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Topics and Sequences in Experienced Teachers' Instructional Planning: Addressing a ~30-Year Literature Gap

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Abstract: Which topics were addressed, and in what sequence(s) did they appear, in experienced K-12 teachers' instructional plans that incorporate students' educational technology use? Eight volunteer classroom teachers with expertise in a broad variety of curricula and instructional levels participated in a university-sponsored professional learning program that helped them to explore ways to plan technology-enhanced, curriculum standards-specific lessons, units, and projects. Data were generated through individual participants' think-aloud and group reflection audio recordings, plus follow-up interviews with two participants that occurred after the planned units were taught. Many individual differences in planning topics and sequences were noted when the data were analyzed. Overall, the teachers' TPCK/TPACK-based pedagogical reasoning first emphasized curriculum content, then knowledge of students and/or learning activities. Technological considerations were voiced far less often than those regarding content, students, and learning activities, but did increase when participants used planning aids that matched recommended educational technologies to specific types of learning activities.

What are the considerations that enter into experienced teachers' TPCK/TPACK-based decision-making when planning a particular lesson or project that incorporates educational technologies? Are there common patterns, sequences, and/or proportions of these considerations that can be discerned across teachers? How, if at all, do these planning approaches change when teachers use professional learning materials that are designed to help them to devise their plans while actively considering technologies to use in lessons and projects? We addressed these questions in the following exploratory study after discovering that these particular dimensions of teachers' planning are surprisingly under-researched. This study's results suggest the possible primacy of teachers' focus upon curriculum content, students, and learning activities during instructional planning, regardless of whether or not their plans incorporate digital tools and resources. Given the preliminary and small-scale nature of this study, we urge other researchers to join us in exploring the topics and sequences addressed in technology-using teachers' naturalistic instructional planning.

Literature Review

Approximately 50 years ago, scholarship about teachers' instructional planning was primarily prescriptive; it was not based upon understanding teachers' decision-making processes in situ. Instead, planning procedures were derived from models of curriculum theory. Recommendations for curriculum-based lesson and unit design at the time suggested that teachers should first "specify objectives," then "select learning activities," then "organize learning activities," then "specify evaluation activities" (Clark & Yinger, 1977, p. 280) in what became known as a rational means-end model for instructional planning. Data-based, empirical investigations of teachers' planning didn't begin until 1970. In that year, Taylor reported that secondary teachers considered students' learning needs, abilities, and interests first during planning, followed by the content to be taught, learning goals, and teaching methods. By contrast, Zahorik (1975) found that most of the teachers he studied began their planning by considering content, which dominated their thinking throughout the process, followed by decisions concerning learning objectives. Both of these studies, however, generated data by asking the participating teachers to report their planning processes via surveys and discussions, rather than observing planning as it occurred (Clark & Yinger, 1977). These data generation methods dominated studies of teachers' planning foci at the time (Shavelson, 1983); a pattern which has persisted to date.

Teachers' planning began to be observed while in process, either in laboratory settings or in the field, in the mid-1970's (Clark & Yinger, 1977). Yinger (1977) and Peterson, Marx and Clark (1978) were the first to ask teachers to voice their planning thoughts and decisions by thinking aloud during planning. The two studies revealed different planning emphases for the participating teachers. Peterson et al. found that secondary teachers spent the most time considering the content to be taught, and the least time focused on learning objectives. Instructional strategies and activities were considered more than learning objectives, but not as much as the content of the lessons being planned. Similar results were reported by Brown (1988), who found that middle school teachers focused upon content topics most often during planning, followed by learning materials, learning activities, and evaluation of student learning. Brown was also among the first to note that content-based learning goals in teachers' planning were taken from state, district, and school policies and documents, rather than being written by the teachers as part of the planning process. By contrast, Yinger's (1977) case study of five months of a first-grade teacher's planning showed the predominance of selecting, organizing, and sequencing instructional activities and routines in a problem-based approach to planning.

Overall, in the 1970's and 1980's, researchers discovered that although teachers were able to name and explain learning objectives as part of their planning process when prompted to do so, they did not use objectives as the primary focus for instructional planning in their everyday teaching practice. As Shavelson & Stern (1981) asserted, "while [the] prescriptive model of planning may be one of the most consistently taught features of the curriculum of teacher education programs, the model is consistently not used in teachers' planning in schools" (p. 477). Similar findings were reported by Young, Reiser and Dick (1998) almost 20 years later. Rather, learning activities were found to be the primary focus of teachers' planning across multiple studies in the 1980's and 1990's.

In this literature, learning activities are conceptualized as the basic units of teachers' planning and classroom-based action. The planning aspects of learning activities were seen as seven types of "tasks," comprising the content to be learned; the materials that students use for learning; the sequencing, pacing, timing, and actions related to content and materials; the general learning goals of the task; students' needs, abilities, and interests related to the learning goals; the socio-cultural context for instruction, including the groupings in which students will be learning; and timing considerations, which teachers consider concurrently at daily, weekly, monthly, term-delimited, and yearly levels. Planning, then, was understood to be teachers creating and sequencing instructional tasks (Shavelson, 1983). However, in teachers' professional practice, "…the sequence of elements considered, and the compromises that have to be made" in the process were seen to be "…unknown" and probably predicated upon "the particular task at hand as well as the proclivities of the particular teacher" (Shavelson & Stern, 1981, p. 478). Calls for "…more intensive studies that either observe teachers during planning or probe their thinking in personal interviews that are held near the time that planning takes place" (Brown, 1988, p. 70) have gone largely unanswered. These particular aspects of teachers' naturalistic planning – that is, the nature and sequence of planning foci – remain surprisingly under-researched, even 30 years later.

In fact, several reviews of scholarship concerning teachers' planning and decision-making (e.g., Warren, 2000) have noted that explorations of teachers' planning after the 1980's became subsumed within much larger-scoped inquiry concerning teachers' instructional thought processes and decision-making that occur during both planning and teaching. During recent years, teachers' planning has been addressed more often as part of research that concerns instructional design (e.g., Romiszowski, 2016), pedagogical reasoning (e.g., Biggers, Forbes & Zangori, 2013), and pedagogical content knowledge (e.g., Stender, Bruckmann, & Neumann, 2017). At the same time, the focus on teachers' planning processes, which emphasized individual cognition, expanded to include a more situated, ecological framework that emphasizes shared knowledge construction among teachers as collaborating professionals (Munthe & Conway, 2017). These patterns are also evident within the subfield of educational technology, which has addressed teachers' planning to teach with digital tools and resources in empirical studies of their general planning patterns (e.g., Tubin & Edri, 2004); pedagogical reasoning (e.g., Feng & Hew, 2005); technological pedagogical content knowledge (e.g., Harris & Hofer, 2011); lesson design procedures and dispositions (e.g., Koh, Chai, Hong & Tsai, 2014); collaborative instructional design (e.g., McKenney, Kali, Markauskaite & Voogt, 2015); tool-based decision-making (e.g., Felger & Shafer, 2016); technological pedagogical reasoning (e.g., Niess & Gillow-Wiles, 2017); and models for professional development (e.g., Hutchison & Woodward, 2018).

Specific information about the nature of teachers' everyday planning processes that incorporate consideration of educational technologies is scant, however. This small-scale exploration of eight teachers' planning

foci and sequences, therefore, was designed to address the temporal and technological gaps between studies of the topics and progressions of teachers' decision-making during instructional planning that were published three decades ago, and those that address the comparative absence of that inquiry at the present time.

Study Design

Local classroom teachers were invited via email messages sent to their school district technology coordinators to participate in an interactive learning session that introduced them to content-specific planning aids that the authors had previously created, vetted, researched, and published. These are comprehensive, freely available taxonomies of learning activity types (LATs) with corresponding recommended technologies in nine different curriculum areas (http://activitytypes.wm.edu/). Using these open educational resources as planning aids, teachers select, combine, and sequence multiple learning activity types to comprise plans for lessons, learning projects, and units based upon knowledge of their students' learning needs and preferences, curriculum standards, and contextual conditions (Harris, et al., 2010). Teachers' TPACK is built, over time, in the process of using the LAT taxonomies to plan learning experiences that incorporate educational technologies in curriculum-based and pedagogically focused ways (Harris & Hofer, 2011). After participating, all study contributors were given the option to complete, then implement the plans that they had started to create during the session as the basis of a lesson, project, or unit that was scheduled to be taught before the end of the academic year.

Participants

Eight classroom teachers from one district volunteered to participate: three elementary-level, three middle school, and two high school. The teachers were asked to pre-select a focus for their planning to be done during the day-long interactive session that was held at the university. Lori is a kindergarten teacher who chose to focus her planning on an integrated mathematics and prereading project. Kathy and Megan teach 5th grade in the same school, and, like Lori, also focused their work on mathematics and reading. Holly and Maria are 6th grade teachers who decided to plan mathematics units that appropriated many different types of educational technologies in curriculum-based ways. Tina teaches 8th grade science and wanted to explore digital tools that would help her to better assess her students' learning. Andy and Hilary work in the same high school, teaching English and art, respectively. Both decided to enhance an existing instructional unit; Andy's was a multimedia book study project, and Hilary's was an examination of famous artists' works, characteristics, and processes. (All names are pseudonyms.)

Their participation in the day-long session yielded six recertification credits each, and they were given the option of earning an additional four credits if they engaged in a 60 – 90-minute individual interview after having completed and implemented the plans in their teaching prior to the end of the school year. Two of the eight teachers were able to teach their units in this time period and opted to participate in individual follow-up interviews.

Data Generation and Analysis

During the day-long session at the university, the participants each generated two individual think-aloud audio recordings (TA1 and TA2) that voiced their pedagogical reasoning and decision-making processes as they began to create their instructional plans. TA1 was generated before the authors' planning aids were distributed and introduced; TA2 was generated immediately afterwards. The teachers also engaged in two group interviews, during which they were encouraged to reflect upon their think-aloud recordings of their mental planning processes.

The think-aloud recordings occurred in separate, empty classrooms that were reserved for each participant, without the instructors present. Prompts for each recording were printed on paper, and participants were given digital recorders to use. The prompt for the first think-aloud (TA1) recording said:

> Choose one or two specific [state standards]-related learning goals for a lesson or short project that you will be using in your classroom later this school year. Plan the lesson or project, narrating what you're thinking and deciding at each step of planning. Pretend that you're talking to someone who is not familiar with how

to do instructional planning, such as someone who is learning to be a teacher. Speak your thoughts, even as they may change, into the recorder as you form the plan.

The prompt for the second think-aloud (TA2) recording, during which the teachers used the planning aids that the researchers had just introduced to the large group, said:

1. Starting with your previous planning, which, if any, of the LATs from the taxonomies were included?
2. Which, if any, might you add or substitute for parts of the previous plan? Why?

Participants were given 45 minutes to complete each think-aloud independently. All returned to the main session room after making their audio recordings within the times allotted.

Andy and Holly were the two teachers who completed, then taught, their unit plans, after which they engaged in semi-structured interviews (one in person and one via telephone, per their preferences) with one of the researchers. Interview prompts began with the following questions, adding follow-up questions and member checking based upon the participants' responses. Each individual interview was approximately 75 - 90 minutes in length.

1. Please describe the lesson/project that you implemented.
2. How, if at all, did you adjust how you implemented the plan as you were engaging in it in the classroom? Why did you make these adjustments?
3. Please describe how the students responded to the lesson/project.
4. Do you think that you will use this lesson/project again? Why or why not?
5. If you plan to use it again, what changes, if any, will you make and why?
6. What, if any, realizations did you have from implementing this lesson/project about the content taught? About the type of lesson/project? About using the technologies in these ways?
7. How did you use the [aids] plan the lesson/project? If you didn't use them, why not?
8. Do you anticipate using the taxonomies in the future? If so, how and why? If not, why not?
9. Do you have suggestions for us about how to improve the LATs taxonomies?

The eighteen think-aloud audio recordings and four interviews (two group; two individual) were transcribed verbatim and analyzed using constant comparative thematic analysis by the two researchers, who worked independently from the same emerging codes-and-definitions list that was posted in a secured, shared virtual drive folder. Six coding categories emerged: content (9 sub-codes), context (5 sub-codes), digital technologies (6 sub-codes), learning activities (5 sub-codes), non-digital materials (5 sub-codes), and students (5 sub-codes). After analyzing each subset of transcribed recordings separately, we met to compare the codes assigned to each utterance, discussing any differences perceived until we could agree upon the codes to assign. Codes' definitions and labels were adjusted by discussion and mutual agreement as necessary, based upon the nature of the study's emerging themes and subthemes. Patterns and frequencies of codes were discerned, first individually, then collaboratively, across all analyzed think-aloud and interview transcriptions to discern the study's results.

Results

As participants described their thinking while they planned lessons, units and projects during the two think-aloud sessions – first using their own planning approach, and then incorporating use of the LAT taxonomies – we noted both common patterns in and highly individualized approaches to instructional planning and decision making. Beginning with and maintaining a focus on curriculum standards was common to all participants. However, considering students' learning needs and preferences, types of learning activities, and digital- and non-digital materials varied considerably across participants, in both relative frequency and sequences within the planning processes. Introducing the planning aids seemed to influence participants' planning somewhat, particularly in terms

of the digital technologies considered and chosen. In the sections that follow, we describe common patterns in and differences among participants' planning emphases and sequences across the two phases of their planning think-alouds.

Common Planning Emphases During TA1

Several common patterns emerged from the participants' first planning session, which focused upon their initial planning or revising of a lesson, project, or unit into which they wished to incorporate use of educational technologies. All participants began their planning processes by considering curriculum content and related learning goals, referencing state standards, curriculum guides, and/or district-level curriculum documents. They then considered learning activity options, students' needs and/or preferences, or both. Their topic sequence patterns diverged later in their planning sequences as they considered a mixture of other elements.

Across participants, consideration of digital and non-digital tools and resources occurred comparatively later in the teachers' planning sequences. Interestingly, comments about technology options totaled only eight percent of all codes assigned during TA1, comprising the least frequently mentioned of the six primary coding categories. It was also surprising how infrequently participants referenced contextual elements and influences in their planning. Only 11% of the codes assigned to the utterances in these initial planning sessions focused on context. Of these contextual considerations, time was the most prevalent factor referenced.

Although we noted these common patterns across participants, several differences were also apparent in the topics that they addressed in their instructional planning. Four of the teachers emphasized a particular category in greater proportion to the others. Kathy and Maria emphasized content in their planning, with 43% and 46% of the codes assigned to their TA1 recordings, respectively. Megan focused primarily on her students' learning experiences, with 43% of her codes referencing some aspect of considering and selecting learning activities. Forty-five percent of Andy's codes related to students, most often focusing on aspects of their motivation and engagement in learning. The other four participants' considerations were more evenly distributed across the six coding categories. Tina's planning topics were perhaps the most balanced, with five of the six categories represented in her TA1, each totaling between 16-23% of the total codes assigned. Figure 1 compares the relative proportions of codes for Megan and Tina, illustrating the differences between a more emphasized and an evenly balanced approach.

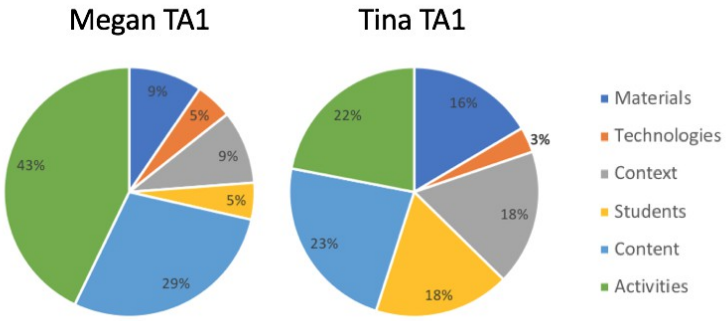

Figure 1. Comparison of Planning Emphases for Megan and Tina During Think-Aloud 1

Variation in Planning Sequences During TA1

Despite the participants' initial common focus on curriculum content, their planning sequences were unique and varied. To create visual representations of the participants' planning sequences, we combined the sequences of topics considered by each participant with the relative emphases/frequencies of each coding category assigned. Sequences are depicted as flowchart elements; comparative frequencies are represented in proportional font sizes in Figures 2, 4, 5, 6 and 7, with larger font sizes indicating greater emphasis. Three participant groups emerged when

we represented their planning sequences in these ways. In one group, three participants focused primarily on content throughout their planning sequences. Three others tended to consider content and learning activities simultaneously. The two remaining participants began and ended their planning sequences with an emphasis upon their students' needs and preferences. For example, Figure 2 illustrates planning sequences for Lori and Andy, the two teachers who focused primarily on students during TA1.

Figure 2. Student-focused planning sequences for Lori and Andy

Emphases During Participants' Planning Using the Planning Aids

During the second phase of the professional learning session, participants were prompted to begin with their previous planning ideas and consider which, if any, activities from the planning aids were included. Then they were encouraged to consider which, if any, learning activities they might add or substitute for parts of the previous plan, explaining why they would consider these changes. Surprisingly, even with this different, directed focus for the second think-aloud, the proportions of teachers' considerations in three of the six coding categories remained comparatively unchanged. See Figure 3 for a comparison of the overall topical emphases in the first and second planning sessions.

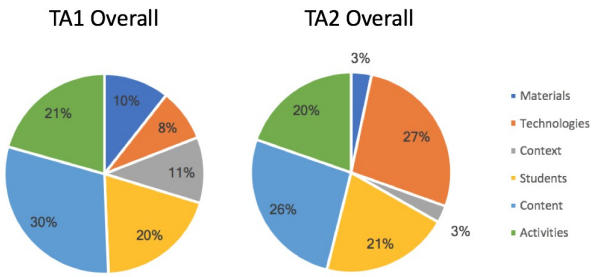

Figure 3. Comparison of Planning Emphases During the First and Second Planning Sessions

In comparing overall planning emphases between the first and second planning sessions, we noted a decrease in focus on non-digital materials (10% to 3%) and contextual considerations (11% to 3%), and only a one percent increase in consideration of learning activities. This was particularly surprising because the planning aids are organized around a wide range of curriculum-based learning activities. Teachers who were introduced to these same planning aids in prior research increased their consideration of learning activity possibilities (Harris & Hofer, 2011).

By contrast, most of the participants discussed educational technology possibilities and choices more often while consulting the planning aids during TA2 (8% of all codes during the first session to 27% during the second). While all participants considered educational technologies during their initial planning (between 2% and 20% of individual participants' topics considered), only half of the participants considered technologies in eight percent or more of the codes that depicted the foci of their planning. The remaining four participants mentioned technologies in five percent or fewer of their utterances. This increase in focus on technologies during the second planning session is intriguing, because participants were not prompted specifically to consider using technologies in their emerging instructional plans. However, recommended technologies appeared in the planning aids, connected directly with each type of curriculum- based learning activity that was included, which probably influenced the teachers' thinking.

Technologies were mentioned more than any other sub-category during the second planning session (27% of all codes) as the teachers consulted the planning aids. Yet half of the participants discussed technologies

comparatively later in their planning sequences, rather than from the outset. This seems to contrast with educational technology-related planning approaches that situate teachers' consideration of technologies' affordances and constraints during the initial phases of the planning process (e.g., Angeli & Valanides, 2005). Holly considered technologies ("Tools" in Figure 4) at each phase of her planning process. Andy was the sole participant who considered technologies only at the beginning of his planning process. As the example varied planning sequences in Figure 4 illustrate, there were no discernable commonalities in when the teachers included technology considerations in their planning sequences.

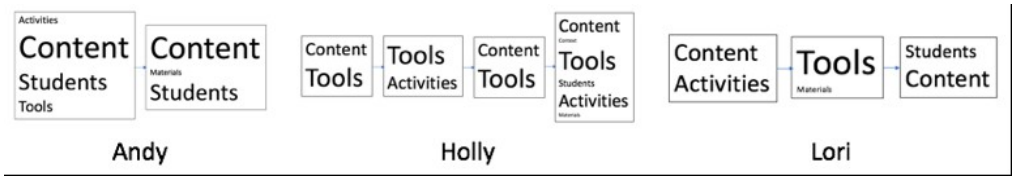

Figure 4. Comparing Andy's, Holly's, and Lori's Planning Sequences

Comparing Planning Sequences

When contrasting participants' planning sequences and relative emphases between the two planning sessions, some interesting patterns emerge. While we illustrate some of these findings visually in Figures 5, 6 and 7, space constraints do not allow us to present diagrams representing each participant's unique planning sequence. Instead, these will appear in the PowerPoint file that will be presented at SITE 2019 and uploaded to the Academic Experts website.

Similar to the patterns that characterized their initial planning sequences, nearly all of the participants began by considering content to be taught during the second planning session. The only exception was Kathy, who focused almost exclusively on learning activities and possible technologies. This may be attributable to the prompt that guided the second think-aloud and/or the structure of the LAT taxonomies that participants consulted, which are organized according to learning activity types and suggested technologies for each. Not surprisingly, Kathy's proportion of content-related codes was well below the 26% overall average. The visual representations of her two planning sequences, found in Figure 5, illustrate this shift in sequence and relative emphasis between the two planning sessions.

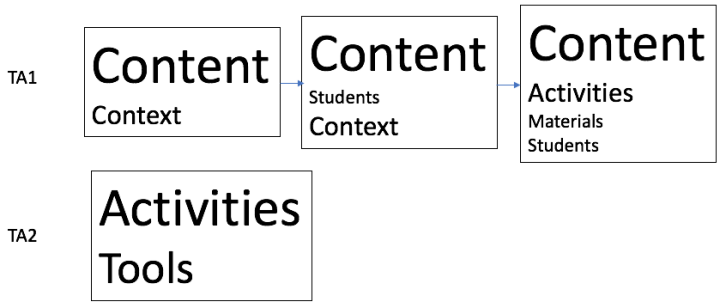

Figure 5. Kathy's Differing Planning Sequences and Emphases

As referenced earlier, the planning sequences that emerged during TA2 also reflected an increased emphasis on technology considerations across all participants. Holly, Megan and Tina showed the largest increase in technological focus from the first to the second planning session. Holly's technology-related considerations increased from 9% to 32%, Megan's increased from 5% to 45%, and Tina's increased from 3% to 41%. The depiction of Holly's planning sequences (Figure 6) illustrate her increased consideration of technologies from her first to second sessions.

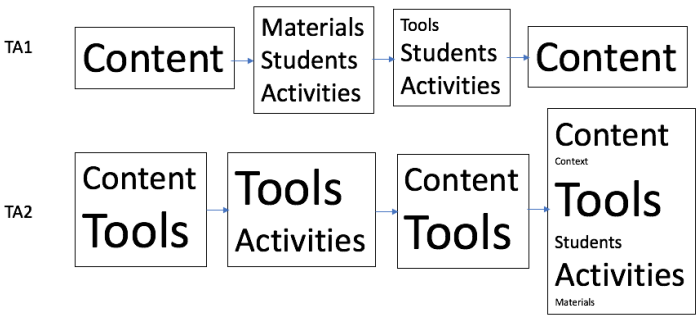

Figure 6: Comparison of Planning Sequences and Relative Emphases for Holly

During the first planning session, all of the participants but Lori and Andy emphasized learning activities. All but Megan also considered learning activities in the second planning session. Interestingly, Andy and Megan were the only two participants whose overall emphases on learning activities did not increase between the first and second planning sessions. As mentioned above, it is possible that the focus on types of learning activities and corresponding technologies in the planning aids stimulated this increased focus on both technologies and learning activities for most of the participants during the second planning session. Interestingly, the relative emphasis on student considerations decreased for three of the participants between the first and second planning sessions, although overall percentages across participants held relatively steady (21% in TA1 and 20% in TA2). Again, it is possible that some participants considered students' needs and preferences less during the second session due to the directed focus on learning activities and corresponding technologies. Moreover, as we looked across all participants' planning sequences voiced during the two sessions, the number of topics that they considered did not change dramatically overall.

Results Summary

While all of the teacher participants began with and maintained a primary focus on curriculum content considerations during their two planning sessions, in many ways their planning emphases and sequences varied considerably. Some participants balanced consideration of many elements simultaneously, while others focused primarily on one or two at a time. Some participants seemed to follow a somewhat linear path in the topics that they considered as they planned, while others contemplated multiple topics concurrently. Few of the participants discussed classroom context concerns at any point in the planning processes. Introducing the planning aids seemed to increase the participants' focus on use of digital technologies and decrease the teachers' consideration of contextual conditions. In the following section, we discuss possible implications of this study's results.

Discussion

Local teachers were invited to participate in this professional development experience to help them to learn more about how to integrate digital technologies in their teaching practice; in essence, to help them to develop and apply their TPCK/TPACK (Mishra & Koehler, 2006) during instructional planning. Despite this focus, all of the participants considered technologies in only limited ways, overall, during their initial planning sessions. Even after we introduced them to the planning aids, which link possible technologies that can support curriculum-based learning activities overtly, much of the teachers' thinking and decision-making about materials, digital tools and contextual considerations were still eclipsed by considerations of curriculum content, students' needs and preferences, and learning activity possibilities and selection. These same predominant foci appear in much teacher planning scholarship, as the literature review above illustrates.

When the teachers were prompted to work with the planning aids during TA2, even though their consideration of technology integration increased, their initial and primary focus on content and pedagogical considerations was maintained. This may suggest that -- as researchers and teacher educators -- rather than perpetuating the more common focus on the educational affordances of digital tools in educational technology

professional development and teacher preparation experiences, we should seek to introduce digital tools and resources primarily vis-à-vis curriculum content and pedagogical methods. In doing so, we would align the design of and emphases for professional learning opportunities more closely with teachers' typical instructional planning approaches (e.g., Bos, 2011; Harris & Hofer, 2009; Roblyer & Doering, 2012).

Our results are limited, however, to this small, though somewhat professionally heterogeneous, group of practicing teachers. More research needs to be conducted to see whether the patterns identified and explained here apply to the planning processes of other inservice teachers with differing years of teaching experience, curriculum areas, teaching levels (elementary, middle, and high school), and educational contexts. And although this study's sample size and data analysis granularity would not suggest that the results reported here are probably even logically generalizable, we note a larger and perhaps more generative aspect of this study's findings. Our study's results revealed a range of planning topics and sequences that are more closely aligned with Shulman's (1987) comprehensive knowledge base for teaching (of which his PCK construct (1986) is only one element), combined with key elements from his model of pedagogical reasoning in action, than they are reflective of well-referenced TPCK and TPACK definitions (e.g., Angeli & Valanides, 2005; Mishra & Koehler, 2006; Niess, 2005). In future studies of and instruction addressing teachers' planning, we urge researchers and teacher educators to broaden their foci to include these more comprehensive constructs of teacher knowledge and action. This, hopefully, will produce more accurate, thorough, and applicable research results.

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