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The Role of Personal Beliefs in the Evaluation of Pre-service Teachers' Lesson Plans – A Single Case Study

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Authors' contributions

This work was carried out in collaboration between both authors. Author DCM designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author AM ran the participants, assisted in the development of the coding scheme, coded the participants' think-alouds and provided feedback on drafts of the manuscript. Both authors read and approved the final manuscript.

Original Research Article

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ABSTRACT

Aims: This study examined the relationship between personal beliefs and views of instructional practice.

Study Design: Anon-experimental quantitative mixed methods research design was used.

Place and Duration of Study: Research setting at Gustavus Adolphus College (St. Peter, MN, USA). Participants individually completed the study during the spring of 2012.

Methodology: Thirty-three pre-service teachers completed a self-report questionnaire and thought aloud as they evaluated two lesson plans.

Results: Two dimensions of epistemological beliefs significantly predicted participants' views of constructivist teaching, $R^2=.25$, $F(1,32)=4.927$, $p=.014$. Additionally, participants' evaluation of how a lesson plan supports self-regulated learning was significantly predicted by constructivist views, $R^2=.14$, $F(1,29)=4.575$, $p=.04$. Lastly, the evaluation of the student-centered nature of a lesson plan was significantly predicted by more traditional views, $R^2=.14$, $F(1, 29)=4.575$, $p=.04$.

Conclusion: Participants with stronger constructivist views of teaching made significantly

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more evaluations based on the lesson plan's support of self-regulated learning. Additionally, stronger traditional views were related to fewer evaluations on the student-centered nature of the lesson plan. Thus, differences in lesson plan evaluations can be explained by pre-service teachers' personal beliefs.

Keywords: Self-regulated learning; epistemology; personal beliefs; pre-service teacher education; think-aloud.

1. INTRODUCTION

It has long been assumed that learning is an active and constructive process resulting from an interaction between prior knowledge and mental representations of new information [1,2]. A rich body of empirical research has supported this theoretical assumption, leading to classroom practices that support active learning. Not surprisingly, teacher education programs tend to emphasize the effectiveness of such instructional practices [3]. During Methods courses, Practicum experiences, and Student Teaching, pre-service teachers are often exposed to inquiry-based approaches such as discovery learning [4] and problem-based learning [6]. These constructivist-based approaches to education deviate from more "traditional" instructional practices in the classroom. Though there is some debate concerning their effectiveness in the classroom [7], constructivist approaches to teaching have gained significant popularity and pre-service teachers are likely to be exposed to them during their training. As such, a fundamental issue for teacher education programs concerns factors that affect pre-service teachers' views of such approaches to teaching. One factor may be pre-service teachers' pre-existing beliefs. Predominant learning theories assume that pre-existing beliefs act as a "filter" during the learning process. In the case of pre-service teachers, personal beliefs may lead to the development of idiosyncratic interpretations of effective instructional practices [8-11]. Despite this theoretical assumption, little empirical work has examined the relationship between various facets of pre-service teachers' personal beliefs and their developing views of effective instructional practice. This study sought to address the gap in the literature by drawing from the fields of epistemology and self-regulated learning.

1.1 Overview of Self-regulated Learning

Imagine, for example, two teachers with distinct beliefs concerning their students' ability to be active participants in learning. One teacher believes that students have the capacity to monitor their emerging understanding and set meaningful goals, while the other teacher does not hold these beliefs. Presumably, such beliefs about student capacity to be an active participant in learning affects how these two hypothetical teachers view effective instructional practices, an assumption that has been supported by previous research [12]. The Self-Regulated Learning (SRL) theory provides a framework to examine these beliefs. This theory broadly defines self-regulation as learning that involves the regulation and monitoring of cognition, behavior, and motivation, and the active construction of knowledge by using strategies and goals [13-24]. The field of SRL has grown in popularity over the last twenty years, resulting in the emergence of divergent perspectives that focus on different constructs [25]. Despite the differences, common assumptions are shared across SRL theories [20]. Firstly, it is assumed that students are proactive in the process of learning, constructing their own strategies and goals. Secondly, these theories assume that students can potentially regulate and monitor certain aspects of their cognition, behavior, and motivation. Lastly, it is

assumed that self-regulatory behavior is a mediator between (a) an individual's performance, (b) contextual factors, and (c) personal characteristics.

These theoretical assumptions provide a framework for instructional practices to support active participation in the learning process. For example, the Information Processing approach [21,26] describes four phases of self-regulation. Metacognitive monitoring, a key SRL process highlighted in this theory, produces information that assists in determining discrepancies between learning goals and current level of domain knowledge. Furthermore, monitoring allows students to adapt their planning and/or strategies to more effectively meet the learning goal(s). These monitoring activities can result in the student making adaptations to schemas that structure various self-regulated processes. As such, metacognitive monitoring greatly affects learning [27,28]. Zimmerman's conceptualization of SRL (2000), a commonly cited theory, also highlights the role of monitoring in three phases of active learning: forethought, performance control, and self-reflection. In the first phase, the student sets the stage for the upcoming learning task, creating learning goals and plans. Performance control, the second phase of self-regulation, constitutes processes that are involved during learning, including specific strategies such as self-talk and self-monitoring. Lastly, self-regulated students reflect at the conclusion of the learning activity, the third phase of SRL. This self-evaluation compares the performance outcome to the goal(s). These assumptions provide theoretical support for instructional practices that offer opportunities for students to self-regulate their learning.

A robust body of empirical research supports these theoretical assumptions by demonstrating the positive relationship between SRL and learning outcomes [16,29,30,]. These findings have led to a conclusion that competencies with the process of learning, such as students' ability to self-regulate their learning, should be a central, explicit aim within education [31]. These self-regulatory processes can be effectively supported through classroom practices, as evidence by Perry and colleagues' work [32]. In fact, this line of research demonstrates that novice teachers can be mentored to design instructional contexts that support SRL [32]. Pre-service teachers' implementation of classroom tasks that offer autonomy, control challenge and provide non threatening evaluations can be supported by both direct scaffolding and explicit instruction in education courses and during student teaching. In conclusion, prior research suggests that teacher education should emphasize instructional practices that support students' development of self-regulation. While empirical evidence supports the theoretical assumption that instructional practices should support SRL, there is currently limited research on pre-service teachers' beliefs regarding these practices.

1.2 Overview of Epistemology

In addition to pre-service teachers' beliefs concerning student capacity and practices that support SRL, views of knowledge as it relates to course content have the potential to also affect implementation of instructional practices [12]. For example, teachers who believe that knowledge related to course content is certain and absolute, as opposed to tentative and evolving, may resort to more pedantic forms of instruction. The field of epistemology provides a theoretical framework to examine how teachers' personal beliefs related to knowledge affect instructional decisions. Originally, epistemology theories suggested a developmental trajectory of how individuals view knowledge, progressing from simplistic views to more sophisticated views of knowledge [33]. Naïve epistemologies, according to these earlier theoretical frameworks, include beliefs that knowledge is absolute and certain. This perspective of knowledge, termed dualism, differs from more sophisticated beliefs that

acknowledge multiple representations and interpretations instead of blindly accepting prescribed knowledge. These views, termed multiplicity and relativism, can eventually lead to an individual to consider the context when evaluating multiple perspectives, known as contextualism.

Perry's work provided the foundation for various perspectives on epistemological beliefs, most notably those theoretical frameworks that articulated developmental ideals. For example, Belenky et al. [34] examined the epistemological beliefs of 135 women and found a similar developmental pattern outlined by Perry's original work. These patterns represented qualitative changes in the complexity of knowledge views and identified positions that aligned with those put forth by Perry [33]. However, this conceptualization of "ideals" has been called into question, particularly in the context of culture. In response to these criticisms, recent theoretical frameworks of epistemology offer distinct perspectives [35-38]. Schommer's [39] perspective, for example, proposes a personal epistemology that includes multiple, independent dimensions. The independent nature of these dimensions is such that an individual can simultaneously hold both sophisticated and naïve views about the nature of knowledge. This perspective includes the following five dimensions: Control of knowledge, authority source of knowledge, speed of knowledge, structure of knowledge, and certainty of knowledge.

Research has empirically documented the effect of personal epistemology on instructional practices in the classroom [40]. Kang [41], for example, developed a set of essay questions to identify the personal epistemologies of pre-service teachers at the beginning of a science methods course. Measures included self-video reflection, lesson plans, video recorded teaching, and classroom observations. Data indicated a relationship between the pre-service teachers' developing instructional practices and their personal epistemologies. Furthermore, pre-service teachers' goals affected the relationship between personal epistemology and instructional practice, suggesting that a broader scope is needed to best understand this complex relationship. The Educational Model for Personal Epistemology [EMPE;42] highlights this assumption, suggesting that a myriad of factors affect the relationship between personal beliefs and teachers' choice of instructional practices. This need to consider a wider range of personal beliefs within pre-service teachers was the rationale for the current study.

1.3 Current Study

A significant body of research has examined the relationship between epistemological beliefs of undergraduates [43], including pre-service teachers [44]. Prior research suggests that these beliefs have the potential to affect how pre-service teachers view effective instructional practice. However, epistemology addresses an important, but insufficient aspect of personal beliefs that are important in this context. Other views, such as beliefs concerning students' capacities to self-regulate learning, have received much less empirical attention with pre-service teachers [45]. A more robust understanding of the relationship between pre-service teachers' personal views and their perspective of effective instructional practice will be realized by considering both Self-regulated learning beliefs (SRLB) and Epistemological Beliefs (EB) with multiple measures. The purpose of this study was to add to the current literature by examining these complex relationships with pre-service teachers at the Gustavus Adolphus College, a small liberal arts college located in St. Peter, MN, USA. A conceptual framework grounded in the notion that teaching is a principled practice guides the teacher Education program at this college. The following research questions guided this study:

1. To what extent are pre-service teachers' EB and SRLB related to their views of instructional practices?
2. To what extent are pre-service teachers' views of instructional practices related to their perceptions of lesson plans?

2. RESEARCH DESIGN AND METHODOLOGY

2.1 Sample

Thirty-three pre-service teachers from the applicable college were participants for the quantitative study. Qualitative data from three participants could not be reliably coded due to poor audio quality on the concurrent think-aloud. As a result, thirty of these pre-service teachers were also respondents for the qualitative analysis of the study. The time intensive nature of the data collection, which is discussed in more detail below, necessitated a smaller sample. This sample included 28 females (85%) and 5 males (15%). This gender distribution is representative of the Education Program at this college. Participants included seventeen (52%) elementary teaching students, five (15%) middle grade teaching students, and 11(33%) secondary teaching students. Their average age was 20.26 ($SD=.90$) and their average grade point average was 3.61 ($SD=.28$)

2.2 Research Design

This study used a non-experimental quantitative mixed-method research design.

2.3 Data-collection Methods

In order to assess participants' SRLB and EB, a self-report questionnaire consisting of two sections was used. The first section, measuring SRLB, included the 10 items from the Self-Regulated Learning Teacher Beliefs Scale [SRLTB;46]. The measure provides the participant with an operational definition of SRL and an example of self-regulation. Sample items include, "Students should be able to make decisions about the sequence and duration of their learning activities" and, "students have the capacity to determine what they want to learn." Each question was answered on a 5-point Likert-type scale (1: Strongly Disagree, 2: Disagree, 3: Neither Agree/Disagree, 4: Agree, and 5: Strongly Agree).The Cronbach's alpha reliability of the 10-item measure of SRLTB was .87.The second section, measuring EB, included 32 questions from the Epistemic Belief Inventory [EBI; 47]. These questions relate to five dimensions of personal epistemology modeled after Schommer's [39] inventory: Omniscient authority, certain knowledge, quick learning, simple knowledge, and innate ability. Research demonstrates adequate reliability [48], ranging from .80 for innate ability to .51 for quick learning.

Two measures were used to assess the participants' views of effective instructional practices. First, participants completed a self-report questionnaire that assessed their views on traditional and constructivist approaches to teaching [49]. This measure includes 21 questions (e.g., "The focus of teaching is to help student construct knowledge" and "Teaching is to provide students with accurate and complete knowledge rather than encourage them to discover it") answered by a 5-point Likert-type scale (1: Never, 2: Rarely, 3: Sometimes, 4: Often, and 5: Always).Research demonstrates adequate reliability [49], with .84 for both the Traditional and Constructivist subscales. Second, a concurrent think-aloud protocol was used as the participants evaluated two lesson plans from their content

area (see the Procedure section for more detail on the lesson plans). Concurrent think-aloud protocols are deeply rooted in cognitive psychology and provide a valid measure, if appropriately applied, to collect process data. In the context of this study, the think-aloud provided real-time data on pre-service teachers' evaluation of instructional practices within a lesson plan. During the think-aloud, participants shared words, thoughts and phrases (indicators), a process Glaser [50] referred to as "the concept-indicator model" (p.62-63). The think-alouds were audio recorded and then transcribed verbatim by one of the researchers or research assistants. The researchers independently engaged in open coding of the transcripts, guided by the questions "What is going on?" and "What is being referenced here"? Through discussions, the researchers collaboratively developed categories based on the relationship between properties of the codes [51]. The process resulted in three "macro" level codes, each comprised of individual "micro" level codes, which were used for the data analyses¹. The transcript from each participant was coded. These codes provided quantitative data on the extent to which participants' evaluated the lesson plan's support of SRL, the student-centered nature of the lesson plan, and the overall format of the lesson plan. The two authors established inter-rater reliability by independently coding the think-alouds from eight participants (27%). There was agreement on 123 of the 130 codes, resulting in an agreement of 94%. Disagreements were resolved through discussion.

2.4 Procedure

The first of second author individually ran each participant in a research setting. Following the consent form, the participant completed a self-report questionnaire measuring SRLB, EB, and their views of effective instructional practice. The researcher then read the directions to the participant, which included an overview of the think-aloud protocol. Next, the participant practiced thinking-aloud by evaluating a lesson plan outside of their content area. The participant was explicitly told that this step served as think-aloud training. Following this training session, the participant was asked to think-aloud as they evaluated two lesson plans. Directions for the lesson plan evaluation were, "As you look at the lesson plan, please evaluate its effectiveness and identify specific pieces of evidence to support your answer." Each participant evaluated one lesson plan that included features that supported SRL and one lesson plan that did not support SRL. Guidelines put forth by Perry and colleagues [52] were used to identify the extent to which the lesson plans support SRL. The presentation of the lessons was counterbalanced across participants. The experimental session averaged one hour for each participant.

3. RESULT

The responses to all research questions were analyzed with the SPSS version 22.0 statistical package. The first research question addressed the extent to which pre-service teachers' EB and SRLB are related to their views of instructional practices. In order to address the first research question, two stepwise regressions were run. In both regressions, dimensions of EB and SRLB were used as independent variables and view of instruction (constructivist/traditional) was used as the dependent variable. The first stepwise regression revealed that views of constructivist teaching was significantly predicted by two dimensions of epistemological beliefs, $R^2=.25$, $F(1,32)=4.927$, $p=.014$. Participants with more

¹ The three macro level codes were: (1) Self-regulated learning comments (comprised of the following micro codes: "student choice" and "control of challenges"); (2) Student-centered comments (comprised of the following micro codes: "developmental considerations", "student motivation", and "student learning"); and Lesson plan (comprised of the following micro codes: "chronology", "assessment", "content", and "modification").

sophisticated views of certain knowledge and innate ability viewed constructivist teaching as more effective see Table 1 below. A second stepwise regression revealed that none of the participants' personal beliefs significantly predicted their views of traditional teaching.

Table 1. Summary of step-wise multiple regression analysis for constructivist view of teaching

Variables	B	SE B	β
Certain Knowledge	-0.288	0.112	-0.414
Innate Ability	-0.174	0.079	-0.351
R^2		.25	
F for change in R^2		4.927	

The second research question addressed the extent to which pre-service teachers' views of instructional practices are related to their perceptions of lesson plans. In order to address the second research question, three stepwise regressions were run. In the regressions, views of instructional practice (constructivist/traditional) were used as independent variables and the macro level codes from the think-aloud were used as dependent variables. Think-aloud data from three participants could not be reliably coded due to poor audio quality. Thus, the following analyses were based on 30 respondents only. The first stepwise regression revealed that the participants' evaluation of self-regulated learning in the lesson plan was significantly predicted by their view of constructivist instructional practice, $R^2=.14$, $F(1,29)=4.575$, $p=.04$. Participants with stronger constructivist views of teaching made significantly more evaluations based on the lesson plan's support of self-regulated learning see Table 2 below.

Table 2. Summary of step-wise multiple regression analysis for lesson plan's support of SRL

Variables	B	SE B	β
Constructivist View	1.784	0.834	0.375
R^2		.14	
F for change in R^2		4.575	

A second stepwise regression revealed that the extent to which the participants evaluated the student-centered nature of the lesson plan was significantly predicted by their view of a more traditional instructional practice, $R^2=.17$, $F(1,29)=5.823$, $p=.04$. Specifically, participants with stronger traditional views of teaching made significantly fewer evaluations on the student-centered nature of the lesson plan see Table 3 below.

Table 3. Summary of step-wise multiple regression analysis for student-centered nature of lesson plan

Variables	B	SE B	β
Traditional Views	-2.653	1.099	-0.415
R^2		.17	
F for change in R^2		4.575	

Lastly, a third stepwise regression indicated that the neither a traditional nor a constructivist view of teaching predicted the extent to which the participants evaluated the assessment, modifications, or content clarity of the lesson plan see Table 4 for descriptive statistics.

Self-regulated learning comments (comprised of the following micro codes: “student choice” and “control of challenges”); (2) Student-centered comments (comprised of the following micro codes: “developmental considerations”, “student motivation”, and “student learning”); and Lesson plan (comprised of the following micro codes: “chronology”, “assessment”, “content”, and “modification

Table 4. Means and standard deviations

Variable	Mean (Standard Deviation)
Constructivist views of Teaching	4.39(0.21)
Traditional views of Teaching	2.32(0.33)
Self-regulated evaluation of lesson plans	1.11(1.29)
Student-centered evaluation of lesson plans	5.53(2.69)
Overall evaluation of lesson plan	10.74(5.35)
Simple knowledge	2.71(0.29)
Certain knowledge	2.13(0.31)
Innate ability	2.34(0.46)
Omniscient authority	3.01(0.52)
Quick learning	1.81(0.26)

4. DISCUSSION

The assumption that students actively construct knowledge in an idiosyncratic process is both theoretically grounded [53] and empirically validated. Not surprisingly, then, teacher education programs tend to emphasize instructional practices that support active learning and model classroom environments in which the teacher acts as a facilitator instead of a prescriber of knowledge. Recently, there has been a call for empirical research to examine individual characteristics of pre-service teachers that affect views of such instructional practices [3]. While the role of personal beliefs in the construction of knowledge has been empirically documented and theoretically grounded, this relationship has not received as much attention with pre-service teachers. Presumably, personal beliefs have the potential to act as a “filter” while pre-service teachers form their views on instructional practices. This study sought to examine the broad issue relating to personal beliefs and pre-service teachers’ views of effective instructional practice. The first set of findings indicates that participants with more sophisticated views of certain knowledge and innate ability viewed a constructivist approach to teaching as more effective. These findings suggest that personal beliefs, and in particular personal epistemology, affect how pre-service teachers view effective classroom practices. Results from the think-aloud protocol further support this assumption. Participants with stronger constructivist views of teaching made significantly more evaluations based on the lesson plan’s support self-regulated learning. Additionally, evaluations on the student-centered nature of the lesson plan were negatively associated traditional views of teaching. Thus, the differences in how these participants evaluated lesson plans can be explained, at least in part, by their personal beliefs.

The Information Processing Theory provides a theoretical framework to explain the mechanisms that account for these findings. In essence, this theory assumes that attention

mechanisms identify a subset of information in the environment, which is then given idiosyncratic meaning by the individual. The information is moved through to working memory and, if learning processes such as rehearsal and elaboration are deployed, the information is processed into the long-term memory. Metacognition is assumed to be the executive functioning of this processing system. The 1970s saw the emergence of metacognition, highlighted by Flavell's theoretical conception [54]. Originally conceptualized as "thinking about thinking", metacognition is now viewed as a construct that focuses on processes related to the abstraction of existing or new cognitive structures [55]. In the beginning steps of processing information, metacognition assumes the executive functioning of guiding the individual's attention. In the case of this study, participants (pre-service teachers) were asked to process information in the context of evaluating lesson plans. The first step of this process, according to the Information Processing Theory, occurred when the pre-service teachers selected the information to evaluate in the lesson plan. The question to be answered was: Did all of the pre-service teachers pay attention to the same information in the lesson plans? The think-aloud suggests qualitative differences; some participants made fewer evaluations based on the student-centered nature of the lesson plan, for example. These findings suggest that metacognition and personal epistemology interact when pre-service teachers process information. A growing body of research supports this connection [56-58] with assertions that epistemological beliefs are 'internal conditions of learning' and linked with process related to self-regulation, including metacognition. These theoretical considerations provided the frameworks for the discussion of the practical implications in the following subsection.

4.1 Practical Implications

This study suggests that teacher programs will be most effective only when personal beliefs of pre-service teachers are explicitly accounted for in the program. This need is highlighted when personal beliefs are inconsistent with underlying assumptions of effective practices in teacher education programs. It is logical to imagine, for example, a pre-service teacher who believes that knowledge is absolute will also believe that it is the teacher's role to provide students with a standardized interpretation of this knowledge. How will this pre-service teacher view instructional practices that call for discovery learning and classroom environments in which the teacher acts as a facilitator? Research from this study suggest that personal epistemologies guide how students evaluate lesson plans, with more sophisticated views of knowledge positively related to evaluation of the student-centered nature of a lesson plan and its support of self-regulated learning. Given this connection between personal epistemology and pre-service teachers' developing views of instructional practice, implications arise as to how teacher education programs can simultaneously support developing views of knowledge and instructional practice. Left unattended, these deep and seemingly robust personal epistemological beliefs may undermine the accommodation of new knowledge, particularly as it relates to developing views of effective classroom practices.

How can teacher education programs address the personal beliefs of pre-service teachers? While research suggests that various dimensions of personal epistemology tend to be resilient to change, past research has identified distinct components of teacher education programs that promote increased sophistication. For example, Tatto [59] came to the conclusion that teacher education programs with a cohesive conceptual framework integrated across its courses was positively related to the development of more sophisticated epistemological views. A specific example of such a conceptual framework can be found in the teacher education program of Gustavus Adolphus College (Saint Peter, MN,

USA). This conceptual framework, which is grounded in the notion that teaching is a “principled practice” see Fig. 1, guides the design of the teacher education program at this small liberal arts college.

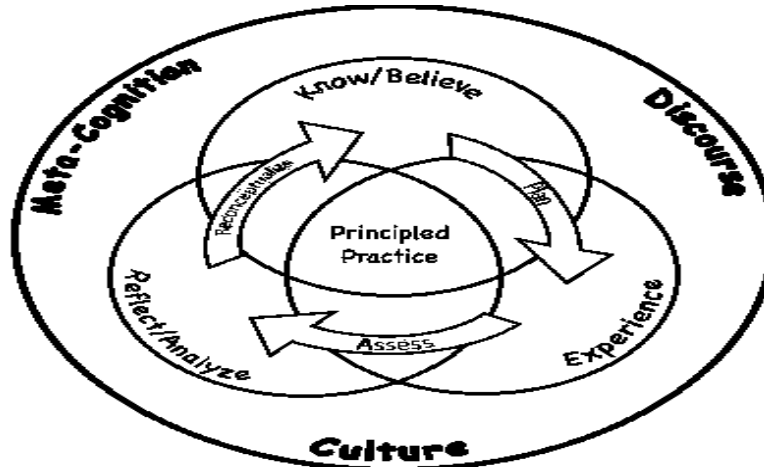


Fig. 1. Conceptual framework

This framework was initially developed around five attributes of a teacher education program knowledge base presented by Galluzzo and Pankratz [60]. In 2011, the conceptual framework was redesigned to more fully reflect the philosophy of the program, the current research literature, and evaluation procedures that provide feedback to the candidates in the program. All education courses in this program explicitly incorporate this conceptual framework to assist candidates in acquiring skills of analysis and reflection, a broad knowledge base, and an array of experiences that will enable them to articulate and examine their own beliefs about teaching and learning. The conceptual framework is shared with pre-service teachers at various orientation points during initial advising, at pre-admission orientation meetings, at the orientation for newly admitted candidates, and in education courses throughout the program. Finally, the candidates are asked to reflect on their beliefs during student teaching and how experiences throughout the program have facilitated change in these beliefs. This broadly shared conceptual model provides regular opportunities for pre-service teachers to explore their changing personal beliefs as they progress through the teacher education program.

4.2 Future Directions

While the field of personal epistemology is robust, limited research in this field has examined the relationship between pre-service teachers’ epistemological beliefs and their actual practices in classrooms. Take the hypothetical pre-service teacher who begins a program with naïve views of knowledge, as evidenced by the belief that the most effective instructional practice is to quickly transmit a standardized interpretation of knowledge to students. Further imagine that this individual is in a program guided by a conceptual framework emphasizing the role of personal beliefs and the importance of experience in re-conceptualizing these beliefs. This particular pre-service teacher may change his or her beliefs and enter student teaching with the desire to engage in more constructivist approaches to learning. Will these changed beliefs lead to altered practices at the conclusion

of a teacher education program? Furthermore, how can programs support developing views of their pre-service teachers, particularly during student teaching? Perry, Hutchinson, and Thauberger [61] presents findings that a variety of scaffolding techniques during discussions with student teachers can effectively develop their willingness and ability to engage in instructional practices that align with more sophisticated views of knowledge. This potential for student teachers to modify thinking as it relates to knowledge and effective instructional practices have been replicated by others studies [61]. Explicit instruction and direct scaffolding in education courses and during student teaching can assist pre-service teachers' implementation of classroom practices that support SRL [61] and reflect more sophisticated views of knowledge. Future research would be well served to continue to examine practices in teacher education programs that foster changes in personal beliefs.

The effect of personal beliefs on other commonly experienced events for pre-service teachers is another area of future research. For example, novice teachers often report feeling overwhelmed, which is not surprising given the extensive nature of information requiring a teacher's attention. The Cognitive Load Theory (CLT) has been used to explain the cognitive effect of these demands on teachers [19]. This theory describes the relationship between the development of an individual's knowledge base, represented as mental models, and the cognitive resources needed to retrieve relevant knowledge [62-66]. Through extensive and deliberate practice, mental models become increasingly sophisticated and require less conscious effort to retrieve. Expertise, a product of extensive practice, allows for the execution of a task and/or retrieval of knowledge to occur unconsciously. Within the context of the classroom, novice teachers may feel overwhelmed by the vast array of information demanding attention. Expert teachers, on the other hand, have sophisticated mental models that allow for unconscious retrieval of knowledge to meet these demands, thus decreasing their feelings of being overwhelmed. Novice teachers, on the other hand, may rely on a "fast and frugal" reasoning strategy due to cognitive overload. Despite a novice teacher's desire to implement an instructional practices that support SRL, as might be advocated in a pre-service education program, he or she may instead rely on a more authority-based approach because of the experienced cognitive overload. The effect of cognitive load during student teaching has received little empirical attention, particularly in terms of its interaction with personal beliefs and views of instructional practices. Additional research examining the complex relationship between these personal characteristics of pre-service teachers will deepen the understanding of their development and behaviors in the classroom.

4.3 Limitations

This study has two limitations that should be addressed in future research, both of which are related to the methodology. Firstly, A concurrent think-aloud protocol was used to examine how pre-service teachers evaluate lessons in real time. The think aloud has an extensive history in cognitive psychology and cognitive science. Cognitive psychology and cognitive science have used both concurrent and retrospective think aloud protocols as data sources for cognitive processes. While this protocol has been demonstrated to be an excellent tool to gather process data, it is time-intensive. After each participant is audio-recorded, the tape needs to be transcribed, coded, and then finally re-coded to establish inter-rater reliability. This process yields rich data and illuminates cognitive process during an event. However, the sample size of this study was small due to the time-intensive nature of the chosen protocol.

Secondly, the Epistemic Belief Inventory was used to assess the pre-service teachers' personal epistemologies. The self-report questions in this measure relate to five dimensions of personal epistemology: Omniscient authority, certain knowledge, quick learning, simple knowledge, and innate ability. Acceptable reliability and validity has been demonstrated in previous research [67]. However, there has been a recent call to re-visit this instrument due to concerns of validity, particularly with the use of more diverse students. Researchers have further articulated the challenges of measuring epistemic beliefs with self-report questionnaires, noting concerns with factor structure and other validity issues [68].

5. CONCLUSION

It has long been assumed that learning is an active and constructive process resulting from an interaction between prior knowledge and mental representations of new information. This study, grounded in Epistemology and Self-Regulated Learning, examined the relationships between pre-service teachers' personal beliefs and their views of instructional practice. Participants, individually run through the study, completed a self-report questionnaire (measuring epistemological beliefs, self-regulated learning beliefs, and views of instruction), and thought aloud as they evaluated two lesson plans. Participants with more sophisticated views of certain knowledge and innate ability viewed a constructivist approach as more effective. Additionally, participants with constructivist views of teaching evaluated the lesson plan based on its support of self-regulated learning. Finally, participants with traditional views of teaching made fewer evaluations of the student-centered nature of the lesson plan. These findings highlight the importance of pre-service teachers' personal beliefs in their developing views of effective instruction.

CONSENT

All authors declare that 'written informed consent was obtained from the patient (or other approved parties) for publication of this case report and accompanying images.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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