for this study stated her intention to: "Project a blank screen on the smart board and write down a few open-ended questions…" This instance was coded as "PR" for *passive-replaces*, which is the least cognitively engaging and least innovative of Kimmons et al.'s (2020) nine categories for technology integration. Relatedly, each of the four technology integration instances that were evident in Tessa's written lesson plan was coded as "PA" for *passive-amplifies* (per Kimmons et al., 2020). Although Tessa was enrolled in EDUC 220 during the fall semester of 2023, her interview data suggested that she lamented not having the same sort of technological support from a coteacher that was evident in four of her counterparts' placements.

Summary of Factors Influencing Technology Integration Choices

In summary, Finding 2, Finding 3, and Finding 4 each pertain to the second research question, which inquires about the factors that participants identify as having an influence on their technology integration choices. Regarding this study's second finding, interview data show that perceptions about technology overuse at home and at school correlated with seven participants' desire to limit student access to screens during the school day. As for the third finding, interview and lesson plan data reveal ambiguity surrounding program-wide expectations for technology integration. Finally, data from Likert-scale survey responses, interviews, lesson plans, and observational data help substantiate this study's fourth finding that participants received varying levels of support in making informed technology integration choices.

Chapter Summary and Synthesis

To make sense of data collected from four different data sets (i.e., survey, lesson plan, interviews, and observations), it is helpful to juxtapose findings pertaining to the first research question against factors that were uncovered in pursuit of answers to the second research question. Broadly speaking, Finding 1 makes it difficult to refute MacKinnon et al.'s (2018) claim that it was unclear how Marbury's preservice teachers "perform in creating opportunities for students to use technology to enhance learning" (p. 36). This assessment from the Council for the Accreditation of Educator Preparation's auditors in 2018 appeared to remain largely valid as of the fall of 2023. Although multiple datasets show that Clara ('25) and Terence ('24) were more inclined than their counterparts to use digital technologies with students in interactive and creative ways (per Kimmons et al., 2020), it appears that Marbury's preservice teachers do not typically design opportunities for P-12 students to have hands-on digital engagement with learning content.

Along these lines, it is instructive to compare Finding 1 against findings that pertain to the second research question to explore possible reasons *why* participants make specific technology integration choices. Put differently, while the first research question assesses the ways in which digital technologies are used in field experience placements, the second research question provides an opportunity to look for causal links that may reveal factors that affect participant choices. For example, participant concerns that P-12 students spend too much time using digital technologies (Finding 2) axiomatically seems to explain why participants are often reluctant to design opportunities for students to utilize their Chromebooks. Relatedly, ambiguous messaging about expectations for technology integration within Marbury's EPP (Finding 3) may also have affected the ways in which participants used digital technologies with P-12 students during the fall semester of 2023. For example, Nancy's ('25) and Mariyah's ('24) interview comments show that these two participants knew about the program's technology integration mandate but did not seem to understand that they were expected to leverage digital technologies in ways that *enhanced* teaching and/or learning in their respective 300- and 400-level field experience placements (per the 2023-2024 Marbury College catalog). Rather than integrating technology to improve teaching and/or learning, interview and lesson plan data show that Nancy and Mariyah's technology integration choices appeared rather perfunctory.

In terms of programming, Finding 4 also signals an important area for improvement within the Marbury EPP given that the lowest rated prompt (M = 3.3, SD = 1.34) on the Technology Integration Experiences Survey states: "I received a great deal of help developing digital technology-rich lessons and projects to use for my internship" (see Appendix J). In terms of support for developing "technology-rich lessons," it seems that there are disparities in the formal and informal support that participants received. For example, the support participants received apparently depended partly upon whether they were enrolled in EDUC 220: Technology Integration for Diverse Learners or worked with cooperating teachers who were proactively involved with the instructional process. Although survey and interview data from each of the four participants (i.e., Clara, Tessa, Anya, and Terence) enrolled in EDUC 220 indicate that the course provided them with generative opportunities to develop digital competencies, it is noteworthy that Tessa still felt her technology integration choices were impaired because she did not have opportunities to work with more proactively involved cooperating teachers. On the other hand, Terence and Clara both demonstrated exemplary (per Kimmons et al., 2020) technology integration plans and practices while experiencing the dual benefits of enrollment in EDUC 220 and placements with cooperating teachers who were seemingly proactive partners in coteaching.

In the chapter that follows, this study's four findings pertaining to technology integration practices and the conditions that influence the choices of Marbury's preservice teachers are further contextualized through a deeper dive into relevant theories. Findings are also compared against what can be learned from related studies. Furthermore, as a part-time employee of the Marbury College Education Department who has examined this problem of practice since the fall of 2020, I also use Chapter 5 to make my own tacit understandings of this local context explicit (Ravitch & Carl, 2021). Following that discussion, I conclude this capstone report with actionable recommendations for the Marbury EPP's leadership to consider.

CHAPTER 5: DISCUSSION AND RECOMMENDATIONS

The inquiry into this problem of practice began with an impetus to determine if Marbury College's preservice teachers have sufficient technology integration skills and digital competencies to create "opportunities for students to use technology to enhance learning" (MacKinnon et al., 2018, p. 36). This assessment is relevant to the Marbury College educator preparation provider's (EPP) leadership given their internal interests in maintaining "Full Accreditation" status and an upcoming (2025) program audit by the Council for the Accreditation of Educator Preparation (CAEP). Therefore, this case study set out to assess whether a subset of Marbury's preservice teachers (*N* = 10) could "integrate technology effectively in their practice" (CAEP, 2020a, R1.3) as of the fall of 2023. In order to arrive at a valid assessment of what Marbury's preservice teachers were able to do, it is essential to clarify what it looks like to integrate technology in ways that *enhance* (per MacKinnon et al., 2018) learning and are *efficacious* (per CAEP, 2020a). Ultimately, in line with the stated mission of Marbury's (2021) EPP and CAEP's (2020a) standards, the best way to measure the efficacy of an educator's technology integration practices is by the holistic impact that these practices have on P-12 student outcomes (Falloon, 2020; Lai et al., 2022).

It is, however, beyond the scope of this inquiry to measure the direct impact of Marbury preservice teachers' technology integration practices on P-12 students. Although P-12 student outcomes would be an ideal mega-level *ends* (Kaufman, 2000) to shape the criteria for judging preservice teachers' technology integration practices (Kohler et al., 2022; Lai et al., 2022), pragmatism dictated a more *means*-oriented (Kaufman, 2000) assessment of these preservice teachers' technology integration practices. Therefore, in the discussion that follows, the technology integration practices that were identifiable in survey responses, lesson plans, interview data, and formal observations are compared against relevant CAEP (2020a) standards to support the Marbury EPP's macro-level goal of remaining fully accredited. The following discussion also contextualizes findings from Chapter 4 using norms from other studies and evaluates participants' technology integration practices using relevant theories.

Discussion

The section that follows resembles the rhythm of Chapter 4 in that discussion pertaining to each of this inquiry's two research questions is presented in order (i.e., *RQ 1* then *RQ2*). It follows that the first part of this discussion compares the technology integration practices of Marbury's preservice teachers against CAEP's (2020a) standards, national norms, and theories. These comparisons serve to validate recommendations that I propose later in this chapter that pertain primarily to this study's first finding (see Chapter 4). In answering the second research question, Kaufman's (2000) conception of *mega-level* (societal), *macro-level* (institutional), and *micro-level* (individual) influences enables a systematic review of factors that are thought to affectively influence an educator's technology integration choices (Falloon, 2020; Tondeur et al., 2012). Again, CAEP's (2020a) standards and the literature help contextualize Findings 2 through 4 from Chapter 4 in a manner that aims to be instructive for the Marbury EPP's leadership.

Use of Digital Technologies During Field Experiences

With regard to the ways in which participants used digital technologies with P-12 students, this inquiry is mindful of CAEP (2020a) Standard R1.3, which that states preservice teachers need to be able to "model and apply national or state approved technology standards." As described in Chapter 1, if the Marbury EPP complied with CAEP Standard R1.3 during the fall of 2023, then the EPP's preservice teachers would have enacted the state-approved International Society for Technology in Education (ISTE, 2020, 2021) standards, which are decidedly *student-centered* (CAST, 2018; Kimmons et al., 2020). As previously mentioned, I used Kimmons et al.'s (2020) PICRAT matrix as a gauge to determine the degree that participants' technology integration practices were student-centered and found that participants tended to position students as *passive* receivers of digital learning content (Finding 1). In other words, participant practices tended to be more teacher-centered as opposed to student-centered (Kopcha et al., 2020; Warner et al., 2018).

To be more specific, 66% (57 out of 87) of technology integration instances that were evident in lesson plan and observational data were coded as *passive-replaces* (per Kimmons et al., 2020), which is synonymous with teacher-centered technology integration practices (Kopcha et al., 2020; Warner et al., 2018). This means that it was more common for participants to use digital technologies such as Elmo document cameras and Promethean Boards in their fall 2023 placements than it was for P-12 students to have opportunities to *interact* or *create* with digital learning content (per Kimmons et al., 2020). Bringing PICRAT (Kimmons et al., 2020) into conversation with student- versus teacher-centered technology integration practices (Kopcha et al., 2020) helps situate this study's first finding against the literature.

Although there is pressure from CAEP (2020a; 2021) to prepare preservice teachers to enact student-centered practices, the leadership of Marbury's EPP should also not overlook CAEP (2020a) Standard R3.2 which states that preservice teachers need to be able to "integrate technology effectively in their practice." Along these lines, it is important to heed Kimmons et al.'s (2020) assertions that "each square in the [PICRAT] matrix is a positive technology application" (p. 192) and that effective instruction "should include activities that span the entire matrix" (p. 190). In other words, the preponderance of technology integration receiving passive-replaces codes in this study does not point to categorically bad instruction on the part of these Marbury preservice teachers. That said, the upper right corner of Kimmons et al.'s (2020) PICRAT matrix (i.e., creative-transformative technology integration) is congruent with seminal student-centered ideals (Jonassen, 1996; Papert, 1993; Hughes et al., 2006).

With regard to the assumption that student-centered technology integration is categorically good (Warner et al., 2018), which is debatable (Clark & Feldon, 2014; Harris et al., 2010; Sweller, 2021), some evidence in Chapter 4 suggests that there may be tradeoffs involved with using digital technologies to support student-centered learning. For example, while observing Terence's ('24) sixth grade English Language Arts lesson, it was not evident to me that having students make a Google Slides presentation was a time-efficient way to assess students' knowledge about similes. With Terence's student-centered approach, along with Clara's ('25) observed usage of shared Google Docs with fourth graders, introducing a novel digital technology to students inherently increased the degree of *element interactivity* (Sweller, 1994) involved with both of the aforementioned learning tasks. In consideration of Sweller's concept of element interactivity, learning to use an unfamiliar digital technology (such as students were doing in Terence's and Clara's lessons) places an extraneous strain on a learner's working memory and therefore can be expected to interfere with mastery of an academic content standard.

On the other hand, Mariyah's ('24) teacher-centered (Kopcha et al., 2020; Warner et al., 2018) approach to technology integration with first-grade students appeared complementary to the learning goals for her lesson about basic subtraction strategies. I say this because in Mariyah's interview comments she spoke about the challenges that a computer's keyboard poses to first graders. Therefore, Mariyah's teacher-centered usage of a Promethean Board during her subtraction lesson is defensible because a first grader's struggles with typing would inevitably increase the element interactivity involved with the learning task and thereby make it more difficult for first graders to master novel subtraction strategies (Harris et al., 2010; Mishra, 2019; Sweller, 1994). As an observer, I perceived Mariyah's lesson to be time-efficient and constructive. Given her instructional goals, Mariyah's choice to use a Promethean Board seemed to be a good "fit" (Harris et al., 2010, p. 3840). More broadly, that participants were more likely to use digital technologies than their P-12 students during fall 2023 field experience lessons does not necessarily reflect poor decision-making on the part of Marbury's preservice teachers (Kopcha et al., 2020).

Norm-Based Comparisons

Although the PICRAT matrix is useful for illustrating clear and tangible ways that Marbury College's preservice teachers could design more cognitively engaging and innovative technology integration practices (Kimmons et al., 2020), this study's first finding is basically congruent with national norms (Cherner & Curry, 2017; Hughes & Read, 2018; Polly et al., 2020). To elaborate, even in classrooms led by professional educators, inservice teachers typically use digital technologies more frequently than their P-12 students (Hughes & Read, 2018; Polly et al., 2020; Welsh & Harmes, 2018). Given these norms, and studies showing that preservice teachers are less likely to enact student-centered technology integration practices than inservice teachers (Hughes et al., 2020; Wekerle & Kollar, 2022), this study's data showing that teacher-centered (Kopcha et al., 2020; Warner et al., 2018) technology integration is the norm for nearly all participants is unsurprising.

Beyond identifying characteristics of teacher- versus student-centered technology integration in participant practices (Kopcha et al., 2020; Warner et al., 2018), comparing findings from the literature against findings from Chapter 4 can be instructive moving forward as the Marbury EPP's leadership looks to clarify expectations for technology integration in field experience placements. For example, the Polly et al. (2020) and the Cherner and Curry (2017) studies both found that preservice teachers tend to enact progressively more student-centered (per Kimmons et al., 2020) technology integration practices after gaining more experience in field experience placements. That said, there was not clear evidence that this trend held true for participants belonging to Marbury's Class of 2024 and Class of 2025 cohorts. Even so, findings from the Cherner and Curry (2017) and Polly et al. (2020) studies suggest that it is logical to expect preservice teachers to enact increasingly student-centered (per Kimmons et al., 2020) technology integration practices as they progress through a four-year program.

Teacher Digital Competency

Although the Marbury EPP has an institutional obligation to prepare preservice teachers to enact student-centered technology integration practices (CAEP, 2020a; WV Policy 5100, 2021), the program's leadership should also not lose sight of what it means to "integrate technology effectively" (CAEP, 2020a, R3.2). Part of being a digitally competent educator is knowing when teacher-centered approaches may be the best fit for a given context or learning goal (Falloon, 2020; Harris, 2010; Kopcha et al., 2020). As previously mentioned, Mariyah's ('24) usage of a Promethean Board during her subtraction lesson seemed to be a better "fit" (Harris et al., 2010, p. 3840) for her learning goal as compared to practices that would push toward the upper-right portion of Kimmons et al.'s (2020) PICRAT matrix (thus being more student-centered).

Mariyah also stands out as the participant who showed the broadest *sociocultural awareness* (Bower, 2019; Falloon, 2020) about potential ramifications associated with technology overuse. Although Anya ('25), Kimberly ('24), and Sally ('25) each raised concerns about the impact of overusing technology on students' physical health, Mariyah was the only interviewee who expressed concerns about the impact that digital technologies can have on mental health and other dangers that can come by way of digital overexposure (e.g., "stranger danger"). Thus, Mariyah's stated concerns exhibit the sort of robust sociocultural understandings that underpin Falloon's (2020) holistic conception of a digitally competent educator.

Summary of Technology Integration Practices

To summarize how this study's first finding compares against the literature, the preponderance of technology integration instances that were coded as passive-replaces (see Finding 1) shows that teacher-centered practices (Kopcha et al., 2020; Warner et al., 2018) are the norm for most participants in this study. As mentioned earlier, teacher-centered practices are synonymous with Kimmons et al.'s (2020) passive-replaces category. Although there are exceptions to this norm within the Marbury context (e.g., Clara's and Terence's student-centered technology integration practices), teacher-centered norms are consistent with what has been found nationally in classrooms led by both preservice teachers and inservice teachers alike (Hughes & Read, 2018; Polly et al., 2020; Welsh & Harmes, 2018). Nevertheless, the Marbury EPP is required to train teachers to enact the state-approved ISTE (2020, 2021) standards, which prescribe student-centered practices. Therefore, in order to comply with accreditation standards (CAEP, 2020a) and state policy (WV Policy 5100, 2021), Marbury's EPP needs to help its preservice teachers improve their ability to enact student-centered technology integration practices (CAST, 2018; Kimmons et al., 2020).

This imposes a multifaceted challenge for the Marbury EPP's leadership. Marbury's education instructors need to find ways to encourage student-centered technology integration practices while also cultivating understandings about when it would be more prudent to deploy teacher-centered practices (Kopcha et al., 2020) and how to take precautions to avoid exposing students to digital dangers (Dawson et al., 2022; Falloon, 2020; Krutka et al., 2020). Therefore, as the leadership of Marbury's EPP looks for ways to nudge preservice teachers toward student-centered technology integration practices (CAST, 2018; Kimmons et al., 2020), these teacher educators should take care to ensure that any impetus toward instructional innovation does not supersede the program's mega-level aim of prioritizing holistic P-12 student outcomes (Falloon, 2020; Harris, 2005; Kaufman, 2000).

Factors that Influence Technology Integration Choices

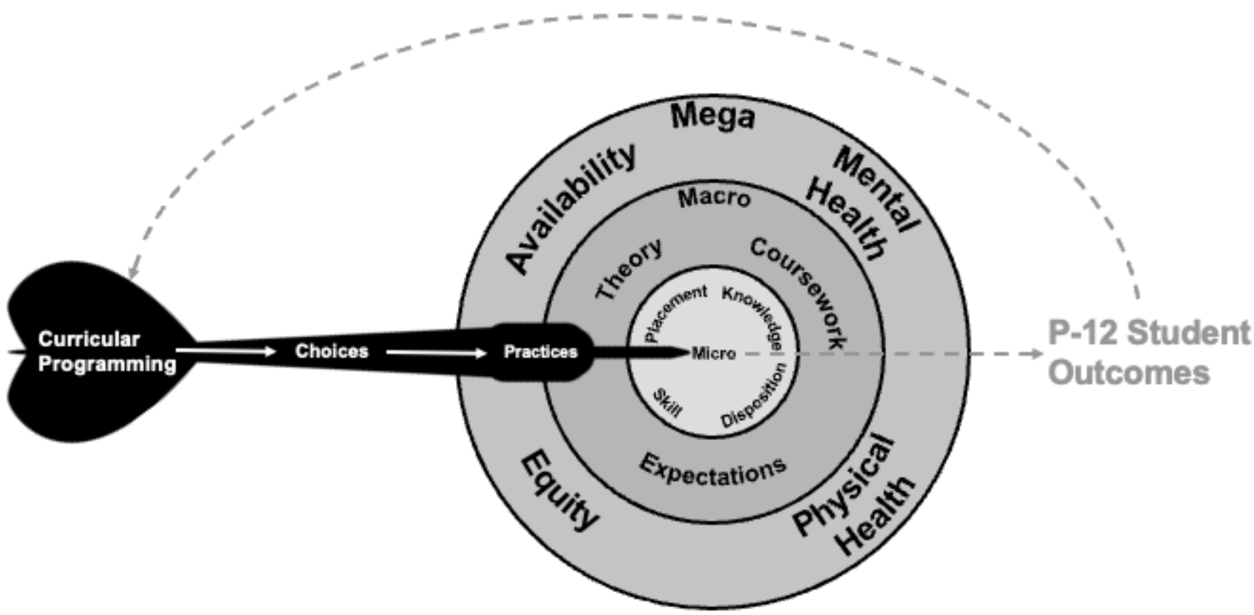
In the section that follows, the goal is to situate findings that are pertinent to the second research question against CAEP's (2020a) standards while again taking stock of relevant theory and the literature. The second research question inquires about the factors that Marbury College's preservice teachers identify as influencing their technology integration choices. To narrow the seemingly infinite number of potential factors that might influence a preservice teacher's technology integration choices, I again borrow from Kaufman's (2000) Organizational

Elements Model to lend a systematic exploration of mega-level (or societal), macro-level (or institutional), and micro-level (or individual) factors that influence and inform a digitally competent educator's technology integration choices (Falloon, 2020; Kopcha et al., 2020).

As shown in Figure 5.2, the subsequent discussion recontextualizes prominent themes from Chapter 4 in a way that intends to steer towards a *mega-level* orientation for curricular programming within Marbury's EPP (Kaufman, 2000). Rather than focusing solely on macro-level aims, such as accreditation, Kaufman stresses a mega-level emphasis on prioritizing the needs of external beneficiaries, which in the case of Marbury's EPP includes P-12 students. Thus, in addition to the Marbury EPP's internal interest in developing skilled technology integrationists and maintaining the program's accreditation status, the Marbury EPP also should aim to cultivate digitally competent educators who understand how their technology integration choices might impact P-12 students' lives (Falloon, 2020).

Figure 5.2

Implications of Findings for Curricular Programming



Mega Level

In terms of how what is happening at a societal level seems to impact the technology integration choices of Marbury College's preservice teachers, interview and observational data in this study affirm that digital technologies were increasingly ubiquitous both in and outside of Rural County classrooms in the fall of 2023 as compared to the pre-COVID-19 era. This increase in available classroom technology is consistent with what happened nationally as a byproduct of COVID-19 era investments in the education sector (EdWeek Research Center, 2022a; Teräs et al., 2020; Trombly, 2020). Perhaps as a consequence of the ubiquity of digital technologies, seven participants in this study expressed concerns about student technology overuse and were reportedly inclined to limit student screen time (Finding 2).

This sort of *technoskepticism* (Krutka et al., 2020) on the part of preservice teachers is gaining traction amongst scholars in the field (Bower, 2019; McDonagh et al., 2021). Relatedly, as mentioned in Chapter 2, an EdWeek (2022a) survey found that professional educators overwhelmingly perceived that too much screen time is correlated with increases in P-12 student misbehavior. With participants raising seemingly valid concerns about technology overuse both at home and at school, it is evident that leaders within Marbury's EPP must strike a delicate balance between encouraging P-12 student usage of digital technologies while also discouraging preservice teachers from making negligent technology integration choices (Dawson et al., 2022; Krutka et al., 2020; Yadav & Lachney, 2022).

At the same time, there are also mega-level (Kaufman, 2000) arguments to be made in favor of the Marbury EPP's existing technology integration mandate and a programmatic impetus toward encouraging student-centered technology integration practices (Todd et al., 2021; USDEOET, 2017; 2022). To bear this out, as West Virginia attempts to transition away from a coal-fired economy, Todd et al. (2021) argue that the state's inhabitants ought to be prepared for work in the knowledge-driven technology sector. This line of logic is compatible with recommendations for ways in which educators should use digital technologies with students by the U.S. Department of Education's Office of Educational Technology (USDEOET, 2017; 2022). Reports by the USDEOET (2017; 2022) emphasize the importance of expanding P-12 student access and agency (Hughes et al., 2020; Kohler et al., 2022) with digital technologies as a means of enabling upward mobility for historically marginalized socioeconomic groups.

This goal of using digital technologies to foster more equitable outcomes is an important consideration for the Marbury EPP because each of the elementary schools in surrounding Rural County receives Title I funds (WVDE, n.d.). As this socioeconomic variable relates to this study, Clara ('25), Mariyah ('24), Nancy ('25), and Sally ('25) each had placements in Title I-funded elementary schools during the fall of 2023 (WVDE, n.d.). Kimberly ('24) was also placed in a Title-I funded high school in a neighboring county during the fall of 2023. Other than Clara's inclination toward student-centered practices, the preponderance of teacher-centered practices among the other four participants placed in Title I-funded schools is consistent with findings from comparable studies that involve students from low-income earning families (Hughes & Read, 2018; Welsh & Harmes, 2018). As described in Chapter 2, Welsh and Harmes (2018) found that teachers in Title I-funded schools tend to use digital technologies in ways that are less cognitively engaging and less innovative as compared to teachers serving non-Title I populations. More broadly, the literature shows that student-centered (per Kimmons et al., 2020) technology integration practices are more likely to be deployed by teachers of P-12 students who belong to historically privileged socioeconomic groups (Hughes & Read, 2018; Rafalow, 2018; Welsh & Harmes, 2018).

Here again, the Marbury EPP's leadership must exercise prudence as it charts a course to cultivate digitally competent educators that can capably serve Title I and non-Title I populations. As previously mentioned in Chapter 2, teacher-centered technology integration practices engender a more heavily structured learning environment (Kopcha et al., 2020; Warner et al., 2018) and therefore can be an optimal fit for low academic achievers who are more likely than comparatively high academic achievers to thrive in academic learning environments that are more structured (Belland et al., 2015; Kalyuga et al., 1998, 2000). That said, socioeconomic status should not be conflated with academic achievement (Belland et al., 2015; Berry, 2005). Thus, in order to have the versatility to meet diverse learning needs, ideally Marbury's preservice teachers would have the digital competencies required to successfully operationalize both student- and teacher-centered practices along with the sound judgment to know which to use when (Kopcha et al., 2020).

Macro Level

Expectations

As reported in Chapter 4, interview comments by six participants and lesson plan data show that the Marbury EPP's expectations for technology integration are ambiguous (Finding 3). For example, Clara ('25) and Anya ('25) reported that there were incongruent expectations between the Marbury EPP and their field experience supervisors. This sort of mismatch in expectations between what is expected in the field and what is prescribed on college campuses is a common challenge for EPPs to grapple with when striving to foster student-centered technology integration practices (Graham et al., 2009; McGarr & Ó Gallchóir, 2020a). Along these lines, the program's stakeholders both on Marbury's campus and in surrounding field experience placements do not seem to share a set of guiding values nor expectations pertaining to technology integration.

Theory

To borrow a metaphor from Hoyle and Jon (1995), *theory* can act as a "broad church of ideas and principles" (p. 65) to guide an educator's choices. At the macro level, it seems that uneven understandings of potentially unifying theories about technology integration within Marbury's EPP contribute to uneven expectations among stakeholders about ways in which preservice teachers should use digital technologies with P-12 students. Although teacher-centered technology integration practices (Kopcha et al., 2020; Warner et al., 2018) appear to be the norm for most participants in field experience placements, this study also uncovered evidence of two theories about student-centered technology integration that seemed to influence the ways that at least three participants conceptualized exemplary technology integration (CAST, 2018; Kimmons et al., 2020). For example, interview and open-ended survey data show that both Mariyah ('24) and Daniel ('24) were familiar with the terminology that frames Kimmons et al.'s (2020) PICRAT matrix.

On the other hand, Clara's ('25) interview comments and the four lesson plans submitted on the program's newer lesson plan template suggest that Professor Zeta's emphasis on using the Universal Design for Learning (UDL) Guidelines (CAST, 2018) appears to be gaining momentum throughout the program. Whereas PICRAT champions creative and transformative technology integration practices (Kimmons et al., 2020), the UDL Guidelines focus more so on using adaptive technologies to meet diverse learning needs (CAST, 2018). Clara's use of text-to-speech extensions is compatible with CAST's (2018) UDL Guidelines and illustrates one way in which adaptive technologies can make learning more equitable for students who have difficulty typing or spelling.

Coursework

As reported in Chapter 4, participants felt that support for making informed technology integration choices varies within Marbury's EPP (Finding 4). Regarding the program's only technology integration course that all of the EPP's preservice teachers are required to take, EDUC 120: Instructional Technology, Chapter 4 also reports that Daniel ('24) and Tessa ('25) said that the program's requirement for most education majors to take only one technology integration course was insufficient. To better contextualize these interview comments about course offerings within Marbury College's EPP, it is helpful to compare Daniel's and Tessa's comments against the arc of the longitudinal survey measures of TPACK (technological, pedagogical, and content knowledge) self-efficacy for preservice teachers (*N* = 120) enrolled in the Mouza et al. (2017) study. In short, survey data from preservice teachers in the Mouza et al.

study reflected significant growth in self-reported feelings of TPACK self-efficacy during semesters in which they were enrolled in two different standalone technology integration courses. These preservice teachers took their first technology integration course as freshmen and a second technology integration course during either their junior or senior year (Mouza et al., 2017). “Statistically significant declines” (p. 15) in self-reported TPACK self-efficacy were also evident in survey data in the interim two- to three-year period in which these preservice teachers were not enrolled in a standalone technology integration course.

In applying findings from the Mouza et al. (2017) context to the Marbury EPP’s setting, it seems that if Marbury’s education department continues to require only one standalone technology course (i.e. EDUC 120: Instructional Technology), then digital competencies can be expected to atrophy after preservice teachers complete this course (per Mouza et al., 2017). Thus, synchronizing the timing of EDUC 120 with field experience placements that Marbury’s preservice teachers take after their freshmen year may provide better opportunities for Marbury’s preservice teachers to apply their learning from EDUC 120 before such knowledge would be expected to decline (per Mouza et al., 2017). In addition to altering the timing of EDUC 120, data collected from the four participants in this study who took a second standalone technology course (i.e., EDUC 220: Technology Integration for Diverse Learners) suggest that it would be beneficial to require this course for all of Marbury’s preservice teachers. As Clara (’25) said, EDUC 220 “is technically in the special education realm, but it relates to *all* of my students.”

Micro Level

While macro-level influences such as the program’s technology integration mandate and the timing and frequency of technology course offerings may have an impact on preservice teachers’ technology integration practices, a variety of micro-level lived experiences, traits, and states also seem to influence the technology integration choices of preservice teachers (Kocha et al., 2020; Nelson & Hawk, 2020; Tondeur et al., 2012). The micro-level richness that emerged from interview comments in this study is particularly instructive for identifying challenges and opportunities facing Marbury College's physical education majors, such as Kimberly ('24). More generally, micro-level variability in interview and observational accounts of what happened in fall 2023 field experience placements provided indicators of knowledge, dispositions, and skills held by participants in this capstone inquiry.

Knowledge

Mishra's (2019) emphasis on the importance of *contextual knowledge* is relevant to Mariyah's ('24) interview and open-ended survey data. In terms of making digitally competent technology integration choices, Mishra (2019) argues that a teacher's knowledge of contextual variables (e.g., a learner's age) can be as important as a teacher's technological, pedagogical, or content knowledge. This sort of knowledge seems essential for deciding whether to deploy teacher- or student-centered technology integration practices (Harris et al., 2010; Kopcha et al., 2020). With regard to evidence of Mariyah's contextual knowledge, her appraisal of first-grade students' emergent keyboarding skills seemed to substantiate her decision to generally limit first-grade student usage of their personal Chromebooks. The idea that less-skilled learners benefit from more structure rather than less is also consistent with other research discussed in Chapter 2 (Belland et al., 2015; Kalyuga et al., 1998; Watkins, 1997). To parlay these takeaways into potential changes in curricular programming, the Marbury EPP's leadership should encourage preservice teachers to account for contextual considerations (e.g., learner ages and skill levels) when making technology integration choices (Kopcha et al., 2020; Mishra, 2019).

Dispositions

It is also worth considering the degree that an educator's pedagogical *disposition*, or values, beliefs, and attitudes, influences their technology integration choices (Kopcha et al., 2020). For example, whereas Clara ('25) and Terence ('24) each stand out as having a relatively student-centered disposition towards technology integration, Daniel ('24) and Marissa

('24) stand out as having a more teacher-centered disposition (per Kopcha et al., 2020). Interview and observational data also suggest that Clara and Terence were more inclined than the other eight participants to provide opportunities for P-12 students to have agency with their Chromebooks (Hughes et al., 2020; Kohler et al., 2022). Conversely, Daniel and Marissa described reasons why they were disinclined to give students agency with their Chromebooks in their fall of 2023 placements. Providing students with agency, or digital autonomy (Kohler et al., 2022) and creative control over the learning process (Hughes et al., 2020), is a defining characteristic of student-centered technology integration.

Skills

In terms of developing technology integration skills, it is important to mention that preservice teachers can lack the requisite skillsets to enact their espoused beliefs (Shifflet & Weilbacher, 2015). Unlike the preservice teacher (*N* = 1) in the Shifflett and Weibacher (2015) case study who lacked sufficient classroom management skills to enact student-centered technology integration practices, during my observation of Terence's ('24) instruction in a sixth-grade placement, I perceived that Terence generally possessed proficient classroom management skills. However, in terms of the overall design of the lesson that I observed Terence teaching in a sixth-grade context, it did not seem to me that Terence's plan optimized efficiency. Although it was apparent that Terence was striving to enact student-centered (CAST, 2018; Kimmons et al., 2020) technology integration practices, I perceived that his skills in designing project-based assessments limited his ability to "integrate technology effectively" (CAEP, 2020a, R3.2) with his teaching practices.

Placement

In addition to variations in participants' technology integration knowledge, dispositions, and skills, it is clear that participants' fall 2023 field experience placements influenced their technology integration choices. For example, at the micro level, Tessa's ('25) challenges in working with instructionally uninvolved coteachers appeared to impede the development of her technology integration skills. Kimberly's ('24) micro-level experiences as a physical education major also testify to the influence of specific field experience placements.

Coteaching Model. As discussed in Chapter 4, participants reported varying levels of support from their cooperating teachers when leveraging digital technologies in the field. As was found in the contexts surrounding Marbury College, the literature shows that a cooperating teacher can have a profound influence on a preservice teacher's developing digital competencies (Englehardt & Brown, 2019; Nelson & Hawk, 2020; Nelson & Voithofer, 2022). Whereas Terence ('24), Isabel ('24), Mariyah ('24), and Clara ('25) worked with cooperating teachers who seemed to be proactive partners as *coteachers* in their classrooms, Tessa ('25) reported that the cooperating teachers she had worked with did not seem to understand Marbury's coteaching model and Sally's ('25) cooperating teacher was instructionally uninvolved during my observation of that fourth-grade classroom. Given the outsized influence that a cooperating teacher can have on a preservice teacher's digital competencies (Englehardt & Brown, 2019; Nelson & Hawk, 2020; Nelson & Voithofer, 2022) and evidence showing that at least Tessa and Sally worked with cooperating teachers who were apparently uninvolved with instruction, it would behoove the Marbury EPP's leadership to clarify expectations for ways in which cooperating teachers can and should help Marbury's preservice teachers improve their technology integration skills.

Physical Education. In terms of the influence that a particular field experience placement can have on a preservice teacher's developing technology integration skills, Kimberly's ('24) interview comments suggest that her fall of 2023 physical education placement in a neighboring county's high school drastically limited her options for using digital technologies with students. This shortage of available technologies, or what Ertmer (1999) refers to as a *first-order barrier*, did not appear to impede the plans or practices of the other nine participants who shared lesson plans and participated in interviews. The shortage of technologies that Kimberly described also indicates a that this neighboring county's physical education setting makes it difficult for the Marbury EPP to demonstrate compliance with CAEP (2020a) standard R6.4, which states that the program needs to have sufficient digital “infrastructure” to enable preservice teachers to use digital technologies “for instruction.”

Summary of Factors that Should Influence Technology Integration Choices

To succinctly summarize the answer to the second research question in a manner that intends to be instructive for the leadership of Marbury’s EPP, there are key takeaways from the preceding discussion that can be used to scaffold better-informed technology integration choices by Marbury’s preservice teachers. As for the mega level (Kaufman, 2000), an aim to improve holistic P-12 student outcomes should be at the forefront of any initiative pertaining to the technology integration practices of Marbury’s preservice teachers (Falloon, 2020; Lai et al., 2022). To transform this theoretical aspiration into action, Marbury’s preservice teachers need to be trained to assess the potential impact of their technology integration choices on their P-12 students’ learning, safety, and overall wellbeing (Dawson et al., 2022; Krutka et al., 2020; Lai et al., 2022).

Because making competent technology integration choices requires nuanced and context-driven judgements (Falloon, 2020; Mishra, 2019), the Marbury program’s leadership should also work toward clarifying the values and theories that undergird the program’s expectations for technology integration. Relatedly, although PICRAT (Kimmons et al., 2020) and the UDL Guidelines (CAST, 2018) seem to be familiar to some participants, the practices prescribed by these student-centered frameworks are less evident in the enacted practices of participants in this research study as compared to teacher-centered (Kopcha et al., 2020; Warner et al., 2018) technology integration norms. Therefore, at the macro level, Marbury’s education courses need to focus more explicitly on helping the program’s preservice teachers develop both the capability to enact student-centered practices (CAST, 2018; Kimmons et al., 2020) and the digital competence to recognize situations in which teacher-centered practices are a better fit (Falloon, 2020; Harris et al., 2010; Kopcha et al., 2020).

At the micro level, it seems that the Marbury EPP can do more to cultivate the knowledge, dispositions, and skills that typically accompany student-centered and digitally competent approaches to technology integration (Falloon, 2020; Kopcha et al., 2020). To highlight a salient micro-level experience from this study, it is also evident that Kimberly's ('24) individual experiences as a physical education major exposed programmatic shortcomings that should be addressed by Marbury's education and sports science departments. Kimberly's individual-level lived experiences as a Marbury preservice teacher, like those of several of her counterparts, also testify to the impact that a specific field experience placement can have on the opportunities that a preservice teacher has to develop their digital competencies. In terms of how this relates to the work of an EPP, it is essential that Marbury's preservice teachers be placed in field experience settings that have adequate digital infrastructure (CAEP, 2020a; Ertmer, 1999). Beyond this baseline-level contextual requirement, Tessa's ('25) and Sally's ('25) micro-level experiences also testify to a need for the Marbury EPP to improve fidelity to its coteaching model to support improved teaching practices in field experience settings.

Recommendations

The final section of this capstone report sets forth plans to transform what I learned about this local problem of practice, relevant theories, and scholarly literature into actionable recommendations that aim toward improving the technology integration practices of Marbury College's preservice teachers. Accordingly, these recommendations for changes to the EPP's curricular programming intend to be especially instructive for an audience that includes Professor Zeta, the current Marbury education department chairperson, and Professor Delta, who is in charge of the program's field experience placements. I plan to meet with these two individuals in an education department meeting to share findings from Chapter 4 and verbally convey highlights from the discussion and recommendations in this chapter. I will also provide electronic copies of my capstone report to each of these two individuals.

To support the transference of the following recommendations into action-steps, the section that follows contains a collection of visual aids and tables that can be used by Professor Zeta and Professor Delta to succinctly convey specific points of emphasis to the program's preservice teachers and Marbury's cooperating Professional Development School partners (i.e., liaisons from five Rural County schools and approximately 30 cooperating teachers). The following recommendations are also accompanied by rationales, limitations, and action-steps:

- Recommendation 1: Adopt a longitudinal plan to scaffold the development of digitally competent educators.
- Recommendation 2: Clarify expectations for technology integration in field experience placements.
- Recommendation 3: Require two standalone technology integration courses for all education majors.

Recommendation 1: Adopt a Longitudinal Plan to Scaffold the Development of Digitally Competent Educators.

To be responsive to this study's first finding, the program's leadership needs to find ways to help Marbury's preservice teachers foster more cognitively engaging and innovative P-12 student usage of digital technologies (per Kimmons et al., 2020). At the same time, this study also highlighted examples of instances in which teacher-centered (Kophca et al., 2020) practices seemed to be the best "fit" (Harris et al., 2010, p. 3840) for a given lesson and found that there were valid reasons why participants chose to limit student screen time (Finding 2). Indeed, the first two findings in Chapter 4 pose nuanced and dialectical challenges for Marbury's leadership to address. In response to these challenges, I recommend that Marbury's leadership adopt a longitudinal plan to scaffold the development of digitally competent educators.

The following longitudinal plan that I propose is essentially a curriculum map that aligns three technology integration theories with specific Marbury College education courses. To provide an advanced organizer (Ausubel, 1960), Table 5.1 shows how relevant aspects of

Falloon's (2020) Teacher Digital Competency Framework, Kimmons et al.'s (2020) PICRAT matrix, and CAST's (2018) UDL Guidelines can complement the learning goals of specific Marbury education courses. The instructors of those courses can use the learning goals set forth in Table 5.1 to amend current course descriptions and syllabi as needed.

Table 5.1

Aligning Technology Integration Theory with Coursework

Theory	Freshmen	Sophomores	Juniors	Seniors
Teacher Digital Competency Framework (Falloon, 2020)	*EDUC 100: The School in American Society-* Be able to describe technology's positive and negative impacts on student outcomes (e.g., physical and mental health).	*EDUC 120: Instructional Technology-* Practice assessing risks associated with specific apps.	*Methods Courses:* Design lessons that demonstrate discipline-specific digital competencies.	
PICRAT (Kimmons et al., 2020)		*EDUC 120: Instructional Technology-* Practice applying PICRAT's nine combinations.	*EDUC 220: Tech Integration for Diverse Learners-* Design lesson plans that move beyond passive-replacement tech usage.	*EDUC 488: Senior Seminar-* Design units that progressively scaffold creative and transformative tech usage.
UDL Guidelines (CAST, 2018)		*Special Education Courses:* Design lessons that use the UDL Guidelines to address specific learning needs and disabilities.	*EDUC 220: Tech Integration for Diverse Learners-* Design lessons that use the UDL Guidelines to address specific learning needs and disabilities.	*EDUC 488: Senior Seminar-* Design lessons that use the UDL Guidelines to address specific learning needs and disabilities.

There is some evidence in this study to suggest that the Marbury EPP has already taken proactive steps to ensure its preservice teachers know about Kimmons et al.'s (2020) PICRAT matrix and CAST's (2018) UDL Guidelines. That said, it was also evident during interviews that most interviewees (excepting Mariyah) were not aware of the broader sociocultural implications that might influence or result from an educator's technology integration choices (Falloon, 2020). Therefore, I suggest that Marbury College's education department also use at least some aspects of Falloon's (2020) Teacher Digital Competency Framework to scaffold a holistic approach toward developing digital competencies.

The three subsections that follow provide more detailed explanations about how each of these three theories (CAST, 2018; Falloon, 2020; Kimmons et al., 2020) can be complementary to the aims of specific Marbury education courses. A limitation of this longitudinal approach to operationalizing theories is that several of the following education courses are taught by adjunct instructors who may not be familiar with these theories. To help overcome this limitation, Professor Zeta would need to both provide support and accountability for instructors of the following courses as they transition toward adopting new learning goals for their course(s).

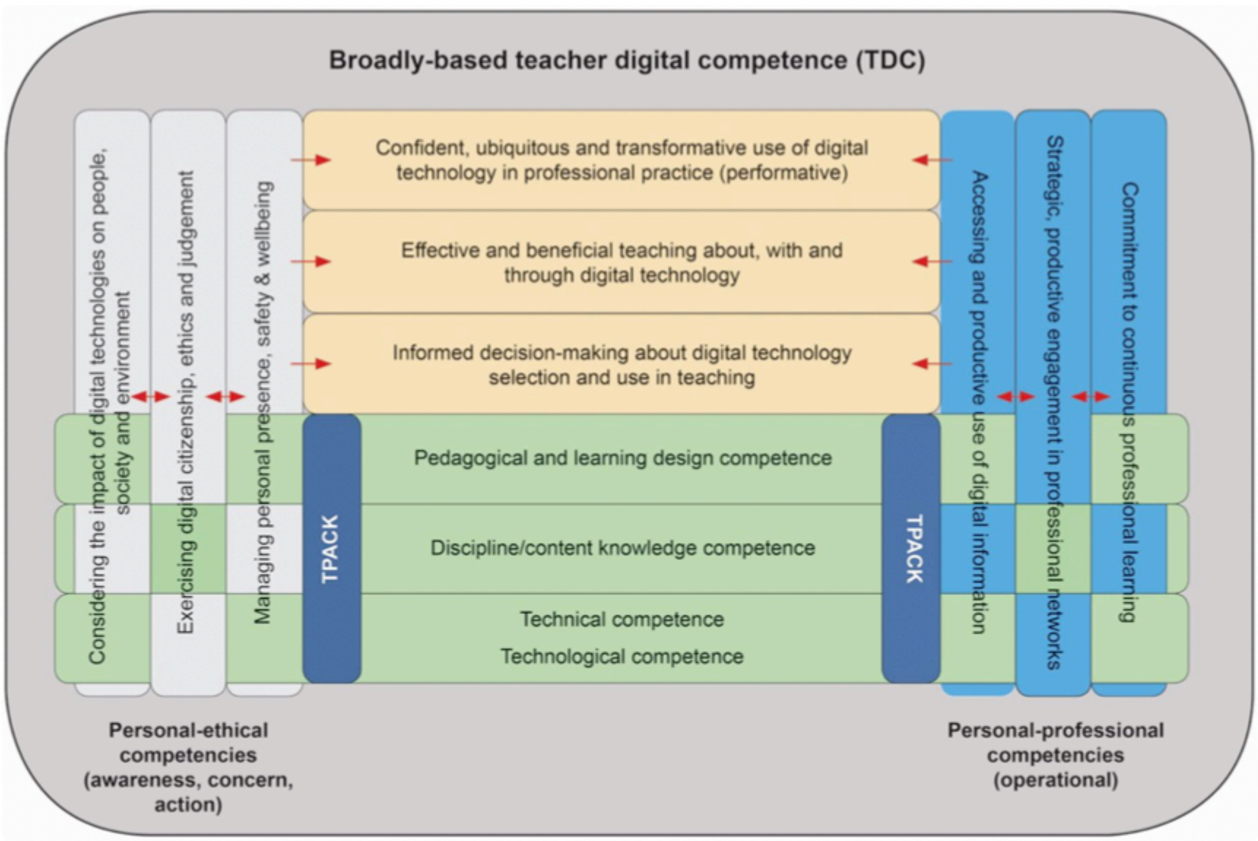
Theory 1: Teacher Digital Competency

The first education course that freshmen can take at Marbury College is EDUC 100: The School in American Society. Based on the description of the EDUC 100 objectives in the 2023-2024 Marbury College catalog, the left portion of Falloon's (2020) Teacher Digital Competency Framework (see Figure 5.4) aligns well with the learning goals of EDUC 100. To elaborate, EDUC 100 is a logical course for exploring the intersection between classroom technology integration and the ethical quandaries that a digitally competent educator should be mindful of when making technology integration choices (Falloon 2020). After exploring these themes in EDUC 100, preservice teachers should be able to describe technology's positive and negative impacts on student outcomes (e.g., physical and mental health).

As preservice teachers progress into their sophomore year, EDUC 120: Instructional Technology would be a logical course to further explore potential risks (e.g., compromised data privacy) associated with specific educational applications. This risk-assessment skill prepares educators to move toward the middle of the graphic in Figure 5.4 toward better "informed decision-making about digital technology selection" (Falloon, 2020, p. 2459). Along such lines, Common Sense Education is a useful resource for assessing digital risks because the website includes *Privacy Ratings* (n.d.) for educational applications. These Commonsense.org ratings (i.e., pass, warning, or fail) are accompanied by brief summaries and link to the website's more comprehensive evaluations of ways in which a given application utilizes student data. Training preservice teachers to perform this sort of due diligence helps prevent negligent technology integration choices (Dawson et al., 2022; Krutka et al., 2020; Yadav & Lachney, 2022).

Figure 5.4

Teacher Digital Competency Framework



Note: From "From Digital Literacy to Digital Competence: The Teacher Digital Competency (TDC) Framework," by G. Falloon, 2020, *Educational Technology Research and Development*, *68(5)*, p. 2459. (https://doi.org/10.1007/s11423-020-09767-4). CC BY 4.0.

Finally, Falloon's (2020) framework can further inform programming during methods courses that Marbury's preservice teachers take primarily during their junior year. These methods courses should require pupils to design lessons that demonstrate their discipline-specific digital competencies (CAEP, 2020a). Figure 5.4 depicts discipline-specific digital competence toward the bottom-middle portion of the graphic. In practice, this means that a course like EDUC 312: Teaching Social Studies would explore discipline-specific knowledge that would be relevant to a social studies teacher. For example, a social studies teacher should know how to teach their P-12 students to evaluate online sources (McGrew & Byrne, 2021; NCSS, 2013). This sort of digital competence conforms to CAEP's (2020a) requirement that EPPs train preservice teachers to teach with digital technologies "in the field(s) where certification is sought" (R3.3).

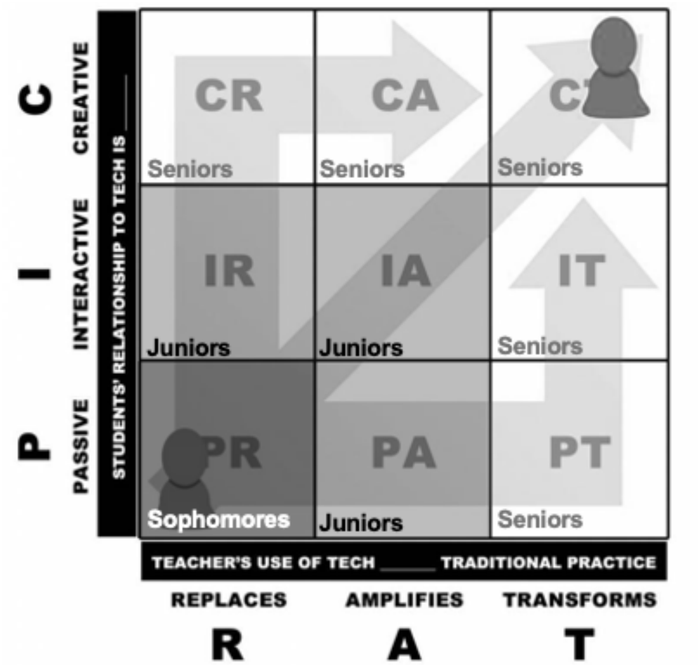
Theory 2: PICRAT

Like with Falloon's (2020) framework, helping Marbury's preservice teachers learn to enact student-centered (CAST, 2018; Kimmons et al., 2020) practices should also figure into a multi-year curriculum plan. As reported in Chapter 4, most technology integration instances in this study were coded as passive-replaces (per Kimmons et al., 2020) and Kimberly's ('24) and Nancy's ('25) open-ended survey responses show that they felt that *passive* student engagement with digital technologies constituted their *most exemplary* technology integration practices. In light of this data, it would be worthwhile for the program's leadership to better define what constitutes exemplary technology integration and scaffold ongoing support for developing relevant skillsets. Along these lines, PICRAT is useful for guiding preservice teachers "to practices that move toward the upper-right corner" (Kimmons et al., 2020, p. 190) of the matrix.

To promote shared understandings of Kimmons et al.'s (2020) matrix, I recommend ensuring that sophomores in EDUC 120 learn to apply the nine combinations of PICRAT's three-by-three grid (Kimmons et al., 2020). Learning to apply the vocabulary that accompanies the PIC- (i.e., passive, interactive, and creative) and RAT-axes (i.e., replaces, amplifies, and transforms) also supports a shared language for technology integration (Kimmons et al., 2020). Moreover, as shown on Figure 5.5, a sense of shared expectations between Marbury's instructors and the EPP's preservice teachers can be visually conveyed in terms how preservice teachers' technology integration skills are expected to longitudinally progress during their latter three years in the Marbury program (adapted from Kimmons, 2016).

Figure 5.5

PICRAT Progression



Note: Adapted from *K-12 Technology Integration* by R. Kimmons, 2016, (https://edtechbooks.org/lidtfoundations/k12_tech_frameworks). CC BY-SA 3.0.

Based on findings in the literature showing that preservice teachers' digital competencies often improve as a function of experience (Cherner & Curry, 2017; Polly et al., 2020), it seems reasonable to then expect preservice teachers' technology integration practices to progress from PICRAT's bottom-left category toward more student-centered practices in a longitudinal fashion. As such, while it might be acceptable for sophomores enrolled in EDUC 120: Instructional Technology to begin designing lessons for 200-level field experience placements at the passive-replacement level, their technology integration skills and digital competencies should be more sophisticated a year later when juniors undertake 300-level field experience placements (per Figure 5.5). In other words, while it may be permissible for sophomores to design lessons at Kimmons et al.'s (2020) passive-replaces level, juniors should be capable of designing lessons that are more interactive and amplify traditional instructional practices (per Hughes et al., 2006). To provide additional support for juniors in meeting this more rigorous expectation, it seems worthwhile for all of Marbury's preservice teachers to take EDUC 220: Technology Integration for Diverse Learners (see Recommendation 3).

Finally, future instructors of record for EDUC 488: Senior Seminar should look for ways to help preservice teachers design creative and transformative (per Kimmons et al., 2020) technology integration practices that can be featured in their Teacher Work Sample unit plans. Although P-12 students need not use digital technologies in creative and transformative ways in every lesson (Kimmons et al., 2020), the EDUC 488: Senior Seminar instructor should work collaboratively with seniors to ensure that these exemplary standards for technology integration (per Kimmons et al.) are tenable in light of contextual constraints (e.g., student ages or skill levels) that may be identifiable in specific field experience placements (Kopcha et al., 2020; Mishra, 2019). Relatedly, as mentioned in Chapter 2, there is dearth of evidence about student-centered technology integration in the early grades.

Using digital technologies in creative and transformative ways is compatible with the ISTE (2021) Standards for Students. At the same time, the EDUC 488 instructor should ensure that holistic P-12 student outcomes (Falloon, 2020; Lai et al., 2022) are not compromised by a compulsion to use student-centered methods (Harris et al., 2010; Kopcha et al., 2020). For some lessons, such as those in Mariyah's first grade subtraction unit, teacher-centered methods (Kopcha et al., 2020; Warner et al., 2018) may be the best "fit" (Harris et al., 2010, p. 3840). Given the relatively small size of the Marbury EPP's cohorts, it seems reasonable for the EDUC 488 instructor to take context-specific considerations (e.g., grade level of field experience placement) into account when assessing the technology integration skills of their pupils (Harris et al., 2010; Mishra, 2019).

Theory 3: UDL Guidelines

In line ISTE's (2020; 2021) emphasis on using digital technologies to support inclusivity, Marbury's EPP should train preservice teachers to use CAST's (2018) UDL Guidelines to accommodate specific learning needs and disabilities. For example, participants need to know how to deploy adaptive technologies such as text-to-speech extensions for students who have difficulty reading (US Code, 2022). For special education majors, specific training with CAST's (2018) UDL Guidelines should begin during sophomore-level coursework (i.e., EDUC 204, EDUC 210, EDUC 212). In these courses, as with EDUC 220: Technology Integration for Diverse Learners and EDUC 488: Senior Seminar, I recommend that CAST's (2018) UDL Guidelines are taught with an emphasis on using specific adaptive technologies to accommodate specific learning needs and disabilities. Proficiency in operationalizing the UDL Guidelines can be assessed in preservice teachers' lesson planning. Therefore, the Teacher Work Sample portfolios that seniors submit in EDUC 488 should contain evidence to show that all of Marbury's preservice teachers know how to use digital technologies to accommodate context-specific learning needs or disabilities.

Action-Step Summary for Recommendation 1

The action-steps for aligning technology integration theories with specific Marbury education courses can be summarized as follows:

1. Infuse Falloon's (2020) Teacher Digital Competency Framework into EDUC 100, EDUC 120, and methods courses to train preservice teachers to make better-informed technology integration choices.
2. Train sophomores to categorize various technology integration practices according to Kimmons et al.'s (2020) nine categories in EDUC 120. Then, provide continual support throughout EDUC 220 and EDUC 488 and hold juniors and seniors to progressively higher standards for technology integration in their lesson plans.

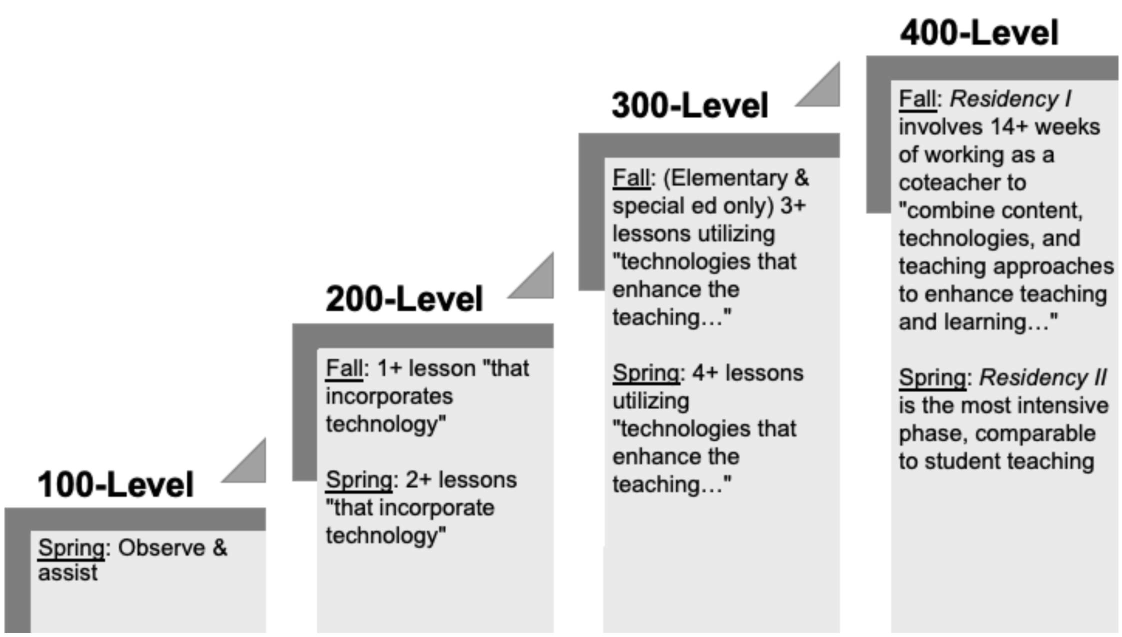
3. Provide continual support throughout 200-, 300-, and 400-level coursework as preservice teachers learn to operationalize CAST's (2018) UDL Guidelines to accommodate specific learning needs and disabilities.

Recommendation 2: Clarify Expectations for Technology Integration in Field Experience Placements.

Based upon this capstone inquiry's finding that there are ambiguous expectations for technology integration within the Marbury EPP (Finding 3), I recommend that the program take specific steps to clarify expectations for technology integration during 200-, 300-, and 400-level field experience placements. As depicted in Figure 5.6, the 2023-2024 Marbury College catalog articulates progressively demanding expectations for technology integration throughout the program's latter years. However, interview data that was described in Chapter 4 showed that participant and stakeholder interpretations of these expectations vary widely. Therefore, I designed three flow charts (see Figures 5.7, 5.8, and 5.9) that intend to clarify the program's expectations for technology integration.

Figure 5.6

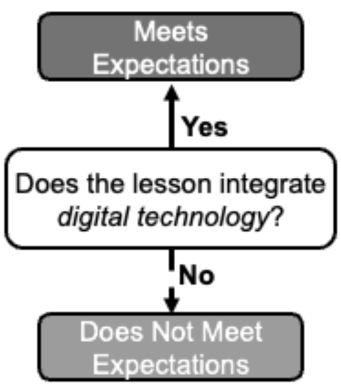
Field Experience Progression



Marbury College's instructors of record for 200-, 300-, and 400-level lab courses typically meet with preservice teachers prior to the dates in which these preservice teachers begin their field experience placements. During at least one of these early-semester meetings, I recommend that these instructors explicitly review the program's expectations for technology integration using the visual aids depicted in Figures 5.7, 5.8, and 5.9. For example, the flow chart in Figure 5.7 shows that as long as 200-level preservice teachers utilize digital technology in some way in their lesson plans, then sophomores meet programmatic expectations. A limitation of this recommendation is that reinforcing this 200-level expectation could foster *technocentric* dispositions (McGarr & Ó Gallchóir, 2020b; Papert, 1987) as opposed to more neutral or technoskeptical mindsets (Falloon, 2020; Krutka et al., 2020).

Figure 5.7

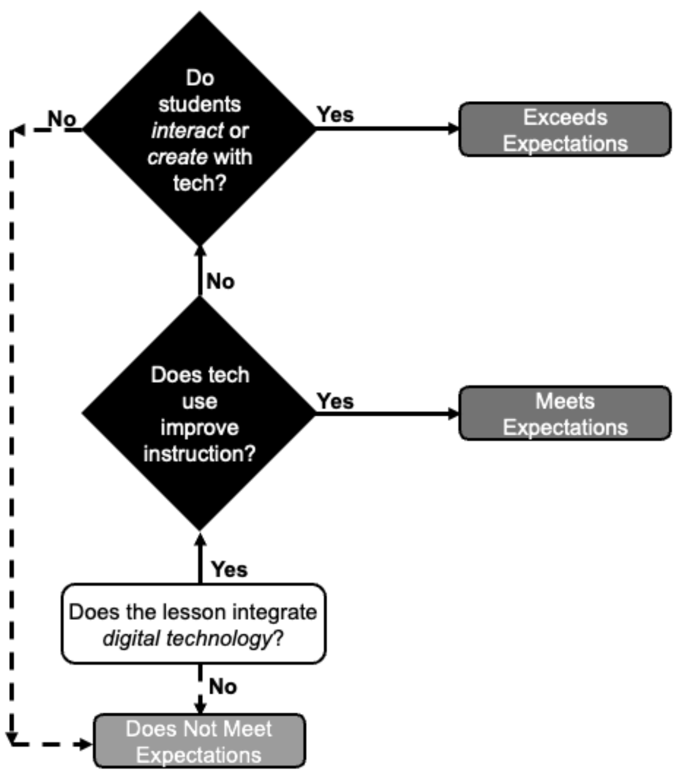
200-Level Field Experience Technology Integration



Marbury's 300-level course description prescribes more purposeful technology integration practices. To illustrate the expectation set forth in the 2023-2024 Marbury catalog, the flow chart depicted in Figure 5.8 shows that preservice teachers in their third year need to demonstrate that their technology integration practices improve instruction. Therefore, per language in Hughes et al.'s (2006) RAT model, such practices should do more than *replace* traditional practices. For example, Nancy's ('24) plan for using an Elmo document camera during a fifth-grade read-aloud does not meet the program's expectation for third-year preservice teachers because this technology integration practice did not apparently *amplify* or *transform* her teaching practice. On the other hand, participants' written plans for using YouTube videos during lessons, which were coded as *passive-amplifies* (per Kimmons et al., 2020), would satisfy the program's expectations for third-year preservice teachers. Furthermore, Figure 5.8 shows that if the integration of digital technologies in a 300-level field experience lesson fosters opportunities for P-12 students to interact or create via digital technologies, then the lesson exceeds programmatic expectations for third-year preservice teachers. For example, Clara's ('25) written plan to use Google Docs for content-related journaling exceeds the current 300-level programmatic expectations because it provided hands-on opportunities for students to create digital artifacts.

Figure 5.8

300-Level Field Experience Technology Integration

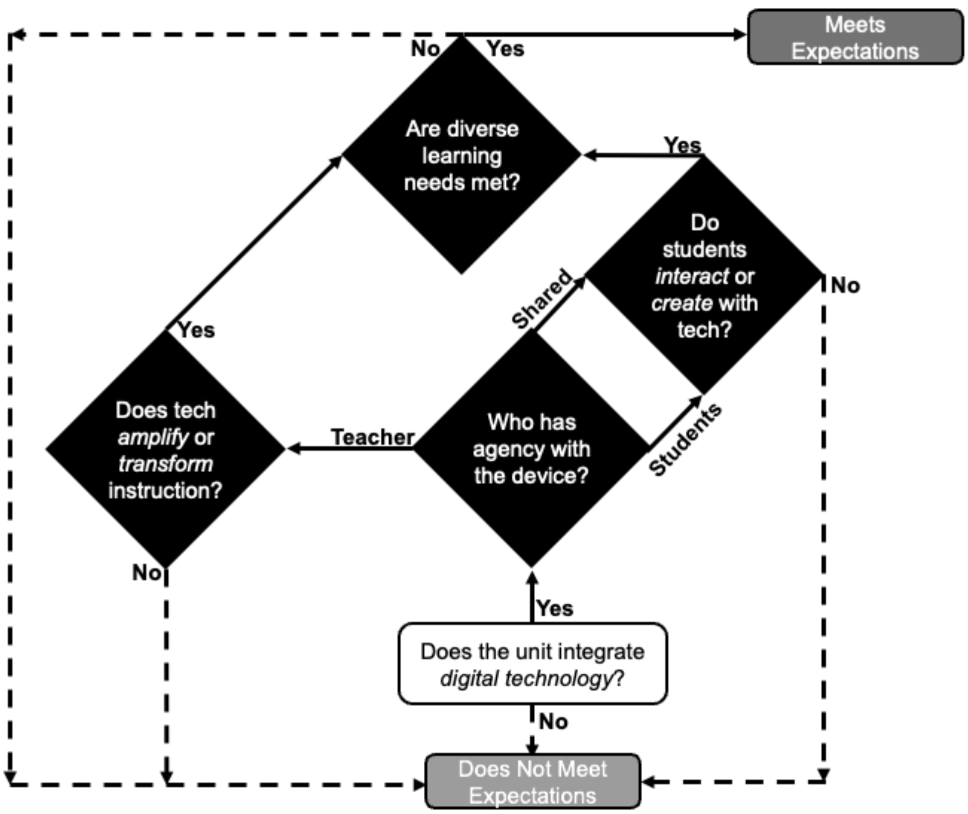


Expectations then become progressively more nuanced and rigorous as preservice teachers reach the 400-level (Marbury, 2023). Findings from the literature support this idea that preservice teachers can be expected to enact increasingly sophisticated technology integration partly as a function of time spent afield (Cherner & Curry, 2017; Polly et al., 2020). According to the Marbury (2023) course catalog, technology integration should “enhance teaching and learning” (p. 59) during this final year of field experience placements. Thus, the flow chart in Figure 5.9 is more complex than the flow charts in Figures 5.7 and 5.8. Furthermore, given the evidence from this capstone inquiry that showed that some teacher-centered (Kopcha et al., 2020; Warner et al., 2018) technology integration practices (e.g., Mariyah’s subtraction lesson) seemed to be an optimal “fit” (Harris et al., 2010, p. 3840) for specific learning goals, the flow chart in Figure 5.9 does not incentivize either student- or teacher-centric practices. Figure 5.9 also builds in further flexibility by assessing technology integration practices at the unit (multiple lessons) rather than the single-lesson level. This unit-level framing is not articulated in the current Marbury catalog, so some revision to 400-level course descriptions would be necessary if this recommendation is adopted.

As a tool that can be used to appraise technology integration in unit plans, Figure 5.9 draws upon Hughes et al.’s (2006) RAT model for determining whether technology integration seems to enhance instruction and Kimmons et al.’s (2020) PIC axis for determining whether student learning seems to improve by way of a digital technology. Given the difficulties associated with readily measuring the degree that a preservice teacher’s technology choice apparently impacts teaching or learning, PICRAT lends a theoretical anchor for evaluating specific practices (Kimmons et al., 2020). At the same time, preservice teachers should not be penalized for having some practices that align with Kimmons et al.’s passive-replaces category. It is possible that instances that fall within Kimmons et al.’s bottom-left help scaffold later activities that are more cognitively engaging and innovative. Here again, looking at the ways in which technology is integrated in a fourth-year teacher’s unit plan (which they are required to submit per their Teacher Work Sample portfolio) builds in some flexibility and supports using a variety of practices. At the same time, Figure 5.9's use of terminology from Kimmons et al.'s (2020) PICRAT model clarifies what it means to use technology in ways that theoretically enhance teaching and learning.

Figure 5.9

400-Level Field Experience Technology Integration



Lesson Plan Template

As with the newer Marbury EPP lesson plan template, a black decision diamond near the middle of Figure 5.9 forces a consideration of whether students or teachers have agency (Hughes et al., 2020; Kohler et al., 2022) with digital technologies. The goal here is to ensure that Marbury's preservice teachers have frequent prompts to enact student-centered technology integration practices (CAST, 2018; Kimmons et al., 2020) by the time they reach 400-level field experience placements. One seemingly effective way to consistently prompt Marbury's preservice teachers to consider whether digital technologies are being used by instructors or their P-12 students is to insist that all lesson plans be submitted on the program's newer lesson plan template. As mentioned in Chapter 4, the old lesson plan template was used in 6 out of 10 lesson plan submissions that were shared with me.

The newer template prompts preservice teachers to distinguish between instructor and P-12 student technology usage. An example of what this looks like can be seen in Figure 5.10, which is excerpted from a lesson plan that was shared by a participant in this capstone inquiry. In addition to distinguishing between teacher and P-12 student technology usage (shown in Figure 5.10), the newer template also prompts a consideration of whether preservice teachers operationalized CAST's (2018) UDL Guidelines in accordance with federal law (US Code, 2022) (not shown in Figure 5.10).

Figure 5.10

Example Technology Prompt on Newer Lesson Plan Template

Technology Integration	
Teacher	**Student** *Include rationale if students do not use digital tools.*
Elmo Promethean Board	

Technology Integration Requirement. Another point of clarification that relates to field experience lesson design is whether or not Marbury's preservice teachers are required to integrate technology in every lesson plan. Per the language in the Marbury (2023) course catalog, it is evident that there is already an expressed technology integration mandate in place for 200-, 300-, and 400-level field experience lab courses. I recommend that Professor Zeta affirm a commitment to this mandate and convey to her colleagues in Marbury's education department and to field experience supervisors that she expects technology to be integrated into lessons that are taught in field experience settings. This sort of technology integration mandate can be enacted given the ubiquity of digital technologies in Rural County Schools placements and would help Marbury comply with CAEP's (2020a) expectation that preservice teachers continually improve their technology integration skills.

Nevertheless, it also seems worthwhile for Marbury's education instructors to engage in ongoing dialogues with preservice teachers about situations in which technology integration does not apparently improve teaching or learning outcomes (Bower, 2019; Krutka et al., 2020). As such, I recommend that Marbury's education instructors occasionally allow pupils to opt-out of this technology integration mandate if the goals of a particular lesson warrant. For example, Marbury's education instructors sometimes have preservice teachers practice writing measurable objectives or perform teaching demonstrations on Marbury College's campus. Technology integration may not be relevant to the learning goals for these mock lesson plans and therefore an instructor may opt not to require digital technologies.

Clarify Expectations for Cooperating Teachers

Another way to clarify expectations for technology integration in field experience settings is to clarify the role of the cooperating teachers who supervise Marbury's preservice teachers. As mentioned in Chapter 3, Marbury's EPP emphasizes a *coteaching* model, wherein teaching duties are meant to be largely shared and a preservice teacher gradually assumes a progressively larger portion of the instructional duties. Chapter 4 showed that while this arrangement seemed to work well for some participants (e.g., Terence), it became evident to me that there is disparate fidelity to Marbury's coteaching model in field experience settings.

Given the profound influence that a cooperating teacher can have on a preservice teacher's developing digital competencies (Englehardt & Brown, 2019; Nelson & Hawk, 2020; Nelson & Voithofer, 2022), I recommend that Professor Delta provide cooperating teachers with actionable steps that they are expected to take with regard to technology integration. To facilitate this exchange, I provided a bulleted list in Appendix K that is especially responsive to Tessa's ('24) comment about the need for cooperating teachers to understand that "coteaching is both of us working together" and Tessa's comment about the challenges she encountered using digital technologies in unfamiliar classroom settings. For example, this list encourages cooperating teachers to demonstrate how to use specific technologies that are located in their classrooms and to identify meaningful ways in which their preservice teachers might facilitate hands-on opportunities for P-12 students to use their Chromebooks. Sharing programmatic expectations with cooperating teachers, such as the list in Appendix K, is a cost-effective way of engendering shared expectations (Chevalier, 2014). A limitation of this recommendation is that it can be difficult to recruit and retain cooperating teachers in specific field experience host sites. Making expectations more stringent may be off-putting to some cooperating teachers.

Physical Education

Kimberly's ('24) experiences as a physical education major raise three important topics that I recommend become the focus of a formal meeting between the chairpersons of Marbury College's education and sports science departments. A limitation of this recommendation is that only two stakeholders would be involved in addressing programmatic shortcomings. To overcome this limitation, Professor Zeta, who is Marbury College's education department chairperson, may also opt to involve other faculty members, preservice teachers, and local practitioners in decisions that would impact curricular programming for physical education majors.

Firstly, in terms of topics that should be on the agenda for representatives from both departments to discuss, every effort needs to be taken to ensure that preservice teachers are placed in field experience settings that have adequate technology integration "infrastructure" (CAEP, 2020a, R6.4). Secondly, representatives from both of the aforementioned departments need to determine if physical education majors should be held to the same expectations for technology integration as other education majors. Thirdly, stakeholders from both Marbury College's education and sports science departments need to explore options for providing more discipline-specific formal training in technology integration for physical education majors (CAEP, 2020a).

Action-Step Summary of Recommendation 2

The action-steps for clarifying technology integration expectations for Marbury's preservice teachers during field experience placements can be summarized as follows:

1. The instructors of record for specific field experience lab courses review the relevant visual aids (see Figures 5.7, 5.8, and 5.9) along with programmatic expectations for technology integration with their pupils prior to the dates in which Marbury's preservice teachers begin their field experience placements for a given semester.
    a. Professor Zeta revises 400-level field experience course descriptions to reflect technology integration expectations at the unit-level.
2. The instructors of record for specific field experience lab courses assess the degree that programmatic expectations for technology integration are met in lesson and unit plans that are submitted for grading per lab course requirements.
3. Marbury College's education instructors require that lesson plans be designed and submitted on the newer version of the program's lesson plan template.
4. Professor Zeta affirms that technology integration mandatory for lesson plans that Marbury's preservice teachers enact in field experience placements.
5. Professor Delta furnishes cooperating teachers with a list of specific ways in which they can contribute to the development of technology integration skills for Marbury College's preservice teachers.
6. Professor Zeta arranges to meet with representatives from Marbury College's education and sports science departments (and possibly other stakeholders) to discuss three topics pertaining to technology integration:
    a. assessing the technology infrastructure of a particular physical education field experience placement;

b. setting discipline-specific expectations for technology integration for physical education majors;
c. providing physical education majors with discipline-specific technology integration training.

Recommendation 3: Require Two Standalone Technology Integration Courses for all Education Majors.

To be responsive to feedback from participants in this capstone inquiry and mindful of findings from the Mouza et al. (2017) study, the Marbury EPP should require preservice teachers to take two standalone technology integration courses. Relatedly, EDUC 120: Instructional Technology should not be offered to freshmen because this study showed that offering the course to freshmen does not provide Marbury's preservice teachers with timely opportunities to apply their learning from EDUC 120 in field experience placements. As was found in the Mouza et al. (2017) study, preservice teachers' feelings of TPACK-related self-efficacy are measurably improved during times in which they are enrolled in technology integration courses. The Mouza et al. study also showed that TPACK-related growth in self-efficacy was found for preservice teachers who had standalone technology integration courses at two different stages of their development.

Table 5.2

Alignment of Coursework and Field Experiences

Year in Program	Technology Integration Course	Field Experience Placement
Sophomore	EDUC 120: Instructional Technology (fall)	295L: Field-Based Experience II (fall)
Junior	EDUC 220: Technology Integration for Diverse Learners (spring)	396L/397L/398L: Field-Based Experience Per Endorsement Area (spring)

A limitation of the standalone technology integration course model is that there is a movement within the teacher preparation field toward infusing an emphasis on technology integration into all courses (Foulger et al., 2019). Although these two models need not be mutually exclusive, it is worth noting that in Foulger et al.'s Arizona State University setting, transitioning toward a technology infusion model required extensive professional development in order for instructors at a large research university to infuse a strong emphasis on technology integration into their various courses. Because the Marbury College EPP is significantly smaller than Arizona State's, it seems that it would be more cost-effective for Marbury's EPP to adjust the timing and requirements of two courses (i.e., EDUC 120 and EDUC 220) that are already offered on Marbury College's campus as opposed to formally adopting a technology infusion approach. That said, the work of developing digitally competent educators within an EPP certainly should extend beyond standalone technology integration courses (Falloon, 2020).

Timing of EDUC 120

Given the way that the Marbury College EPP's field experience lab courses are structured, it would be more beneficial to offer EDUC 120: Instructional Technology to sophomores than to freshmen. My interview data and an email communication with Professor Zeta (personal communication, December 1, 2023) show that EDUC 120 is comprised primarily of sophomores some years and primarily of freshmen during other years. Ensuring that EDUC 120 is a course that is not offered to freshmen would be responsive to interview comments by Terence ('24) and Daniel ('24). Both of these Marbury College preservice teachers lamented that they did not have timely opportunities to apply their learnings from EDUC 120 afield because they took the course as freshmen. To elaborate, when Marbury College freshmen take EDUC 120, they are unlikely to have opportunities to apply their learning in field experience settings because freshmen field experiences position preservice teachers more so as observers rather than as instructors.

Timing and Requirement of EDUC 220

In addition to adjusting the timing of EDUC 120: Instructional Technology, it is important to reiterate that the work of developing preservice teachers' digital competencies should extend beyond a single standalone educational technology course (Falloon, 2020). In this capstone inquiry, it was apparent through survey and interview data that participants received varying levels of support for making informed technology integration choices (Finding 4). One way to ensure that this sort of technology integration support is formally offered to all of Marbury College's preservice teachers is to require them all to take EDUC 220: Technology Integration for Diverse Learners. This capstone inquiry found quantitative and qualitative indicators that EDUC 220 had a generative impact on the technology integration choices of the four participants who were enrolled in this course during the fall semester of 2023. In light of the apparent need for further support with technology integration, requiring all Marbury preservice teachers to take EDUC 220 during the spring of their junior year seems a viable way to ensure that they have formal technology integration training as they enter and prepare for the program's most intensive practicum phases.

Action-Step Summary for Recommendation 3

The recommended action-steps involved with requiring education majors to take two standalone technology integration courses are as follows:

1. Make EDUC 120: Instructional Technology a required course for sophomore education majors to take during the fall semester.
2. Make EDUC 220: Technology Integration for Diverse Learners a course that is required for all education majors to take during the spring semester of their junior year.

Conclusion

This capstone inquiry concludes in a manner that again intends to be instructive for the Marbury EPP's leadership by highlighting salient findings pertaining to each research question and synthesizing what can be learned from this local context and the scholarly literature to inform potential programmatic changes. With regard to the first research question, which inquires about the ways in which Marbury's preservice teachers use digital technologies with P-

12 students in field experience settings, evidence pertaining to Finding 1 (see Chapter 4) indicates that participants' technology integration practices tend to position P-12 students as passive receivers of digital learning content. In response to Finding 1, the longitudinal plan that I propose per Recommendation 1 shows how Marbury's education courses can offer ongoing to support to Marbury's preservice teachers to help their practices progress toward the upper-right portion of Kimmons et al.'s (2020) PICRAT matrix.

Although a digitally competent educator should have the capacity to enact these sorts of creative and transformative practices (per Kimmons et al., 2020), they also need to understand when teacher-centered practices may be a better fit and be aware of potentially negative consequences associated with student technology use (Falloon, 2020; Harris et al., 2010; Kopcha et al., 2020). To support the development of this sort of digitally competent disposition, Recommendation 1 also includes an outline of action-steps for infusing Falloon's (2020) Teacher Digital Competency Framework into several Marbury education courses. This recommendation is also responsive to this study's second finding that there are valid reasons why participants in this study deliberately chose to limit P-12 student access to screens (see Finding 2 in Chapter 4). Other studies have similarly found that there are negative consequences that can accompany student technology use (Dawson et al., 2022; EdWeek Research Center, 2022a; Han, 2022).

With regard to the second research question, which examined factors that influence the technology integration choices of Marbury's preservice teachers, it is apparent that there is a need to clarify expectations for technology integration within the Marbury EPP (see Finding 3 in Chapter 4). In response to Finding 3, my second recommendation is that the program's leadership clarify expectations for technology integration in field experience placements. Based upon a comparison of interview data from six participants and course descriptions set forth in the 2023-2024 Marbury College catalog, it seems that although there are clear expectations for technology integration per the course descriptions, these expectations are not well understood by the program's stakeholders and inconsistently enforced. Therefore, Recommendation 2 prescribes ways in which the program's existing expectations can be made more clear.

To be responsive to this study's fourth finding that participants receive discrepant levels of support for making informed technology integration choices, my third recommendation is that Marbury's EPP require all of the program's preservice teachers to take a second standalone technology integration course (i.e., EDUC 220: Technology Integration for Diverse Learners). As previously discussed, EDUC 220 seemed to benefit the four participants enrolled in that course during the fall of 2023. It is also worth noting that Recommendation 1 is also responsive to Finding 4. To recap, Recommendation 1 outlines ways in three technology integration theories (CAST, 2018; Falloon, 2020; Kimmons et al., 2020) can be infused into Marbury's education courses. Each of these frameworks can be used to support better-informed technology integration choices by the program's preservice teachers.

In short, the path toward improved classroom technology integration practices and developing digitally competent educators is dialectical in several ways. First and foremost, the efficacy of technology integration practices should be judged by their apparent impact on holistic P-12 student outcomes (Falloon, 2020; Kaufman, 2000; Lai et al., 2022) rather than the degree that the practices reflect student- or teacher-centered digital pedagogy (Harris et al., 2010; Kopcha et al., 2020). As described in Chapter 3, due to the delimitations in the scope of this study, it was not possible to measure the impact of participant technology integration practices on P-12 student outcomes. Given the small size of the Marbury education department's faculty, it also seems impractical for the EPP's leadership to be able to identify causal connections between specific technology integration practices and P-12 student outcomes. Therefore, because the P-12 student outcomes associated with a preservice teacher's technology integration choices are difficult to readily measure, the three recommendations discussed in the prior section prescribe ways to assess technology integration practices that are grounded in existing theories and prior research.

Other tensions involved with this problem of practice include pressure to:

- Maintain a focus on using digital technologies to further higher-order cognition (per Kimmons et al., 2020) while not losing sight of diverse learning needs (per CAST, 2018).
- Provide students with more hands-on opportunities to engage with digital technologies without overusing digital technologies or placing students in harm's way (Dawson et al., 2022; ISTE, 2020; Krutka et al., 2020).
- Improve students' technological proficiency by way of exposing them to novel technologies (ISTE, 2021; USDEOET, 2022) without compromising student mastery of content knowledge (Sweller, 1994).

In working to resolve these various conundrums, the Marbury EPP's leadership should continually strive for consistent messaging (e.g., the technology integration mandate will be enforced) while also training preservice teachers to account for specific contextual considerations (e.g., a learner's age) when making technology integration choices.

Although the recommendations proposed in this chapter may seem daunting, the relatively small size of Marbury's EPP enables the leadership to be nimble. Moreover, with Professor Zeta as the Marbury education department's chairperson, it seems to me that improving technology integration practices and digital competencies are high priorities for the program's leadership. Professor Zeta's capacity to bring about generative improvements in digital competencies is evident through her work with preservice teachers enrolled in EDUC 220: Technology Integration for Diverse Learners. That said, in order for curricular improvements to be impactful at mega, macro, and micro levels (Kaufman, 2000), the leadership of Marbury's EPP needs to ensure that expectations are clearly understood by the program's stakeholders and will be enforced by the program's instructors and field experience supervisors. These expectations for the *means* by which preservice teachers leverage digital technologies to mediate learning should ultimately align with the *end* goal of improving outcomes for P-12 students.

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Appendix A

Macro-Level Algorithmic Logic

Table A-1

Algorithmic Table Connecting CAEP Standards to Capstone Inquiry

If **Marbury's EPP Complies with CAEP (2020a) Standards…**	***…Then…***	***…Therefore.***
Preservice teachers "model and apply national or state approved technology standards" (R1.3)…	…the EPP's preservice teachers operationalize the WV-approved International Society for Technology in Education (2020, 2021) standards…	…ISTE's (2020, 2021) student-centered approach to digital pedagogy should be evident in lessons designed by the program's preservice teachers.
Preservice teachers can "integrate technology effectively in their practice" (R3.2)…	…stakeholders must agree on program-wide "criteria for measuring success" (ISTE, n.d., para. 5)…	…PICRAT (Kimmons et al., 2020) can be used to taxonomize technology integration practices within the EPP given the 2021-2022 program leadership's decision to use the PICRAT in templates and assessments.
Preservice teachers have digital competency "in the field(s) where certification is sought" (R3.3)…	…the EPP's preservice teachers should possess what Mishra and Koehler (2006) refer to as *technological content knowledge…*	…Mishra and Koehler's (2006) TPACK constructs can be used to describe what Marbury's preservice teachers know about technology integration.
The program's digital "infrastructure supports faculty and candidate use of information technology for instruction" (R6.4)…	…opportunities to leverage digital technologies to support teaching and learning are not hindered by *first-order barriers* (Ertmer, 1999)…	…devices such as Promethean Boards and Chromebooks are readily available in field experience placements.

Appendix B

Electronic Informed Consent Agreement

Please read this consent agreement carefully before you decide to participate in the study.

Consent Form Key Information: If you agree to participate in this study, your name and identity will not be shared. As part of this study, you will be invited to:

- Complete a survey about your technology integration experiences.
- Share a lesson plan you taught in a field experience placement.
- Participate in an interview to discuss your technology integration experiences.

You may also be observed teaching one lesson in a field experience placement.

Purpose of the research study: The purpose of the study is to learn more about the ways in which Marbury College's preservice teachers use classroom technologies with PK-12 students in field experience settings. This study also seeks to understand what factors influence the technology integration choices of Marbury's preservice teachers. Findings from this study may be used to propose possible improvements within the Marbury education program's curriculum.

What you will do in the study:
If you choose to participate, you will complete an online survey. In this survey, you will describe one way that you have used classroom technologies to improve PK-12 student learning outcomes in a field experience setting. You will also rate the technology integration experiences that you have had as a learner at Marbury College.

You will also share one written lesson plan that you have used or will use in a field experience setting this semester (Fall, 2023). This file will be shared as an email attachment. You will choose a lesson plan that contains your most exemplary example(s) of technology integration.

You will also participate in an interview to further discuss your survey responses, written lesson plan, and other experiences pertaining to your usage of classroom technologies as a learner and as an instructor. This interview will take place over Zoom and will be video recorded.

Some participants in this study will also be observed delivering instruction for one lesson in a field experience setting. These participants will be selected based on the ways in which they reportedly use classroom technologies as instructors. This determination will be made by the researcher after reviewing survey responses, written accounts of technology integration in lesson plans, and interview comments.

You can choose to stop participating in this study at any time.

Time required: The survey should take less than 20 minutes to complete.

Sharing your lesson plan should take no more than a few minutes by email. This is a lesson plan that you used in field experiences this semester (Fall, 2023) as part of your normal EDUC 395L or EDUC 480L course requirements. Participating in this study does not require you to write any additional lesson plans or change your lesson plans in any way.

Participating in a one-on-one interview over Zoom will require 30- to 45-minutes and can be scheduled at a time of your choosing.
If you are selected for an instructional observation, the observation will be for a single class session. You will have the flexibility to schedule the time and date for this observation.

Risks: There are no anticipated risks for participants in this study.

Benefits: There are no direct benefits to you for participating in this research study. The study may help us understand more about the ways in which Marbury's preservice teachers use classroom technologies with PK-12 students in field experience settings. Understanding the factors that influence these choices may help inform improvements to the curricular programming within Marbury College's educator preparation program.

Confidentiality: The information that you share will be handled confidentially. Your name will be replaced with a pseudonym and the list connecting your name to this pseudonym will be stored on a secure UVA server. Audio files recorded during interviews will be destroyed following transcription of the recordings (by December of 2023). Your name will not be used in any report and the list connecting your name with your assigned pseudonym will be destroyed by December of 2023.

Given the nature of this study, it may be possible for others to deduce your identity. However, there will be no deliberate attempt to do so, and your data will be reported in a way that will not identify you.

Voluntary participation: Your participation in the study is completely voluntary. Findings from this study will be shared with the Marbury education program's leadership. Your decision to participate will have no effect on your grades or standing within the Marbury education program.

Right to withdraw from the study: You have the right to withdraw from the study at any time without penalty. Data obtained from your survey responses, lesson plan, interview, and observation will be destroyed if you decide to withdraw.

How to withdraw from the study: If you want to withdraw from the study at any time, you can either tell the researcher, Scott Biola, or notify the researcher by email at jsb9qa@virginia.edu. There is no penalty for withdrawing and withdrawing will not affect your experience or grades as a student at Marbury College.

Payment: You will receive no payment for participating in the study.

If you have questions about the study, contact:
Scott Biola
UVA School of Education
405 Emmett Street
Charlottesville, VA 22904
(304) 582-0586
jsb9qa@virginia.edu

Faculty Advisor: Matthew Wheelock
UVA School of Education
405 Emmett Street
Charlottesville, VA 22904
(434) 243-2948
mhw4f@virgina.edu

To obtain more information about the study, ask questions about the research procedures, express concerns about your participation, or report illness, injury or other problems, please contact:
Tonya R. Moon, Ph.D.,
Chair, Institutional Review Board for the Social and Behavioral Sciences
One Morton Dr Suite 400
University of Virginia, P.O. Box 800392
Charlottesville, VA 22908-0392
Telephone: (434) 924-5999
Email: irbsbshelp@virginia.edu
Website: https://research.virginia.edu/irb-sbs
Website for Participants: https://research.virginia.edu/research-participants
UVA IRB-SBS #: 5960

Study Agreement: (In Qualtrics)
I agree to participate in the research study described above.

- ☐ Yes
- ☐ No

Electronic Signature Agreement: (In Qualtrics)
I agree to provide an electronic signature to document my consent.

- ☐ Yes
- ☐ No

Please sign your name in the box below with your mouse or touchpad.

[Signature box appears in Qualtrics]

Developing Preservice Teachers' Technology Integration Skills and Digital Competencies
UVA IRB-SBS #: 5960

You may print and/or save a .PDF copy of this consent agreement for your records.

Appendix C

Technology Integration Experiences Survey

[This survey is preceded by the Electronic Informed Consent Agreement in Qualtrics]

Initial Text: Welcome!

Thank you for participating in this study! Please click the arrow below to begin the Technology Integration Experiences Survey.

This survey takes approximately 15- to 20-minutes to complete.

Part One: Demographic Information

1. What year are you in college?
   - ☐ Freshman
   - ☐ Sophomore
   - ☐ Junior
   - ☐ Senior

2. Did you graduate from a high school in West Virginia?
   - ☐ Yes
   - ☐ No

3. What is your gender identity?
   - ☐ Gender Non-binary (Gender nonconforming, Genderqueer, Nonbinary)
   - ☐ Man
   - ☐ Questioning
   - ☐ Transgender
   - ☐ Woman

4. What is your racial/ethnic identity?
   - ☐ American Indian or Alaskan Native
   - ☐ Asian or Asian American
   - ☐ Black or African American
   - ☐ Hispanic or Latino/a or Spanish Origin of any race

- ☐ Middle Eastern or North African
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ Race and Ethnicity unknown
- ☐ Two or more races
- ☐ White or European
- ☐ Prefer not to say
- ☐ My race or ethnicity is best described as:

[Single line text box appears in Qualtrics]

5. In which school(s) have you participated in field experiences as a Marbury College candidate?

[Please mark all that apply]

- ☐ Local Elementary School 1
- ☐ Local Elementary School 2
- ☐ Local Elementary School 3
- ☐ Local Elementary School 4
- ☐ Local Elementary School 5
- ☐ Local Middle School
- ☐ Local High School
- ☐ Other: (write below)

[Single line text box appears in Qualtrics]

6. What is your area of specialization?

[Please mark all that apply]

- ☐ I am on a non-certification pathway
- ☐ Elementary Education, K-6
- ☐ Art, PK-Adult
- ☐ Special Education
- ☐ English, 5-Adult
- ☐ General Science, 5-Adult
- ☐ Health Education, PK-Adult
- ☐ Mathematics, 5-Adult

☐ Social Studies, 5-Adult

☐ Physical Education, PK-Adult

☐ Other: (write below)

[Single line text box appears in Qualtrics]

Part Two: Open-Ended Response

7. In one paragraph or less, describe the most exemplary way in which you have used digital technology to improve PK-12 student *learning outcomes* in a field experience setting.
   Note: Respondents can hover their mouse over blue underlined font in Qualtrics for a definition of *digital technology* [i.e., Digital technology is defined as a digital tool (e.g., Chromebook or Promethean Board) that can support classroom teaching and/or learning.].

[Essay text box appears in Qualtrics]

Part Three: Likert-Scale Responses

During my teacher preparation programming…

Note: Respondents can hover their mouse over blue underlined font in Qualtrics for a definition of *digital technology* [i.e., Digital technology is defined as a digital tool (e.g., Chromebook or Promethean Board) that can support classroom teaching and/or learning.].

[Likert-Scale in Qualtrics under Each Prompt]

Totally Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Totally Agree

8. I saw many examples of digital technology use in an educational setting
9. I observed sufficient digital technology use in an educational setting in order to integrate applications myself in the future
10. I saw good examples of digital technology practice that inspired me to use classroom technology applications in the classroom myself
11. The potential of digital technology use in education was demonstrated concretely

[Likert-Scale in Qualtrics under Each Prompt]

Totally Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Totally Agree

12. I was given the chance to reflect on the role of digital technology in education
13. We discussed the challenges of integrating digital technology in education
14. We were given the opportunity to discuss our experiences with digital technology (i.e., during internships).
15. There were specific occasions for us to discuss our general attitude towards digital technology in education

[Likert-Scale in Qualtrics under Each Prompt]

Totally Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Totally Agree

16. I received sufficient help in designing lessons that integrated digital technology
17. We learnt how to thoroughly integrate digital technology into lessons
18. We received help to use digital technology when developing educational materials
19. I received a great deal of help developing digital technology -rich lessons and projects to use for my internship

[Likert-Scale in Qualtrics under Each Prompt]

Totally Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Totally Agree

20. There were enough occasions for me to work together with other students on digital technology use in education (i.e., we developed classroom technology-based lessons together)
21. I was convinced of the importance of cooperation with respect to digital technology use in education
22. Students helped each other to use digital technology in an educational context
23. Experiences using digital technology in education were shared

[Likert-Scale in Qualtrics under Each Prompt]

Totally Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Totally Agree

24. There were enough occasions for me to test different ways of using digital technology in the classroom
25. I was able to learn to use digital technology in the classroom through the internships
26. I was encouraged to gain experience in using digital technology in a classroom setting
27. Students were encouraged when they attempted to use digital technology in an educational setting

[Likert-Scale in Qualtrics under Each Prompt]

Totally Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Totally Agree

28. I received sufficient feedback about the use of digital technology in my lessons
29. My competences with digital technology were thoroughly evaluated
30. I received sufficient feedback on how I can further develop my digital technology competences
31. My competences in using digital technology in the classroom were regularly evaluated

Closing Text: Thank You!

Thank you for completing this survey! The researcher, Scott Biola, will contact you by email soon to invite you to share a lesson plan that you have used or will use this semester in your field experience placement.

Appendix D

Document Analysis Protocol

Email participants who indicated their willingness to share a lesson plan on their survey.

a. Dear _____________,

   Thank you for indicating your willingness to share a lesson plan with me. Please reply to this email with an attached copy of one lesson plan you have already used or will use soon in your field experience placement this semester (Fall, 2023).

   If you have completed more than one lesson plan this semester, please share the example that you feel contains your most exemplary example(s) of technology integration in a field experience setting. If classroom technologies are not used in any of your lesson plans, please share a recent plan that you have already used with PK-12 students this semester (Fall, 2023).

   Your lesson plan will help me learn more about the ways in which Marbury College's candidates use classroom technologies with PK-12 students in field experience settings. Ultimately, the information that you share may help inform the curricular programming within Mabury's educator preparation program.

   I will replace your name on this lesson plan with a pseudonym and store your file in a secure "UVA Box" online database. Your name will not be shared with others and I will delete the file containing your lesson plan by December of 2023.

   Your lesson plan will help me learn about ways in which digital technologies are used (or not used) by Marbury candidates and P-12 students in field experience settings. You are not required to share a lesson plan and can choose to withdraw from this study at any time without penalty.

   I will collect data pertaining to technology integration from your lesson plan and develop interview questions for you. I hope to schedule a time in the near future to discuss your technology integration experiences at a time that best suits your schedule.

   Sincerely,
   Scott Biola
   University of Virginia Doctoral Candidate
   Marbury College Adjunct Professor
   UVA IRB-SBS #: 5960

2. Highlight all technology integration instances in lesson plan accordingly:
   a. P-12 student use of digital technology (yellow).
      i. For example, students play a review game, watch a video independently
   b. Instructor (either candidate or cooperating teacher) use of digital technology (blue).
      i. For example, instructor displays information on the Promethean Board.

    c. Both P-12 student and instructor simultaneous or near simultaneous use of digital technology (green).
        i. For example, the instructor gathers data from students through a poll in Google Classroom or Kahoot!.
    d. Digital technology appears to be used but it is unclear who is the primary intended user (grey).
        i. Make note of points of clarification for follow-up interview (if candidate is willing to participate).
            1. For example, "Ask candidate who the primary user was for grey-5."
3. Number each technology integration instance (e.g. yellow-1, blue-2, yellow-3, grey-4).
4. Briefly describe instances of digital technology use in Excel spreadsheet (Digital Technology Use Log).
    a. Data source: DateLessonPlanCandidateName
    b. Location: Instance #
    c. Primary user (i.e., Student, Instructor, Both, or Unclear).
5. In Excel (Digital Technology Use Log), code these instances of technology integration using the following PICRAT combinations:
    a. PR, PA, PT, IR, IA, IT, CR, CA, CT (or indicate "unclear")
    b. Use PICRAT Flow Chart (see Appendix G) for coding algorithm.
        i. Passive, Interactive, Creative
            1. Instances that straddle passive/interactive: coded as interactive.
            2. Instances that straddle interactive/creative: coded as creative.
        ii. Replaces, Amplifies, Transforms
            1. Instances that straddle replaces/amplifies: coded as amplifies.
            2. Instances that straddle amplifies/transforms: coded as transforms.
6. If candidate used the PICRAT matrix to reflect on the *Lesson Plan Reflection* template, compare researcher's PICRAT codes to candidate's PICRAT self-assessment.
    a. Note discrepancies in "Memo" in Digital Technology Use Log.
        i. Make note of points of clarification for follow-up interview (if candidate is willing to participate in interview).
    b. If preservice teacher's *Lesson Plan Reflection* indicates that specific technology integration instances were perceived as hindering teaching or learning, duplicate row describing instance in Digital Technology Log and recode as "hinderance."
        i. Make note about this instance in protocol for follow-up interview (if candidate is willing to participate in interview).
7. If candidate…
    a. Participates in interview, edit codes in Digital Technology Use Log if necessary after the interview and enter totals in Digital Technology Use Aggregate Totals Excel spreadsheet (Primary User totals, PICRAT code totals, and hinderance totals).
    b. Does not participate in interview, enter totals in Digital Technology Use Aggregate Totals Excel spreadsheet (Primary User totals, PICRAT code totals, and hinderance totals).

Appendix E

Interview Protocol

Date:	Start Time:	Stop Time:
Interviewer:	Setting:	Participant:

[Email questions to candidate in advance of interview].

Opening statement:
[Make small talk]
“Thank you for joining me today. It was helpful for me to see your survey responses and review the lesson plan that you shared with me.

“Today I will invite you to share more about the technology integration experiences that you have had as a candidate at Marbury College. The information you share may help improve the programming in the education program at Marbury College. I’m now going to take just a moment to explain more about this research and then I’ll check to see if you are comfortable with my recording our conversation.

“As part of the final phase of my doctoral research at the University of Virginia, I am conducting a study to learn more about the ways in which Marbury’s candidates use digital technologies with PK-12 students. I am also interested in exploring factors that candidates like yourself identify as having an influence on their technology integration choices.

“The information you share with me today will be kept confidential and, if I quote you, I will use a pseudonym to protect your identity. However, as you know Marbury College is a small institution and it may be possible for others to deduce your identity. That said, Professor Alpha, Professor Delta and Professor Zeta are interested in finding ways to continuously improve based upon feedback from participants in this research, such as yourself.

“Now that I’ve given an overview of this study, do you mind if I record today’s conversation?

“Thank you, and please remember that you are not obligated to participate. You can choose to end the conversation at any point and can also choose not to not answer specific questions.”

Interview Questions:

1. What semester and year did you take EDUC 120?

Part One: Survey Follow-Up

2. Develop follow-up questions based on survey responses.
    a. For example: In your survey response, you described your most exemplary example of classroom technology integration as…

            i. Could you tell me more about this example?
                1. Follow-up…
            ii. It sounds like that was a successful example of technology integration. Could you tell me about another example where things didn't go as well?
            iii. How would you describe your typical experiences using classroom technologies as an instructor during your field experiences?
    b. For another example: In your survey response, you had relatively strong reactions to your experiences with…(e.g., role models, reflection, etc.)
            i. Could you tell me more about these kinds of experiences?
            ii. Do you have any suggestions about … that we could use to improve our programming at Marbury?

Part Two: Lesson Plan Follow-Up

3. Develop follow-up questions based on Lesson Plan submission.
    a. For example: In the lesson plan that you shared with me, I noticed that you/your students used digital technologies to…
        i. Could you tell me more about this example?
        ii. How would you code that example using the PICRAT matrix? (share matrix and discuss)
            1. Have you had any classes at Marbury that required you to reflect on your practices using the PICRAT matrix?
    b. In looking back at this lesson plan with me now, are there any examples of digital technology use that you feel improved student learning outcomes?
        i. How, specifically, would you say [said digital technology] improved student learning in [said example]?
    c. Were there times in this lesson that you felt digital technologies hindered teaching or learning?
        i. Why did you feel [said digital technology] was a hindrance?
    d. I know that oftentimes, we write things in our lesson plan in a certain way and then things go differently in the actual lesson. Looking back at this lesson plan, can you think of any examples of ways that what actually happened did not match up with what you have written here?

Part Three: Experiences, Knowledge, and Dispositions

4. How well do you think the expectations for technology integration at Marbury College match up, or align, with what is expected of you in field experience settings?
5. What kinds of digital technologies would you describe as being available for use by you as an instructor or for your students in field experience settings?
6. Have you encountered any obstacles to using technology integration in field experience settings?
    a. Follow up: Please tell me more about [said obstacle]…
7. How knowledgeable do you consider yourself to be about using digital technologies in the classroom?
8. As a teacher, what digital technologies do you find to be the most helpful for delivering instruction?
    a. Who do you think uses digital technologies more often in a typical lesson, you or your students?
9. How would you describe your willingness to experiment with new digital technologies?
    a. What kinds of criteria would factor into your decision as to whether or not to use a digital technology?

Part Four: Societal and Ethical Considerations

10. Could you describe a positive impact that gaining experience with digital technologies at school might have on PK-12 students' lives?
    a. In other words, are there any benefits you can think of to having students use technology at school?
11. Could you describe a negative impact that gaining experience with digital technologies at school might have on PK-12 students' lives?
    a. In other words, can you think of any potential harmful effects that might come to students by way of using technology at school?
12. Do you have any ethical concerns about students using digital technologies in general (either in school or out of school)?

Part Five: Wrap-up

13. Is there anything else about your experiences with technology integration that you would like to share?
14. For participants who may be selected for observation, inquire at the end of the interview as to whether they would be willing to be observed and inquire about a range of possible dates and times.

Closing statement:

"Thank you for sharing your thoughts with me today. If you have any further ideas later about anything we talked about today, please feel free to send me an email to let me know. I am interested in gathering any additional input you'd like to share.

"I will transcribe parts of today's conversation as part of my data collection process. Your feedback today helped me get a better understanding of your experiences as a candidate here at Marbury. Through this research, I hope to gain a better understanding of our program's needs that I can share with stakeholders here at Marbury. This information also helps me answer questions that are central to my doctoral research. Again, thank you for participating today."

Appendix F

Interview Questions Posed to Each Participant

Table F.1

Interview Prompts Posed to Each Participant

Prompt	Daniel ('24)	Isabel ('24)	Kimberly ('24)	Mariyah ('24)	Terence ('24)	Anya ('25)	Clara ('25)	Nancy ('25)	Sally ('25)	Tessa ('25)
1. What semester and year did you take EDUC 120?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2. Follow-up questions based on survey responses.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3. Follow-up questions based on Lesson Plan submission.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
(Explicit discussion pertaining to PICRAT)	✓	✓		✓		✓	✓			✓
4. How well do you think the expectations for technology integration at Marbury College match up, or align, with what is expected of you in field experience settings?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5. What kinds of digital technologies would you describe as being available for use by you as an instructor or for your students in field experience settings?	✓	✓	✓	✓		✓	✓	✓	✓	✓
6. Have you encountered any obstacles to using technology integration in field experience settings?		✓	✓	✓	✓	✓	✓	✓	✓	✓

Prompt	Daniel ('24)	Isabel ('24)	Kimberly ('24)	Mariyah ('24)	Terence ('24)	Anya ('25)	Clara ('25)	Nancy ('25)	Sally ('25)	Tessa ('25)
7. How knowledgeable do you consider yourself to be about using digital technologies in the classroom?		✓	✓	✓		✓	✓	✓	✓	✓
8. As a teacher, what digital technologies do you find to be the most helpful for delivering instruction?	✓	✓	✓	✓	✓		✓	✓	✓	
a. Who do you think uses digital technologies more often in a typical lesson, you or your students?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
9. How would you describe your willingness to experiment with new digital technologies?		✓	✓	✓		✓	✓	✓		✓
a. What kinds of criteria would factor into your decision as to whether or not to use a digital technology?		✓	✓		✓		✓	✓	✓	✓
10. Could you describe a positive impact that gaining experience with digital technologies at school might have on PK-12 students' lives?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
11. Could you describe a negative impact that gaining experience with	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

digital technologies at school might have on PK-12 students' lives?										
12. Do you have any ethical concerns about students using digital technologies in general (either in school or out of school)?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
13. Is there anything else about your experiences with technology integration that you would like to share?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Appendix G

Observation Protocol

Date:	Start Time:	Stop Time:
Observer: Scott Biola	Setting:	Participant
Cooperating Teacher:	Grade Level(s):	

1. Arrive 5 to 10 minutes prior to the beginning of class.
2. Briefly make small talk with participant and cooperating teacher and ask where they would like me to sit.
3. Request a copy of today's written lesson plan (if available).
4. Begin with a quick sketch of the room configuration. Include noteworthy placement or configuration of digital technologies.
5. Fill in observation log below.

Time stamp	PICRAT Code	Brief description of digital technology use (enacted practices)	Primary intended* user (Instructor, Student, Both)	Memo	Bracketing

6. Following class, thank the participant and cooperating teacher and leave the room.
7. After leaving the classroom, find a quiet place to review observation log and record additional reactions in the bracketing column.
8. Transfer this data to Microsoft Excel spreadsheets and enter additional codes for data as applicable (e.g., “hinders”).

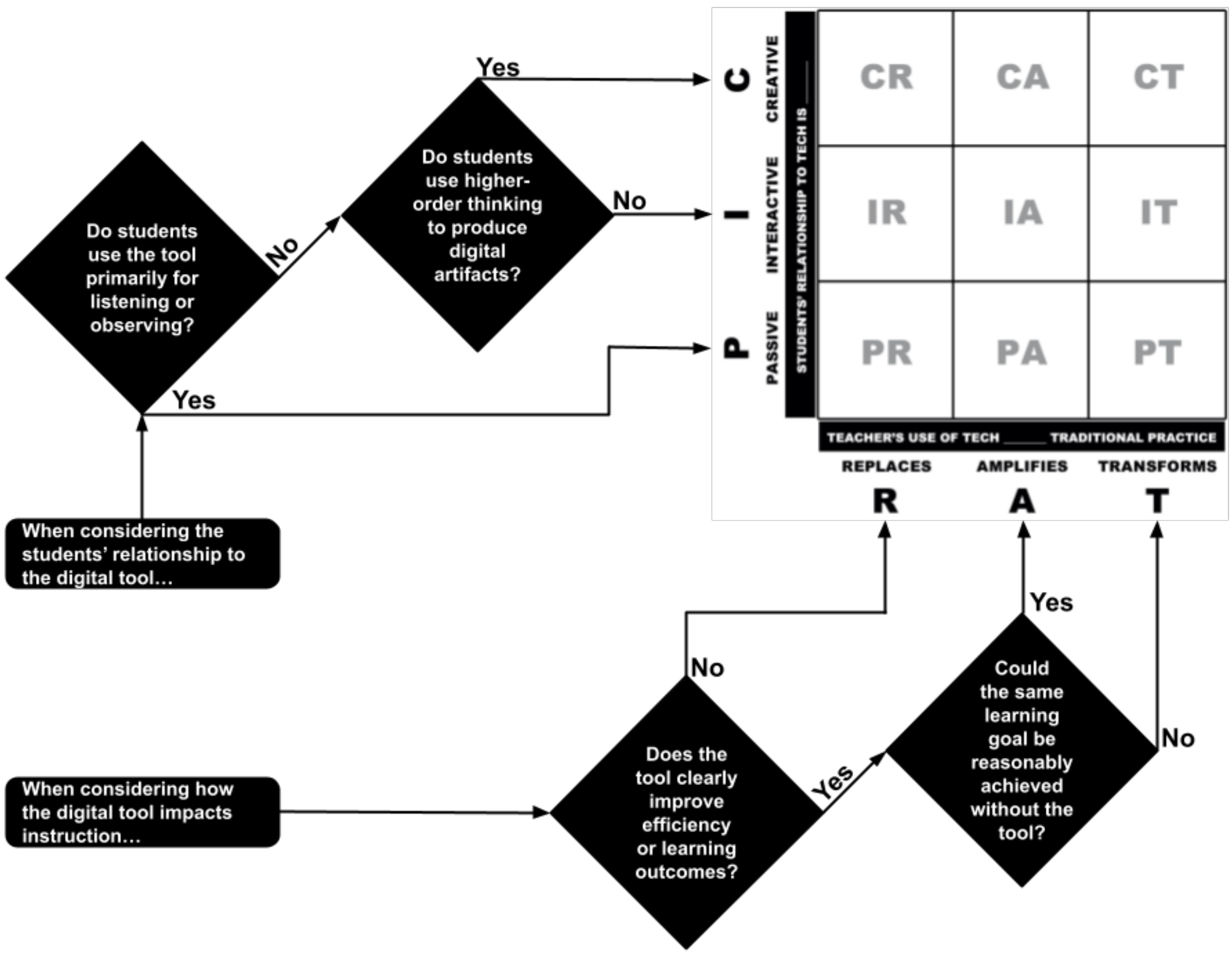
*Intended user is to be determined via the preservice teacher’s written lesson plan and through spoken or written instructions that are shared with learners.

Appendix H

PICRAT Flow Chart

Figure G-1

PICRAT Flow Chart



Note. Adapted from "The PICRAT Model for Technology Integration in Teacher Preparation," by R. Kimmons, C. R. Graham, and R. E. West, 2020, *Contemporary Issues in Technology and Teacher Education, 20*(1), p. 189. (https://www.learntechlib.org/primary/p/210228/paper_210228.pdf). © 2020 Society for Information Technology & Teacher Education.

Appendix I

Qualitative Codebook

Table H-1

Qualitative Codebook

Code	Definition	Example	Inclusionary Criteria	Exclusionary Criteria
Mega	Consideration of societal level influences on technology integration.	"Outside of school, the impacts are like stranger danger, cyber bullying, and other mental health impacts via social media."	Clear indication of societal level affects or consideration of societal level impacts on choices.	Societal level factors not pertaining to digital technologies.
Macro	Pertaining to intra- and inter-institutional planning.	"Because the cooperating teachers aren't really understanding what they're supposed to be doing to help us…"	Evidence of CAEP compliance, coordinating planning, aligned expectations, etc.	Individual-level influences that are not reflective of institutional coordination.
Learner Characteristics	Consideration of learner characteristics such as age, skill levels, or demographics.	"I haven't used much technology in my lessons because of the age of most the classes I have taught."	Perceptions about age, academic ability, intelligence, socioeconomic status, race, gender, etc.	Decisions made without apparent regard for individual students or groups.
Hinders	Digital technologies apparently impede teaching and/or learning.	"…you know technology can be more of a distraction…"	Observations or descriptions of instances in which digital technologies apparently interfere with teaching and/or learning.	Instances in which there is ambiguity in terms of whether digital technologies necessarily impeded outcomes.
Role Model	Technology integration practices modeled by inservice teachers or teacher educators.	"she utilizes the Promethean Board, and the projector, and she projects…"	Descriptions of practices in practicum settings or in courses on Marbury's campus.	Descriptions of prior lived experiences as a PK-12 student.
Instructional Design	Data including a significant focus on ways in which digital technologies mediate learning.	"Nearpod was helpful because it was so structured…"	Descriptions of technology integration decisions, design-oriented comments, considerations of affordances versus constraints, technology-	Perfunctory highlighting of digital technologies in lesson plans.

			rich design of instructional materials, etc.	
Collaboration	Experiences collaborating with peers using digital technologies.	“We did a lot of partner work…”	Descriptions of collaborations that involve digital technologies with peers.	Descriptions of collaborations that do not involve digital technologies or collaborations with supervisors.
Authentic Experiences	Using digital technologies as a learner or as an instructor.	“…like those tools that I've been using in my assistive technology class…”	Descriptions or observations of experiences in practicum settings or on Marbury’s campus.	Descriptions of experiences that are external to the programming of Marbury’s EPP.
Amplifies	Digital technology clearly improves instructional efficiency or learning outcomes.	“[Desmos] did improve the learning outcome for the students.”	Technology integration instances that move beyond replacement but stop short of transformation.	Technology integration instances such as journal writing that replace traditional practices.
Creative	Students use higher-order thinking to produce digital artifacts.	Students develop computer-based codes for Lego robot prototypes that could intervene in a natural disaster.	Extended usage of digital technologies wherein students deploy new or recently acquired content knowledge to create digital artifacts.	Technology integration instances in which students do not appear to use higher-order thinking or instances that involve a brief activity.
DDDM	Using digital technologies to collect data that will be used to inform classroom practices.	“I've used Google Forms to do like a pre and posttest.”	References to data that is collected via digital technologies.	References to data that is not collected via digital technologies.
Digital technologies	Description of specific uses of digital technologies.	“We used Mobymax. Um, we used Clover. Um IXL. And I think that's about it.”	Teacher and student uses of technology for teaching and/or learning (Elmos are included).	Low tech, non-ICT technologies.
Feedback	Evaluative and formative feedback pertinent to the development of technology integration skills.	“[Professors say] ‘you need to integrate technology, but you are the star of the show.’”	Descriptions of feedback from teacher educators, inservice teachers, or peers.	Self-assessments of TPACK or digital competencies.
First-Order Barriers	Limitations in digital technology infrastructure.	“at Neighboring County High School…they are limited with funding and resources.”	Shortages in availability of digital technologies.	Limitations imposed by decisions made by teachers and/or students.
Hinders	Digital technology apparently interferes with teaching and/or learning.	“you know, technology can be more of a distraction…”	Instances in which digital technologies are a learning distraction, malfunction, or apparently impede teaching/learning.	Limitations imposed by a teacher’s lack of technological knowledge.

Interactive	Students use digital technologies to interact with content, others, or the technology itself for the sake of learning.	Students responded to a prompt using Google's Jam Board.	Technology integration instances in which students actively answer questions, interact with peers, interact with their instructor, etc.	Interactions that are not apparently relevant to the learning goal (e.g., students texting one another).
Passive	Student engagement with digital technology is limited to listening or observing.	Students watched a video on YouTube.	Technology integration instances in which students watch videos, teachers lecture with PowerPoint slides, etc.	Instances in which students are prompted to electronically respond or interact following a relatively brief period of seemingly passive behavior.
Reflection	Pertaining to cultivating reflective practice.	"…part of the Teacher Work Sample you have to have a certain amount of videos of your teaching recorded."	Evidence of reflection on technology integration.	Reflection that is not relevant to technology integration.
Replaces	Digital technology is used as a substitute for traditional instructional practices.	Teacher projects spelling words on the Promethean Board.	Technology integration instances that can easily be replicated without digital technology.	Technology integration instances that appear to straddle the replaces/amplifies cutoff.
Student-centered	Differentiated learning experiences, project-based tasks, and opportunities to engage in higher-order cognition.	Adaptive technologies allow for differentiated assessments.	Activities that reach the creative realm or involve differentiation.	Teacher explanation or students positioned as receivers of information.
Teacher-centered	Describes teacher-centric technology use.	"Observation: Candidate models coloring, labeling on the Elmo."	Teacher is using digital tools.	Students are active, but not with the digital tool.
Technocentrism	Ascribing teaching or learning achievements to digital technology.	"the Chromebooks have changed the way kids think…"	Favorable views of digital technology.	Consideration for the role that teachers and students play in choosing and using digital technologies.
Technoskepticism	Concern for harms associated with technology use.	"overuse of technology with them right now…like, students are craving these hands-on activities."	Rationalizing decisions to avoid tech use.	Favorable comments about technology integration
TPACK	An educator's knowledge about teaching with digital technology.	"I can't think of any good ways to use the Chromebooks when I'm teaching math."	Pertains to an educator's technological, pedagogical, and/or content knowledge.	Comments that focus on student engagement or learning outcomes.

Transforms	Students pursue a learning goal that would not be reasonably possible without digital technology.	Physical education students throw balls at a digital projection while a Lü projector keeps track of scores.	Technology integration instances that move beyond amplification.	Technology integration instances that could reasonably be achieved with no tech/low tech.

Appendix J

Likert-Scale Survey Data

Table J-1

Aggregate Item Analysis

Item	Prompt	*M*	*SD*	*Mdn*	Mode
ROL1	I saw many examples of digital technology use in an educational setting	4.5	0.85	4.5	5
ROL2	I observed sufficient digital technology use in an educational setting in order to integrate applications myself in the future	4.6	0.70	4.5	4
ROL3	I saw good examples of digital technology practice that inspired me to use classroom technology applications in the classroom myself	4.4	1.17	5	5
ROL4	The potential of digital technology use in education was demonstrated concretely	4.8	1.03	5	5
	Summary *Role Model* Construct Data	4.58	0.93	5	5
REF1	I was given the chance to reflect on the role of digital technology in education	4.5	0.97	5	5
REF2	We discussed the challenges of integrating digital technology in education	4.5	1.35	4.5	6
REF3	We were given the opportunity to discuss our experiences with digital technology (i.e., during internships)	4.1	1.45	4	4
REF4	There were specific occasions for us to discuss our general attitude towards digital technology in education	4.4	1.33	4	4
	Summary *Reflection* Construct Data	4.28	1.26	4	5
DES1	I received sufficient help in designing lessons that integrated digital technology	4.2	1.40	4.5	5
DES2	We learnt how to thoroughly integrate digital technology into lessons	4.4	1.07	4.5	4
DES3	We received help to use digital technology when developing educational materials	4.4	1.43	4.5	4
DES4	I received a great deal of help developing digital technology-rich lessons and projects to use for my internship	3.3	1.34	4	4
	Summary *Instructional Design* Construct Data	4.08	1.35	4	4
COL1	There were enough occasions for me to work together with other students on digital technology use in education (i.e., we developed classroom technology-based lessons together)	4.1	1.52	4	4
COL2	I was convinced of the importance of cooperation with respect to digital technology use in education	4.6	0.97	4.5	4
COL3	Students helped each other to use digital technology in an educational context	4.2	1.23	4	4
COL4	Experiences using digital technology in education were shared	4.6	1.07	5	5
	Summary *Collaboration* Construct Data	4.38	1.19	4	4

Item	Prompt	*M*	*SD*	*Mdn*	Mode
AUT1	There were enough occasions for me to test different ways of using digital technology in the classroom	4.1	1.45	4.5	5
AUT2	I was able to learn to use digital technology in the classroom through the internships	4.7	0.95	5	5
AUT3	I was encouraged to gain experience in using digital technology in a classroom setting	5	1.05	5	6
AUT4	Students were encouraged when they attempted to use digital technology in an educational setting	4.6	0.70	5	5
	Summary *Authentic Experiences* Construct Data	4.6	1.08	5	5
FEE1	I received sufficient feedback about the use of digital technology in my lessons	4.2	1.40	4.5	5
FEE2	My competences with digital technology were thoroughly evaluated	4.2	1.03	4.5	5
FEE3	I received sufficient feedback on how I can further develop my digital technology competences	4.1	1.29	4.5	5
FEE4	My competences in using digital technology in the classroom were regularly evaluated	4	1.33	4.5	5
	Summary *Feedback* Construct Data	4.13	1.22	4.5	5
	Summary Data for 24 Likert-scale Prompts	4.34	1.18	4.5	5

Note: Data reflect 10 participants' responses to each prompts using the following Likert-scale: 1 = Totally Disagree, 2 = Disagree, 3 = Slightly Disagree, 4 = Slightly Agree, 5 = Agree, 6 = Totally Agree

Appendix K

Expectations for Cooperating Teachers

To promote a sense of shared expectations within the Marbury College educator preparation program, a bulleted list, such as the one that follows, should clearly articulate ways in which cooperating teachers can assist with the technology integration skill development of Marbury College's preservice teachers:

- Please take time to show your preservice teacher how to use the digital technologies in your classroom (e.g., Promethean Boards and Elmo document cameras).
- Please help your preservice teacher *troubleshoot*, or fix, technological malfunctions as they arise.
- Please help your preservice teacher look for meaningful ways in which P-12 students can have hands-on opportunities to use their Chromebooks.
    - Try to identify specific lessons that would be appropriate for project-based approaches, digital collaborations between P-12 students, and other activities that are prescribed by ISTE's (2021) Standards for Students, which are linked here: https://iste.org/standards/students.
- Please ensure that your preservice teacher knows about students with specific learning needs and disabilities and talk with your preservice teacher about ways in which adaptive technologies could be used for specific accommodations.
    - Your preservice teacher is expected to use the Universal Design for Learning (UDL) Guidelines to accommodate specific needs and disabilities. The UDL Guidelines are linked here: https://udlguidelines.cast.org/.
- Please ensure that your preservice teacher includes some form of digital technology in every lesson they teach.
    - Technology integration should improve teaching and learning outcomes.
    - If technology integration seems perfunctory, engage in a dialogue with your preservice teacher about ways in which their practices might be improved.