

PEDAGOGY

Measuring Preservice Teachers' Knowledge of Instructional Tasks for Teaching Elementary Content

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Abstract

Purpose: *The purpose of this study was to measure preservice teachers' knowledge of instructional tasks for teaching three manipulative skills in elementary physical education. Method:* Data were collected to measure preservice teachers' entry and exit knowledge of instructional tasks that require selecting developmentally and sequentially appropriate content for elementary students. Preservice teachers from four PETE programs in the United States participated. Descriptive statistics were used to report the data. **Findings:** *The results of this study showed that (a) preservice teachers' entry and exit levels of task knowledge for teaching elementary content were insufficient and varied across programs and (b) the improvement in task knowledge from entry to exit of the elementary content courses was small. Conclusion:* *The results challenge the current methods for teaching elementary content in PETE programs. Several research-driven strategies are suggested for promoting preservice teachers' knowledge of instructional tasks.*

Teachers' knowledge of instructional tasks and their ability to select developmentally appropriate tasks and sequence them in meaningful ways have been recognized as critical skills for teachers (Ball, Thames, & Phelps, 2008; Krauss et al., 2008; Rink, 2009; Siedentop

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& Tannehill, 2000; Ward, 2013). Given that students achieve more learning outcomes in high-quality tasks than in low-quality tasks in physical education lessons, the quality of teachers' instructional tasks should be examined in determining in-depth understanding of content (Ward, 2013).

To design quality instructional tasks, teachers require two distinct forms of content knowledge in physical education (Ward, 2009), derived from the work of Ball et al. (2008) in mathematics. Common content knowledge (CCK) is the knowledge that a teacher needs to perform the activity including knowledge of game rules, safety, etiquette, techniques, and tactics in physical education (Ward, 2009). On the other hand, specialized content knowledge (SCK) is the unique knowledge that a teacher needs to teach the content to students including knowledge of common errors, error corrections, and instructional tasks (Ward, 2009). These forms of content knowledge are distinguished from other teacher knowledge bases such as pedagogical content knowledge (PCK), "a focal point, a locus, defined as contextually specific event in time where teachers decide contents according to their understanding of other knowledge bases (e.g., knowledge of curriculum, pedagogy, student, and context)" (Ward, Kim, Ko, & Li, 2015, p. 2). For example, a teacher's ability to list critical elements of a kicking skill can be identified as CCK, whereas a teacher's ability to list common mistakes that students make or to sequence the instructional tasks appropriately from static tasks (e.g., kicking to wall) to dynamic tasks (e.g., 2 vs. 1 pass) can be identified as SCK. In particular, a teacher's ability to select, represent, or adapt the content appropriately for specific learners (e.g., fourth grade students who had at least two previous instructional units of soccer) using other knowledge bases (e.g., knowledge of students, context, curriculum, and pedagogy) can be identified as PCK.

Researchers have reported that teachers who have strong content knowledge use more instructional tasks than do teachers with weaker content knowledge (Ayvazo & Ward, 2011; Gusthart, Kelly, & Rink, 1997; Hastie & Vlaisavljevic, 1999; Kim, 2015). Recently, several researchers have used experimental studies to examine changes in teachers' use of instructional tasks and concomitant changes in student learning as a result of changes in teachers' SCK (Iserbyt, Ward, & Martens, 2015; Kim, 2015; Sinelnikov, Kim, Ward, & Li, 2015;

Ward, Kim, et al., 2015). These studies showed change in the teachers' use of extending and refining instructional tasks. In addition, the results of the studies indicated that teachers who improved their SCK selected more developmentally appropriate tasks and presented the tasks to students in more depth. This area of research focused on in-service teachers' SCK, knowledge of instructional tasks. No existing research examines the role of SCK and preservice teachers' SCK. Therefore, little is known about how much in-depth content knowledge that preservice teachers have prior to content coursework and how much they acquire by the conclusion of their content coursework in physical education teacher education (PETE) programs.

Measurement of content knowledge has relied on Rink's (1985) content development categories: (a) an informing task that is the initial task in a sequence of learning tasks, (b) an extending task that is the modified task for increasing or decreasing the difficulty or complexity of performance, (c) a refining task that is intended to improve the technical quality of a skill or strategy performance without changing the practice conditions, and (d) an applying task that is intended to provide students with the chance to apply their skills and use strategies in more authentic ways. Rink's categories provide clear distinctions among content. Barrett, Sebren, and Sheehan (1991) used written lesson plans to measure how the teaching content was developed through changes to content development patterns over 2 years (i.e., methods course, student teaching, and first-year teaching). The format of written lesson plans included instructional tasks, organizational procedures and patterns, and major emphases. More recently, Ward, Lehwald, and Lee (2015) suggested a content map that illustrates sequential and interconnected tasks using Rink's content development categories as a way to measure knowledge of instructional tasks for teaching a specific content area in PETE. The authors used the content map as an alteration of a concept map that has been used in other subjects, considering that both are designed to represent relationships among concepts to be learned. However, a content map is distinguished from a concept map, emphasizing the analysis of instructional tasks that teach the concepts (Ward, Lehwald, & Lee, 2015). To create a content map, these tasks must be completed in sequence: (1) listing the major skills that would be taught in a 10-day instructional unit along the bottom of the tem-

plate, (2) listing the sequenced tasks that would be used to teach each of the listed skills in brief, and (3) connecting the listed tasks if they are not discrete by drawing lines that link them (Ward, Lehwald, & Lee, 2015). The authors argued that the content map defines the SCK to be taught and its relationship to other SCK.

The purpose of this study was to determine the usefulness of a content development measurement tool to assess preservice teachers' knowledge of instructional tasks. The measurement tool required preservice teachers to complete four tasks that allow a score reflecting the depth of content knowledge to be reported. The strategy was to compare pre- and postmeasurement scores on preservice teachers' instructional task knowledge for teaching three commonly taught manipulative skills before and after their engagement in elementary physical education content courses. The specific research questions of the study were as follows: (a) How does preservice teachers' knowledge of instructional tasks differ between pre- and postmeasurements across the task categories? (b) How does preservice teachers' ability to list developmentally and sequentially appropriate tasks differ between pre- and postmeasurements across the programs?

Method

The study was approved by the university institutional review board. Signed informed consent was obtained from all participants. A descriptive–analytic research design was utilized for collecting, analyzing, and interpreting data for this study.

Participants

To recruit potential participants in the study, we contacted via e-mail more than 10 teacher educators who taught elementary content courses in the United States at PETE programs with established reputations. Five faculty members in four programs agreed to participate (i.e., one instructor from each institution in the states of California, Tennessee, and Ohio and two instructors from the same institution in the state of North Carolina who taught the same course with rotation over 2 years). The instructors had a mean of 8.6 years (range = 3–25) of experience in teaching elementary content courses in PETE. Each instructor explained the research to their students who were taking elementary content courses and asked for

their consent to participate in the study. Eighty-one PETE students (11–25/site) from sophomores to seniors agreed to participate in this study. From this pool, we randomly sampled data from 55 participants, with equal sample sizes ($n = 11/\text{site}$).

Data Collection

We measured knowledge of instructional tasks that inform SCK using an instructional task assessment form. The participants enrolled in the elementary content courses completed the form at the beginning and end of the elementary content courses during a class meeting. The form took 40–50 min to complete.

Instructional Task Assessment Form

To examine the depth of their instructional task knowledge, we requested that the participants complete four tasks. First, the participants listed as many skill-relevant instructional tasks as possible that they would use to teach three manipulative skills (e.g., throwing/catching, volleying, and kicking). Second, the participants wrote clear individual task statements by including three components: (a) what to do - content, (b) where to do - context, and (c) how well to do - criteria. This was done to clarify the task intentions. Third, the participants listed the tasks they had written for each manipulative skill in what they considered to be the appropriate sequence ranging from simple (easy) to complex (difficult). Finally, the participants used their best judgment relative to what grade level they might begin teaching each instructional task. These tasks have been commonly used in teacher education in the past (e.g., French et al., 1991; Rikard, 1991, 1992; Siedentop & Tannehill, 2000; Silverman, Subramaniam, & Woods, 1998; Silverman, Woods, & Subramaniam, 1998; Werner & Rink, 1989).

Data Coding

Before starting to code data, we determined whether the individual statements were appropriately stated for the analyses. If an individual statement was in one of three cases—(a) no description of learning activity but merely listing the critical elements of the skill, (b) not relevant to teaching the designated skill (e.g., rolling a ball to hit standing targets for throwing), or (c) too brief task description that hindered correct judgment (e.g., throwing the ball or kicking

the ball)—it was excluded from further examination. On 21 occasions we excluded the statements from the entire data set. After that, each individual task statement was coded using two task categories: (a) developmentally appropriate selection and (b) sequentially appropriate progression.

First, we examined the participants' individual task statements for their developmental task appropriateness. For example, if a written task statement was developmentally appropriate for a designated target grade (e.g., throwing at a wall target 10 ft away from the wall for second graders or tapping the stationary ball on the personal space for first graders), it was coded as appropriate. If a written task statement was developmentally inappropriate for a designated target grade (e.g., passing game in 3 vs. 3 for first graders or throwing the ball at wall targets for fifth graders), it was coded as inappropriate.

Second, the individual task statements were further examined for their sequentially appropriate task progressions. For example, if a written task statement was appropriately progressed from the prior task (e.g., from simple to complex, from easy to difficult, or from static to dynamic), it was coded as appropriate. If a written task statement was inappropriately progressed from the prior task (e.g., volleying on a move and then volleying on the personal space or passing game in 2 vs. 2 and then passing game in 1 vs. 1), it was coded as inappropriate.

Finally, it was determined whether the individual task statements were only developmentally appropriate, only sequentially appropriate, developmentally and sequentially appropriate, or developmentally and sequentially inappropriate based on the previously determined individual task statements in each developmentally appropriate and sequentially appropriate category.

Coder Training

Two coders were trained for 3 hr over 2 days. The procedures for training were organized into three phases. In the first phase, the coders learned the definitions of the coding variables (e.g., content relevancy, developmental appropriateness, and sequential appropriateness), receiving the sample responses of skill-relevant/irrelevant, developmentally appropriate/inappropriate, and sequentially appropriate/inappropriate task statements. Their understanding was

evaluated through a verbal test with a criterion (i.e., 90% correct responses).

In the second phase, the coders practiced coding with the investigators using the developed coding template and three instructional task assessment forms that were randomly selected from the entire data set. If there were incorrect observations, the investigators delivered corrective feedback.

In the third phase, the coders used the developed coding template to individually code another five instructional task forms that were randomly selected from the remaining data set. Coder training was continued until they reached 100% agreement with the investigators' coding.

Interobserver Agreement

After the completion of coder training, interobserver agreement (IOA) was conducted on 33% of the collected pre- and postmeasurement forms (i.e., 36 of 110). IOA was computed by the following formula: $[\text{Number of Agreements} / (\text{Number of Agreements} + \text{Disagreements})] \times 100$. The mean for the IOA data was 91.3%, which meets the 85% criterion suggested by Cooper, Heron, and Heward (2007).

Data Analysis

In all, 110 measurement forms were coded. Coding data were tallied and then added up across the three teaching skills in each participants' pre- and postmeasurements. The summed data were descriptively analyzed using SPSS 20.0 statistical software. The means and standard deviations of the instructional tasks listed by the entire programs across the task categories in the pre- and postmeasurements were reported. The mean gains and standard deviations of skill-relevant tasks and both developmentally and sequentially appropriate tasks from pre- to postmeasurements were reported later. In addition, Cohen's *d* effect sizes (Cohen, 1988) were reported to indicate the standardized mean differences among groups.

Results

How Does Preservice Teachers' Knowledge of Instructional Tasks Differ Between Pre- and Postmeasurements Across the Task Categories?

The first research question of the current study was how preservice teachers' knowledge of instructional tasks differs across the task categories before and after taking the elementary content courses. The analysis of the pre- and postmeasurement data indicated that the preservice teachers' stated instructional tasks for teaching the three manipulative skills were insufficient. The premeasurement data showed that the preservice teachers enrolled from all the programs had a mean of 13.2 skill-relevant tasks ($SD = 5.9$), 5.8 developmentally and sequentially appropriate tasks ($SD = 5.0$), and 4.0 developmentally and sequentially inappropriate tasks ($SD = 4.7$) for teaching the three manipulative skills. The postmeasurement data showed that the preservice teachers from all the programs had a mean of 15.2 skill-relevant tasks ($SD = 8.0$), 8.5 developmentally and sequentially appropriate tasks ($SD = 6.6$), and 2.9 developmentally and sequentially inappropriate tasks ($SD = 3.0$) for teaching the three manipulative skills. In both pre- and postmeasurements, on average less than one stated task was observed as only developmentally appropriate and fewer than three listed tasks were only sequentially appropriate from all the programs (see Figure 1).

The results of the mean differences from pre- to postmeasurements in terms of the listed skill-relevant tasks and developmentally and sequentially appropriate tasks showed that the preservice teachers, on average, were able to list more than two skill-relevant tasks ($SD = 5.4$) and fewer than three developmentally and sequentially appropriate tasks ($SD = 4.4$) after completing the elementary content courses. However, the values of Cohen's d —skill-relevant tasks ($d = .29$) and developmentally and sequentially appropriate tasks ($d = .45$)—indicated a small or medium effect of the elementary content study, which falls behind Cohen's (1988) convention for a medium effect ($d = .50$).

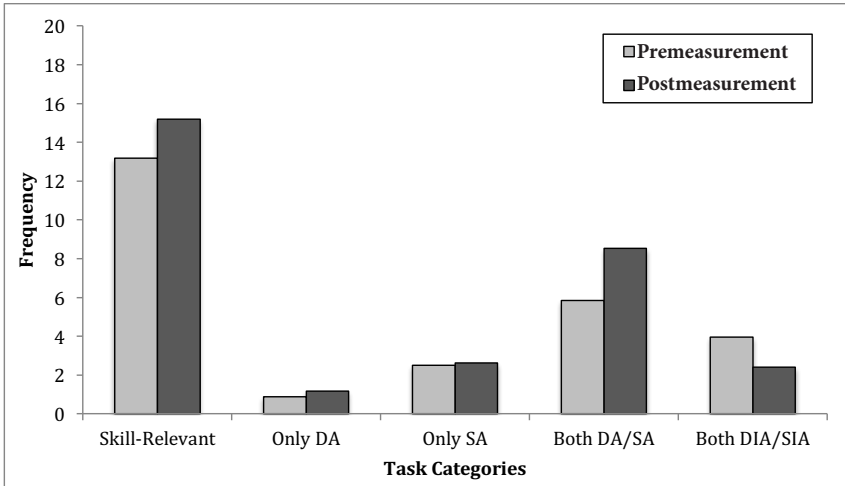


Figure 1. Means of total program pre- and postmeasurements on knowledge of instructional tasks across the task categories.

How Does Preservice Teachers’ Ability to List Developmentally and Sequentially Appropriate Tasks Differ Between Pre- and Postmeasurements Across the Programs?

The second research question of the study was how preservice teachers’ ability to list developmentally and sequentially appropriate tasks before and after taking the elementary content courses differs across the programs. Data indicated that the preservice teachers’ listed instructional tasks that were developmentally and sequentially appropriate for teaching the three manipulative skills were insufficient and varied across the programs. The premeasurement data showed that the preservice teachers in Program 2 ($M = 10.1, SD = 6.9$) and Program 3 ($M = 8.2, SD = 5.4$) listed more developmentally and sequentially appropriate tasks for teaching the three manipulative skills than did those in Programs 1-1, 1-2, and 4 ($M = 3.0 \sim 4.3, SD = 2.3 \sim 3.0$). The postmeasurement data showed that the preservice teachers in Program 1-1 ($M = 3.4, SD = 3.7$) and Program 1-2 ($M = 4.5, SD = 2.6$) listed fewer developmentally and sequentially appropriate tasks for teaching the three manipulative skills than did those in Programs 2, 3, and 4 ($M = 10.8 \sim 12.9, SD = 4.6 \sim 7.7$; see Figure 2).

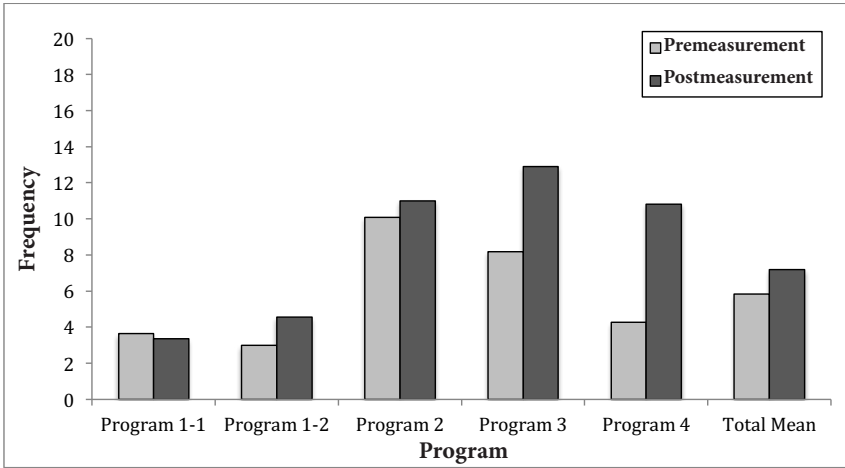


Figure 2. Means in pre- and postmeasurements of developmentally and sequentially appropriate instructional tasks across the PETE programs.

The mean differences between pre- and postmeasurements of the listed instructional tasks that were developmentally and sequentially appropriate varied across the programs. Improvement of preservice teachers' knowledge of instructional tasks in Program 1-1 ($d = .09$) and Program 2 ($d = .12$) was rarely observed at the conclusion of the content study, which falls behind Cohen's (1988) convention for a small effect ($d = .20$). On the other hand, the preservice teachers enrolled in Program 1-2 ($d = .63$), Program 3 ($d = .74$), and Program 4 ($d = 1.70$) showed medium-large effects of the elementary content study, which exceeds Cohen's (1988) convention for a medium effect ($d = .50$) or a large effect ($d = .80$).

Discussion

Considering that students in physical education lessons learn better from meaningful learning experiences and appropriate level of task difficulty provided by a teacher who possesses in-depth content knowledge (Rink, 2009; Silverman, 1985; Silverman, Subramaniam, & Woods, 1998), future physical educators should be well prepared for using in-depth content knowledge. A pressing task of teacher education programs is to promote preservice teachers' content knowledge. Yet there are few tools to assess content knowledge. This study presented four tasks that can be used to generate a score with which to judge the depth of content knowledge.

Measuring teachers' content knowledge is essential for planning and teaching, but there has been limited examination of the relationship between teachers' content knowledge and student learning in research on content knowledge (Ward, 2013). From this study, we gained knowledge about the level of content knowledge obtained by preservice teachers when they exit content courses, allowing us to discuss the direction and focus of professional development for preservice teachers. We found that the preservice teachers' initial knowledge of instructional tasks was weak; they listed only one or two developmentally and sequentially appropriate tasks per skill at the beginning of their content study. Siedentop (2002) pointed out preservice teachers' lack of content knowledge at program entry, which hinders students from developing in-depth understanding of content, and argued for intensifying and expanding the amount of content knowledge course requirements in PETE, reporting examples of other subject matters (e.g., art, music, and dance education programs). Additionally, Kim, Lee, Ward, and Li (2015) explained the lack of preservice teachers' content knowledge at program entry as an outcome of their K–12 physical education experiences, noting that few preservice teachers enter the programs with adequate content knowledge in more than one or two sports. In addition, we found that the preservice teachers' initial levels of elementary task knowledge that represents their SCK varied across the programs and the individuals. This result can be explained by the contention that the preservice teachers' performance knowledge (i.e., CCK) and their initial knowledge of instructional tasks (i.e., SCK) were acquired through their prior sport and coaching experiences (Ward, 2009). Most PETE programs in the United States and other countries (e.g., South Korea) have been designed based on the assumption that performance is the pathway to learning to teach physical education (Ward, 2009; Ward, Kim, et al., 2015; Ward, Li, Kim, & Lee, 2012). There are consistent findings related to teacher knowledge in math, science, and physical education that have shown that preservice teachers or beginning teachers' performing experience (i.e., CCK) plays a vital role in the quality of the content selections, sequences, and representations (i.e., SCK; Ball et al., 2008; Sinelnikov et al., 2015; Ward et al., 2012). To ensure that potential physical education teachers have appropriate levels of content knowledge at program

entry in their admission process, PETE educators should consider the relationship between CCK and SCK.

The postmeasurement data showed that the preservice teachers who completed the elementary content course requirements listed, on average, three developmentally and sequentially appropriate tasks per skill. Compared to the mean of 27 developmentally and sequentially appropriate tasks per skill listed by Graham, Holt/Hale, and Parker (2013), this represents a lack of preservice teachers' SCK acquisition at the conclusion of their elementary content study. More surprisingly, some preservice teachers rarely improved knowledge of instructional tasks after completing the elementary content study. Based on the argument of Ball et al. (2008) that CCK and SCK may exist independently, it may be possible for preservice teachers not to know how to teach a fundamental motor skill by selecting developmentally and sequentially appropriate tasks, even though they know how to perform it correctly. Some have argued that preservice teachers' SCK may not develop naturally without having specific learning practices intended to develop SCK during content courses, and they have suggested a focused learning environment for CCK and SCK (Kim, 2015; Kim et al., 2015; Sinelnikov et al., 2015; Ward, 2013).

This study supports the argument that in the absence of focused instruction that emphasizes developing knowledge of instructional tasks, preservice teachers may exit their programs with a lack of potential to mature as content experts (Ball et al., 2008; Kim et al., 2015; Ward et al., 2012). Similarly, Blankenship and Ayers (2010) argued that preservice teachers lack support for developing in-depth content knowledge that includes appropriate content progression, clear content representations, and teaching cues, even though they experienced shallow game play and joy of movement during activity courses in PETE. With large-scale studies in the United States reporting 10% to 15% of lesson time allocated to learning motor skill development at the elementary school levels (McKenzie & Lounsbury, 2013), Dyson (2014) argued that elementary teachers do not have task progressions for skill learning. Additionally, Constantinides, Montalvo, and Silverman (2013) reported that elementary physical education specialists used more skill practice tasks, which results in more student practice trials, when compared with nonspecialists who provided game play in teaching elementary content. Given

that teachers' teaching effectiveness can be differentiated by their use of instructional tasks (Kim, 2015; Pellett & Harrison, 1995; Rikard, 1991; Rink, 2009; Sinelnikov et al., 2015; Ward, Kim, et al., 2015), the focus of professional development programs should be to improve preservice and in-service teachers' knowledge of instructional tasks that inform their in-depth content knowledge acquisition.

To compound the issue regarding preservice teachers' lack of SCK acquisition during content courses, there has been an enduring voice related to the current policy for initial teacher education, with the structures of PETE programs reflecting national and state standards for beginning teachers (Kim et al., 2015; Ward, 2013; Ward, Kim, et al., 2015). Under the National Standards for Initial Physical Teacher Education (National Association for Sport and Physical Education, 2008), which require a teachers' motor skill competence in a variety of activities and movement patterns, many PETE programs have been compelled to teach more CCK rather than SCK (Kim et al., 2015; Ward, 2014). This absence of policy support for SCK fostered a recent policy initiative that emphasizes SCK development in the beginning teacher standards in physical education by SHAPE America. Under the newly proposed policy initiative, PETE programs can initiate or enable curriculum change or reform for promoting SCK. With the view that preservice teachers "will carry PE forward for the next decade or longer" (Pill, 2007, p. 25), PETE programs can therefore actively promote curriculum innovation and change and provide an ideal environment that supports the adoption of new ideas (Macdonald et al., 2002).

With the goal of improving teacher quality and meaningful student learning, physical education teachers face a challenging issue in preparing future physical education teachers well beyond the content standards (Ward, 2013). With an essential concept of "less is more" for improving quality physical education (Rink, 2009), and given that developing in-depth content knowledge takes a great amount of time, effort, and persistence (Dyson, 2014), teachers need initiative actions to make some changes in teacher preparation programs. The University of Michigan elementary teacher education program offers 19 high-leverage teaching practices in which the proficient enactment by a teacher is likely to lead to comparatively large advances in student learning (e.g., group discussion, modeling content/

practices/strategies, coordinating/adjusting instruction, specifying/reinforcing productive student behavior, and designing single lessons/sequencing of lessons; see University of Michigan School of Education, n.d.). In physical education, Ward and his colleagues, who early recognized the importance of preservice teachers' SCK development, suggested several research-driven strategies for developing or measuring SCK: (a) using specific teaching practices that include video performance analysis, repeated peer teaching, scenario-driven instructional problems, freeze replay of teaching episodes, and assessment of SCK knowledge (Ayvazo, Ward, & Sthur, 2010; Kim et al., 2015); (b) using a content knowledge packet that includes the intended goals of instructional tasks, a list of well-sequenced task progressions, common performance errors, teaching cues, and task organizations (Ayvazo & Ward, 2011; Kim, 2015; Kim et al., 2015; Sinelnikov et al., 2015; Ward, Ayvazo, & Lehwald, 2014; Ward, Kim, et al., 2015); and (c) using a content map that illustrates appropriately sequenced and interconnected tasks for teaching a certain sport (Ward, Lehwald, & Lee, 2015). Teacher educators should consider incorporating these research-driven strategies into their curricula in ways that will promote SCK. Further research that examines the effects of each strategy on developing preservice teachers' SCK would be worthwhile.

Conclusion

We examined the extent to which SCK achievement was occurring after completion of elementary content courses by directly measuring preservice teachers' abilities to list developmentally and sequentially appropriate tasks for teaching three manipulative skills. A primary conclusion from this study is that preservice teachers' entry and exit levels of task knowledge that allows for the selection of developmentally and sequentially appropriate tasks for teaching elementary content were insufficient and varied across programs. In particular, we found that some preservice teachers barely improved their knowledge of instructional tasks, even though they passed the semester-long elementary content courses.

The results of the study were rationalized under the two conceptualizations of content knowledge: (a) the independent existence of CCK and SCK and (b) the interrelationship between CCK and SCK (Ball et al., 2008; Sinelnikov et al., 2015; Ward, 2009, 2013). The

operationalized content knowledge concepts allow practitioners and researchers to create learning environments that would nurture and enhance preservice teachers' in-depth understanding of content and to measure their learning outcomes in CCK and SCK. We suggested several strategies to promote preservice teachers' knowledge of instructional tasks: (a) organizing content courses with different content foci, (b) using specific teaching practices driven from research findings, (c) measuring CCK and SCK with relevant pedagogical tasks, and (d) challenging policy initiatives that emphasize CCK and SCK.

In conclusion, this study provides a foundation for initiating ongoing research on content knowledge that employs various research approaches (e.g., intervention or experimental study), and its findings may guide future professional development efforts aimed at strengthening CCK and SCK for elementary school teachers.

Limitations

This study has several limitations that require caution when interpreting the results. First, the results of this study cannot be generalized, because of our convenient sampling method. Second, this study used a small sample of 55 participants from five content courses, which precluded us from using inferential statistics. Third, the pre-post design was utilized without a control group, which limited ensuring the effects of content courses through comparison with the results of a control group. By overcoming these research limitations, researchers could evaluate preservice or in-service teachers' in-depth content knowledge using the four tasks identified in this study.

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