

A Study of Classroom Inquiry and Reflection Among Preservice Teachers Candidates

Étude d'une approche d'expérimentation et de réflexions en classe auprès de candidats à la profession enseignante

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Article abstract

The purpose of this study was to explore the experiences of four preservice teachers who used classroom inquiry and reflection to solve problems when implementing differentiated instruction in elementary classrooms during a practicum. Data from classroom observations, individual reflections, and discussions with a teacher educator were analyzed inductively. The findings show that the preservice teachers were able to describe their situations and reflect individually and collaboratively to analyze and resolve problems related to instruction, discipline, and student learning. The results extend our understanding of how teacher educators, mentors, or instructional coaches may provide preservice teachers with individualized support that can facilitate inquiry and reflection during their practica.

A STUDY OF CLASSROOM INQUIRY AND REFLECTION AMONG PRESERVICE TEACHERS CANDIDATES

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ABSTRACT. The purpose of this study was to explore the experiences of four preservice teachers who used classroom inquiry and reflection to solve problems when implementing differentiated instruction in elementary classrooms during a practicum. Data from classroom observations, individual reflections, and discussions with a teacher educator were analyzed inductively. The findings show that the preservice teachers were able to describe their situations and reflect individually and collaboratively to analyze and resolve problems related to instruction, discipline, and student learning. The results extend our understanding of how teacher educators, mentors, or instructional coaches may provide preservice teachers with individualized support that can facilitate inquiry and reflection during their practica.

ÉTUDE D'UNE APPROCHE D'EXPÉRIMENTATION ET DE RÉFLEXIONS EN CLASSE AU-PRÈS DE CANDIDATS À LA PROFESSION ENSEIGNANTE

RÉSUMÉ. L'objectif de ce projet de recherche était d'étudier l'expérience vécue par quatre futurs enseignants en contexte de stage. Ceux-ci ont utilisé une approche basée sur l'expérimentation et la réflexion pour résoudre des problématiques rencontrées lors de la mise en œuvre de pratiques de différenciation. Pour ce faire, les auteurs ont effectué une analyse inductive des données recueillies lors d'observations en classe et suite à des réflexions individuelles et des discussions réalisées avec un formateur de maîtres. Les résultats démontrent que les futurs enseignants sont en mesure de décrire leur situation et de réfléchir, individuellement ou en mode collaboratif, pour analyser et trouver des solutions aux problèmes liés à l'enseignement, la discipline et l'apprentissage des élèves. Ces résultats approfondissent notre compréhension de la manière dont les formateurs, les mentors et les conseillers pédagogiques peuvent prodiguer un soutien individualisé aux futurs enseignants, facilitant l'expérimentation et la réflexion en cours de stage.

Classroom inquiry is a way to improve teacher quality by producing informal knowledge that has the potential to inform practice. It is a type of educational research in which teachers study their classrooms in order to improve their own practice and the students' learning (Hubbard & Power, 1993; Richardson, 1994): identifying a problem, systematically collecting data, and reflecting on and analyzing the data of the everyday work in schools (Cochran-Smith & Lytle, 2009; Darling-Hammond, 2006). This approach assumes that teachers can be "expert knowers about their own students and classrooms" (Cochran-Smith & Lytle, 2009, p. 16) and that they can function as teacher researchers of their own practices (Duckworth, 1987; Richardson, 1994). During their practica, even preservice teachers (PSTs) can use inquiry and reflection to resolve tensions and develop informal or personal knowledge about classroom practice that may improve student learning outcomes (Rich & Hannafin, 2008; Schulz & Mandzuk, 2005), thus improving teacher quality. Recent research shows a relationship between teacher quality and student achievement (Clarke & Fourmillier, 2012; Darling-Hammond, 2006; Kunter et al., 2013). Cochran-Smith and Fries (2005) define teacher quality as all teacher-related characteristics that produce favourable educational outcomes for students. While one way to improve teacher quality is to focus on the formal learning opportunities found in teacher education programs (Anderson et al., 1995; Shulman, 1998) and particularly on the acquisition of profession-specific knowledge through coursework, another way is through the informal opportunities for teacher learning while in the field of practice

Reflection in teacher education programs

One of the components of classroom inquiry is reflection, described by Van Manen (1991) as a mental action that distances the person from events in order that they may be viewed in an objective manner. Reflection involves thinking about past or ongoing experiences or events, situations, or actions so as to make sense of them, with a view to informing future choices, decisions, or actions (Dewey, 1938). Schön (1991) has described reflection as problem-solving for the purpose of gaining insights into a problem and developing a plan of action to resolve it. Reflection is a mechanism for improving practice and involves framing and re-framing a problem according to one's values (e.g., improving student outcomes, Ghaye et al., 2008).

Reflection is taught in teacher education programs to PSTs who typically reflect on incidents occurring during their practica (Moon, 2001). PSTs are often required to record data from their practicum experiences in journals or videos with the intent of reflecting later and learning from experience (Gelfuso & Dennis, 2014; Hatton & Smith, 1995; Moon, 2001). Reflection can occur individually, such as when engaging in journal writing or collaboratively when discussing incidents with peers or a more knowledgeable individual (e.g., a teacher educator, Hatton & Smith, 1995; Moon, 2001).

Gelfuso and Dennis (2014) make the point that without support structures provided by teacher educators, PSTs may only describe events as they reflect on classroom experiences (low level reflection), particularly when reflection occurs in isolation. These researchers found that PSTs engage in higher levels of reflection when support structures are in place (Gelfuso & Dennis, 2014). In their study of 13 PSTs in a residency program conducted in two phases during one academic year, Gelfuso and Dennis (2014) used three types of structures to support reflection: videos, prompts, and conversations with professors. After completing the first phase of their research, they found that videos of PSTs' teaching were useful for capturing data. However, their participants were not placing an emphasis on teaching and learning when they coded their videos. The participants were left with a novice's understanding of teaching and learning gleaned from coursework and their "apprenticeship of observation" (Lortie, 1975). Conversations with university supervisors resulted mostly in descriptions of events and the participants' feelings about them. In other words, at the end of the first phase, the PSTs were not able to develop "warranted assertabilities" (Dewey, 1986), or knowledge gained through inquiry that is subject to continued testing, about teaching and learning. Hence, the researchers introduced prompts about effective literacy instruction to guide reflection (e.g., balanced, comprehensive instruction; a lot of reading and writing; skills explicitly taught and coached; and use of a wide variety of materials). They also decided to revamp their discussions with the PSTs to encourage analysis and synthesis. By the end of the second phase of the study, Gelfuso and Dennis (2014) concluded that the framework for analyzing teaching alone was insufficient. They suggested that "more knowledgeable others" (Vygotsky, 1978) can help PSTs analyze and synthesize during collaborative reflection and that these play an important role in the development of the reflective skills. They called for further research to understand reflection and its development of reflection among PSTs, as well as the effects of various support structures, particularly how knowledgeable others may propel reflective thought (Gelfuso & Dennis, 2014). The research on which this article is based is in response to that call.

Further, several authors have described typologies that may be used to categorize reflection (Hatton & Smith, 1995; Jay & Johnson, 2002; Van Manen, 1991). Ward and McCotter (2004) proposed a framework consisting of four levels of reflection as a means of examining and understanding the development of PSTs' reflection. The first level of reflection is *routine* in which the focus is on the self and blame is attributed to others or on little time and few resources. There is a lack of questioning and little sense of responsibility for change. The next level is *technical* and is centred on how to improve the implementation of a strategy or technique. There is no questioning of the appropriateness of the practice or the perspectives of students. While the PST is committed to improvement, reflection is limited to how the individual can improve the execution of a strategy. The third level of reflection is *dialogic* in which

the views and perspectives of others are considered. At this level, the PST is often concerned with the achievement of a struggling student and develops new insights about teaching and learning. The fourth level of reflection is *transformational* and involves a long-term, ongoing inquiry in which personal beliefs are questioned, leading to fundamental changes in practice. PSTs rarely reach this level of broad reflection because they are so often occupied by the day-to-day tasks of teaching (Ward & McCotter, 2004).

In regard to the third level of reflection (dialogic), Ward and McCotter (2004) contend that PSTs *can* develop insights about teaching and learning. However, research by Gelfuso and Dennis (2014) demonstrated that on their own, PSTs were only able to engage in low levels of reflection. They were not able to develop personal, practical knowledge. It was only during collaborative reflection with a knowledgeable other that the participants were able to analyze and synthesize the classroom data they collected.

In the present study, classroom inquiry was defined as a process whereby PSTs identify tensions in their emerging practice during a practicum (e.g., tensions related to student learning and discipline) and use reflection to analyze the problems, decide on future actions, and assess the effectiveness of the approaches on student outcomes. Reflection may be done individually by the PST or collaboratively with a teacher educator, and it may be categorized according to four levels (Ward & McCotter, 2004). Classroom inquiry and reflection help PSTs develop personal and practical knowledge about their students and refine their instructional practices in a way that will respond to student learning needs. Although the process is most powerful when it reviews and builds on each cycle of inquiry, these cycles are often limited by the short time period of the practicum.

The purpose of the research reported here was to explore the experiences of PSTs as they engaged in classroom inquiry and reflected on the implementation of differentiated instruction (DI) during a practicum placement. Two support structures were provided: guided questions for daily data collection and reflection and weekly discussions about implementation of DI with a teacher educator. The research questions were: (1) What were the PSTs' experiences using classroom inquiry when implementing DI? (2) What levels of reflection were achieved by the PSTs? (3) What was the role of the teacher educator?

CONTEXT OF THIS STUDY

This research was conducted in the province of Ontario, where the participants were registered in a one-year, post-degree teacher education program offered in the primary and junior divisions (Kindergarten to Grade 6). There were two practica: one in the fall (4 weeks) and another in the spring (4.5 weeks). The PSTs were assigned to one practicum in each division during the program. The province adopted an inclusive policy and DI is recognized and promoted by

the Ontario Ministry of Education (2005) as a means of meeting the diverse learning needs of students in the province's classrooms (*Education for All: The Report of the Expert Panel on Literacy and Numeracy Instruction for Students with Special Education Needs, Kindergarten to Grade 6*). All PSTs in this teacher education program were required to take a course in special education and DI is an important component of it.

DI is an approach to teaching that purports to meet the diverse needs of students in general education classrooms. It is generally defined as a way of teaching in which teachers modify curriculum, instructional methods, resources, learning activities, and student products as a means of addressing the range of learning needs among students (Tomlinson, 2001). It is posited that the flexibility of DI instructional and assessment methods provides opportunities for students to align their learning strengths and needs with the options available (Tomlinson et al., 2003).

Wertheim and Leyser (2002) make a case for including DI in preservice programs. They argue that it provides additional knowledge for PSTs enrolled in general education programs because it emphasizes the development of skills required for the successful teaching of students with diverse learning and behavioural needs. Other researchers contend that if PSTs are to be prepared to work with diverse learners, then they need to learn about DI, develop beliefs about it, and have the opportunity to acquire skills using it while in their teacher education programs (Edwards, Carr, & Siegel, 2006; Goodnough, 2010). The PSTs in this particular teacher education program learned about DI and had opportunities to develop skills using it in their practica. The experiences of four PSTs engaged in classroom inquiry while implementing DI and their reflections on them are reported here.

METHODOLOGY

This project was carried out in two phases according to the two practica undertaken by the PSTs: the first phase was in the fall and the second phase was scheduled in the spring. A description of the participants, data collection methods, data analysis, trustworthiness indicators, and limitations follows.

Participants

Four PSTs registered in the teacher education program offered at the primary/junior level volunteered to participate in this research. The PSTs ranged in age from early twenties to late forties. The three females and one male (Lisa, Toni, Jane, and Karl – pseudonyms) had all earned an undergraduate degree and two held qualifications in other areas. Teaching was not the first career for the three older participants, and they were drawn to it because they enjoyed working with children and felt teaching was a good fit for them.

Lisa was assigned to a junior / senior kindergarten combined class (ages 4-5) and observed that of her 25 students, only five were girls. Jane was in a junior kindergarten classroom (age 4) and her students were evenly divided between girls and boys. In Ontario, four- and five-year olds attend kindergarten on a full-time basis. The curriculum is play-based and facilitated by a teacher and an early childhood educator (ECE).

Toni was placed in a grade 4 class in which she taught math and language arts and she also instructed math to a grade 6 class. Karl did his practicum in a combined grade 4/5 classroom where he taught all subjects. Like Jane, Toni and Karl observed that there was an even distribution of girls and boys. They also noticed that there was a range of ability levels among their students and that many of them had individual education plans (30% of Karl's students). Another observation they both made was that a few of their students seemed to have internalized the notion that they were not capable of doing the work and in some cases were no longer interested in completing the assignments. All of their associate teachers supported the use of DI strategies during the practicum.

Recruitment

This project was implemented in two phases. Lisa was recruited in phase one, which occurred during the fall practicum. She responded to a request made by the teacher educator (and first author) to a colleague teaching the special education course for a PST to participate in the first phase of the study. The other three participants were recruited by the teacher educator, who spoke to some classes about phase two of the research. Three PSTs contacted her and expressed an interest in participating in the study. The teacher educator did not teach any courses to these four PSTs and was not involved in supervising or evaluating their practica. This study followed university ethical research protocol and was approved by the Research Ethics Board.

Data collection

In the first phase of the research, a pilot study was carried out with Lisa during the four-week practicum in the fall of the academic year. She was registered in the special education course offered in the teacher education program and had learned about DI. This information was supplemented by the teacher educator who gave her a description of various DI strategies (see Table 1). Instead of keeping a journal, Lisa was given a form on which she recorded the strategies she used (see Table 2). It was intended to help her organize her daily observations and reflections on the DI strategies she implemented. Questions such as "Are the expectations / learning goals for the lesson being met?," "How do you know?," "What went well?," "What needs improvement?," and "Next steps" served as prompts to guide the type of thinking that might otherwise not occur if she were merely describing events in a journal.

Table 1. Differentiated strategies

Strategy	Description
Observe students	Develop an understanding of students' skill levels and interests to inform instruction.
Learning channels (VAKT)	VAKT (visual, auditory, kinesthetic, and tactile) – use pictures and manipulatives + key words to describe concepts, demonstrate what to do + key words to show students what to do, use at least two learning channels
Cognitive supports	Use scaffolding (bridge understanding through demonstration or explanation from what the students know now to what you expect them to know at the end of the lesson), give students enough time to practice and provide feedback on what they are doing to ensure accuracy and to build fluency, use direct instruction, chunk or divide concepts into management parts + key words, provide explicit explanations and instructions + key words
Extension and Remediation	Plan extension activities for students who finish their work early, use Bloom's Taxonomy (especially application, analysis, synthesis, and evaluation) in questioning and activities. Work with individuals and small groups of students as often as possible to remediate by re-explaining instructions or concepts.
Small Group Work	Use partner work and cooperative learning.
Gardner's Multiple Intelligences	Use Gardner's multiple intelligences.
Tiered Assignments	Provide materials and assignments at varied levels to meet the needs of weaker and stronger learners.

NOTE. Adapted from *Education for All: Report of the Expert Panel on Literacy and Numeracy Instruction for Students with Special Needs, Kindergarten to Grade 6* by the Ontario Ministry of Education (2005) and "The Differentiated Classroom: Responding to the Needs of all Learners" by Tomlinson (1999).

Weekly conversations with the teacher educator were the second structure that supported classroom inquiry and reflection. The teacher educator telephoned Lisa once a week to talk about her experiences implementing differentiated instruction, and the information on the data collection form (see Table 2) helped her recall the events. The conversations followed a pattern adapted from Harrison, Lawson, and Wortley's (2005) trigger event format, with Lisa describing the trigger event. This event usually took the form of a problem encountered when implementing a DI strategy. The nature of the concern was explored and the particular problem was identified. Alternate ways of handling it were then discussed and Lisa used the same DI strategy in a different way the following week. During the next discussion the teacher educator inquired about the revised implementation and asked Lisa what she learned from the situation. The teacher educator took notes during the conversation and they were verbally summarized for Lisa's approval at the end of each discussion.

TABLE 2. *DI research data collection form*

Step	Observations
Name of strategy / strategies	
How it was / they were implemented in the lesson plan	
Expectation / learning goal achieved? How do you know?	
What went well?	
What needs improvement?	
Next steps	

NOTE. Instructions were to write observations and reflections in a journal in the evening, and to use point form notes to fill in the form.

Phase two occurred during the second practicum period in the spring with the other three PSTs participating in this study. They also received supplemental information on DI strategies, were asked to record data on the form, and participated in weekly conferences that were structured similarly to the ones with Lisa. During the last conversation, the teacher educator asked the PSTs in the second phase questions to elicit demographic data and their thoughts on the experience of using DI during their practicum. The questions about DI focused on the utility of DI, advantages and disadvantages, and value of the weekly discussions. The teacher educator documented the answers given by the PSTs and re-read them to each participant. The same questions were sent to Lisa by email and she typed her responses to them.

Data analysis

After the practicum the PSTs submitted their data collection forms to the researcher who coded the entries (Miles & Huberman, 1994). The data were then classified into three categories (DI strategies used, perceived student outcomes, and reflections) and summarized on a table for each PST. The notes from the weekly discussions were re-read, coded, and chunks of data were grouped according to the categories listed above. Then this information was cross-referenced with the data on each summary table. Next, the notes on the weekly discussions were coded according to the four different types of reflection (Ward & McCotter, 2004) and these findings were inserted into each PST's data summary table. Similarities and differences among the participants across the four categories in each of their summary tables were noted. Key words and phrases from the responses to the questions about using DI asked by the teacher educator during the final conversation were underlined and notes were made in the margins. Similarities and differences in these responses were noted and themes emerged.

Trustworthiness

Trustworthiness was established by using credibility and confirmability as the two main indicators that the data were believable and authentic (Freeman, de Marrais, Preissle, Roulston, & St. Pierre, 2007). Mertens (2014) describes credibility as the correspondence between the researcher's portrayal of the participants' views and the way those individuals actually perceive the phenomenon under study. In this research, the participants systematically collected their own data on DI implementation using prepared forms and submitted them to the teacher educator. Additionally, at the end of each telephone conversation, the teacher educator read her notes to the PST. In no cases were there any revisions. A confirmability audit on the PSTs' data and the discussion notes was also conducted to ensure that the information in the summary tables could be traced back to the original sources (Mertens, 2014).

Limitations

One limitation of this study is that the participants did not represent a wider range of the grades taught in elementary schools. The four PSTs were placed in kindergarten and grade 4 classes for their practicum. It is possible that other PSTs did not choose to volunteer because implementing DI did not constitute a personal goal for their practicum. A second limitation is that the participants only told the researcher what they chose to reveal. Although the teacher educator had no reason to question their claims about DI implementation, it would have been useful to speak with their associate teachers and observe them teaching.

FINDINGS

PSTs' experiences using classroom inquiry when implementing DI

All four participants encountered some difficulties in discipline and/or student learning that was linked to their lack of expertise in using specific behavioural or instructional strategies. Three PSTs encountered challenges related to the technical mastery of specific instructional strategies. Using these strategies effectively with the purpose of improving student learning became the focus of their experiences with classroom inquiry. Two PSTs reflected collaboratively with the teacher educator during the weekly conversations. They first described the event and their concerns about it. The teacher educator and PST identified particular elements of the problem and discussed possible ways to resolve it. The PST then implemented the DI strategy differently the following week. For example, during the first discussion with the teacher educator, Lisa revealed that her first attempt at implementing group work with her young students ended in "chaos." She observed that they did not learn much because they were too distracted. The teacher educator suggested reducing the size of each group, providing closer supervision, and using the cooperative learning ap-

proach of assigning each group member a specific task to perform. During the next week, Lisa divided the students into pairs and gave them an activity that was highly structured and required the active involvement of each partner. With the help of the ECE, close supervision of the students ensured that they remained on task and received immediate feedback and remediation if required. The students were able to complete the task and Lisa's observations of their work led her to believe that they had met the learning expectations. By the third week of her practicum, Lisa was using cooperative learning with groups of four in a math unit on measurement, and she later wrote on her data collection form, "cooperative learning was the only real means of [using] small groups that worked." In this case, through classroom inquiry and collaborative reflection, Lisa was able to develop practical knowledge about how to structure group work that helped her resolve a specific problem.

Like Lisa, Toni identified some challenges with cooperative group work early in the practicum, and after discussing the problem and alternative ways to organize the groups with the teacher educator, she was able to resolve this difficulty. Toni also wanted to meet the needs of the diverse learners in her classroom, particularly in language arts. After reviewing the list of DI strategies provided by the teacher educator, she decided to try tiered assignments in which the reading material for each group was directed to their comprehension levels. She hoped to meet the needs of both the more advanced and weaker readers in her class. She reflected on her data collection form that "providing different articles to coincide with different [reading] levels was great because there was no competition to come up with the best answers." In this case, Toni reflected individually to understand the problem and consider alternate approaches.

In the third week, Karl was concerned that some of his students did not fully understand the ideas and concepts he was presenting in his math lessons. During the next telephone conversation he explained that he reflected on his own about the organization of his lessons and considered other ways to structure them. After reviewing the list of DI strategies, he decided to break up his math lessons into smaller chunks and summarize concepts in each section using a few key words. He used key words ("base ten" and "place holder") to emphasize important concepts. When he began teaching fractions the following week, he summarized the concept of fractions by using the phrase "part / whole." Karl described this change as the "biggest shift in my teaching" and as he noted in his data collection form and during the weekly discussion, it also improved the students' learning.

Jane's problem did not involve DI strategies or student learning; it was related to behavioural management. She was having trouble controlling the fidgety behaviour of her young students during transition times. She and the teacher educator discussed her data to gain a better understanding of the problem and possible ways to address the situation. Although it was not clear if she

implemented any of the strategies suggested by the teacher educator, she did report that transitions were flowing smoothly during the third week when she was teaching full-time.

Levels of reflection achieved by the PSTs

Reflection is an important component of classroom inquiry, and data from the data collection forms and weekly conversations with the teacher educator were analyzed to distinguish between the four levels of reflection developed by Ward and McCotter (2004). The first level of reflection is *routine*, attributing blame to others when things do not go well with their lessons. In a conversation with the teacher educator early in the practicum, Jane described her problem with discipline during transition times and blamed the teachers who came to the classroom to provide specific instruction for arriving late. While she was eager to resolve this problem, she attributed the cause of the students' misbehaviour to others.

Ward and McCotter's (2004) second level of reflection is *technical*, as when PSTs are concerned with improving the implementation of a strategy or technique. Toni, Lisa, and Karl all engaged in this type of reflection to resolve issues they had when implementing cooperative learning. For example, Toni's first attempt at using group work in math with her grade 4 class did not go as planned. One girl was "in tears" because she couldn't understand how to solve the equation and Toni concluded that she had organized this group incorrectly. She described what happened, and the teacher educator helped her determine areas that could be changed and recommended other ways to select the groups and structure the activities. Toni was eager to refine the execution of this strategy so that cooperative learning activities would be an effective way for the students to learn. She implemented the suggestions the following week and recorded her observations on her data collection form: "The weaker students were able to learn from their stronger peers." In conversation with her the next week, she commented that she felt the change in group structure improved student learning. She also reflected that "in the upcoming fraction unit" she should "designate groups of four with closer [ability] levels." In this case, improving student learning was linked to developing skills in implementing a specific DI strategy. Karl, however, appeared to prefer to reflect on his own about how his practice could be improved. For example, as shown in his data collection form, he also refined his use of cooperative learning and composition of the group members in particular, "I should select some to facilitate effective working and not give them [the students] that option [to self-select] all the time."

Dialogic reflection, the third level, involves a focus on student learning and how to improve it, especially for struggling students (Ward & McCotter, 2004). Evidence of reflecting on the process of student learning was not found on the data collection forms, likely because the questions that served as prompts were directed at implementing various DI strategies. However, the comments

of the participants during the discussions with the teacher educator and their notes on the data collection forms indicated that three of them were deeply concerned about student learning and considered the views of others to gain new insights into how their implementation of DI strategies could facilitate the achievement of the required learning outcomes.

In this research, two of the four participants regularly engaged in collaborative reflection with the teacher educator in which they described their experiences implementing DI strategies and provided some analysis of the situation. The PST and the teacher educator then further analyzed the problem and discussed possible alternatives. This type of conversation occurred most frequently with Toni and Lisa when the implementation of a DI strategy did not work well initially, having a negative effect on student learning. However, the PSTs all reflected on tensions related to their classroom practice on their own. For example, one week Karl was concerned that two or three students did not seem to understand his explanations about place value. He observed that they were struggling and he decided to provide remediation by working individually with them. During the next week's conversation with the teacher educator, he described his observations, reflections, actions, and the successful outcome. The teacher educator followed up by asking him to state what he learned from the experience. He responded, "Sometimes just a quick re-explanation is all a student needs to be able to understand a concept. I learned about the power of one-to-one to help a kid learn a concept." In this case, Karl reflected individually and with the prompt of the teacher educator's questions, he stated what he learned from the incident.

Likewise, Lisa recorded on her data collection form her observation that she had a "very high proportion of kinesthetic learners" who needed more than visual and auditory methods of instruction. She added tactile and kinesthetic approaches to her lesson plans (e.g., play-doh to make geometric shapes, b-bushka dolls to compare heights, and acting out stories). After a math lesson, she wrote on her data collection form that "the kinesthetic learners seemed to really have a 'eureka' moment when they were forced to only feel the weight instead of looking at the object when estimating [how heavy it was]."

Three of the four participants demonstrated that changes in implementation of various DI instructional strategies were motivated by behavioural issues and/or inadequate student learning. During his last conversation with the professor, Karl stated, "If I was not seeing learning, I asked myself what I can do differently to reach these kids." Toni also recognized that it was her job to ensure that each student learned and stated that "I should have a way to get to them." These comments suggest that they took responsibility for student learning and their reflections were motivated by a desire to revise their instructional strategies in order to improve students' understanding of the concepts. They were concerned about the practical aspects of teaching and used reflection to solve

professional problems with a view to developing insights into how to improve their implementation of instructional strategies so that students would achieve the desired learning outcomes.

In the fourth level of reflection (*transformational*), PSTs regularly question their existing personal beliefs and assumptions, which results in the transformations of perspectives and practice. Ward and McCotter (2004) noted that very few PSTs reach this level of reflection in which, over a long period of time, personal beliefs are questioned and fundamental changes in practices are implemented. While there was evidence of reflection among the participants in this study, there were no data to support the observation of transformative reflection within the short practicum period. In summary, the participants engaged in the first three levels of reflection during their practicum. However, most of the reflection was at the second and third levels in which the PSTs were concerned with honing instructional skills, which in turn improved their students' learning.

The role of the teacher educator

The teacher educator telephoned the participants once a week to talk about their experiences implementing differentiated instruction. During the conversations, they were able to describe at least one event related to their execution of a DI strategy that concerned them. The teacher educator listened to their descriptions of the events and their analyses of them. Questions about student outcomes were then asked: Were the students engaged? Were they meeting the learning expectations? These questions helped the PSTs further analyze the situation to deepen their understanding of the particular problem. They also helped to direct the PSTs' thoughts about the students as they worked at mastering a technical aspect of DI. For Lisa and Toni, it was often the case when discussing technical problems that they did not have sufficient experience or information to generate alternate ways of implementing the DI strategies. The teacher educator was able to offer suggestions, which the PSTs implemented and the results were described during the next telephone call. The reflective discussions simultaneously focused on the PSTs' technical competence and student needs, with the aim of improving the quality of their teaching and student achievement.

Like Lisa and Toni, Karl discussed his experiences and reflections on them. He also asked the teacher educator for her perspectives on some situations; however, he seemed to want to address technical problems on his own. With Karl, the teacher educator did more listening than offering suggestions, as he used the description of DI strategies as a prompt to develop alternative actions on his own.

When the teacher educator and Jane spoke on the telephone, she usually described the learning centre she had prepared that week and the ways her kindergarten students used it. She was able to identify how DI had been in-

corporated and from her accounts, it went as planned. She only revealed that problems occurred during some transitions times, and like Karl, she seemed to want to resolve the difficulty on her own. Unlike the other three participants, the teacher educator did not often ask Jane what she learned from the situation, mostly because she seemed reluctant to open up and reveal concerns about her own practice.

For the most part, the PSTs appreciated the opportunity to talk to a teacher educator during their practicum. Toni stated,

[The discussions] helped me talk through scenarios and issues that had come up, and to develop more suitable strategies. The conversations helped me to plan for implementing new strategies that I felt could benefit particular students as I got to know them better, as well as to recognize other strategies I didn't realize I was using.

Karl said that the weekly discussions were "very helpful." He explained that having an experienced teacher to talk things through and hearing her perspective was useful and sometimes changed his thinking about a situation.

In summary, the weekly discussions ensured that the PSTs were implementing DI and engaging in classroom inquiry by collecting descriptive data on their experiences and reflecting on them. Lisa and Toni seemed to be very open to the suggestions made by the teacher educator and Karl was enthusiastic about the opportunity to garner different perspectives on situations. From his accounts, Karl was also able to resolve problems on his own. The data collection sheets completed by these three participants revealed the knowledge they were developing (e.g., cooperative learning, remediation, and tiered instruction). As well, the teacher educator asked them directly what they had learned from their experiences so that they could articulate the practical knowledge they had gained. Jane was content to discuss her work in the classroom and manage issues on her own. Hence, unlike the other participants, the teacher educator's comments and questions did not seem to propel her to higher levels of reflection or help her address problems in her practicum.

DISCUSSION

The purpose of this research was to examine PSTs' experiences using classroom inquiry, levels of reflection, and the role of the teacher educator. The findings for each of the three research questions are discussed below.

Experiences of PSTs using classroom inquiry when implementing DI

The PSTs in this study were motivated to master technical skills in implementing DI as they linked the quality of their own performance to the achievement of the students. They used classroom inquiry to solve classroom problems and in turn developed informal, practical knowledge (Richardson, 1994).

Lisa and Toni had a similar problem when implementing DI: how to manage cooperative group work so that the students achieved the learning goals. Unlike Gelfuso and Dennis' (2014) PSTs, they were able to analyze the particular difficulty and with the additional support of discussions with the teacher educator, they were able to resolve their problems with group work. Other concerns were addressed individually following the pattern modelled by the professor and outcomes were shared during the weekly conversations.

Karl generally conducted classroom inquiry on his own using the description of the DI strategies as a prompt when reflecting on alternatives. He appeared to be capable of describing the problem and analyzing the particular area of concern. Sometimes Karl and the teacher educator collaboratively reflected on possible solutions; however, he usually considered the alternatives individually and implemented them. During the next discussion, Karl described how he had used classroom inquiry on his own to resolve an issue and the teacher educator's comments helped him understand the situation from a new perspective (Rodgers, 2002).

Unlike the other three participants, Jane did not describe any difficulties implementing DI. She did, however, open up about a problem with discipline, which she addressed on her own. Although other ways to manage student behaviour were suggested, it is not known if this support was useful. Unlike Karl, she did not share with the teacher educator how this problem was resolved other than that she had more control over the schedule when she began teaching full-time.

In this study, therefore, three of the four participants demonstrated that they engaged in classroom inquiry to resolve problems encountered during their practicum and, using the data collection form, were able to describe and analyze the particular problems. Two of them regularly reflected collaboratively with the teacher educator to learn how to examine possible changes and implement a solution. One of the PSTs was comfortable using the description of DI strategies as a prompt to generate alternatives and discussed his experiences using classroom inquiry with the teacher educator after the issue had been resolved. They were also able to gain insights into their students and emerging practice (Cochran-Smith & Lytle, 2009). Moreover, they perceived that the experience of implementing DI by conducting inquiry produced informal knowledge that was used to improve their classroom practice and the students' learning (Richardson, 1994).

Levels of reflection used by the PSTs

Unlike the results previously reported by Gelfuso and Dennis (2014), the findings showed that the participants in this study were able to analyze, on their own, those situations in which strategies were poorly implemented. The difficulty faced by these PSTs was in identifying exactly how their implementa-

tion of a DI strategy could be better executed to meet their goal of improved student learning. Discussions with the teacher educator helped them understand alternatives and decide how to make improvements, thereby advancing their reflective skills. This finding is similar to a conclusion made by Gelfuso and Dennis (2014), in which they emphasized the importance of collaborative reflection with a knowledgeable other. However, their participants were not able to identify the knowledge they had acquired from their experiences. In this study the dual structures of the forms and the weekly discussions advanced the participants' reflective skills, contributed to their problem-solving abilities and helped them develop practical, personal knowledge about their use of instructional strategies to achieve the desired student learning outcomes.

All but one of the PSTs in this research demonstrated that they reflected mostly at Ward and McCotter's (2004) technical and dialogic levels of reflection. They were concerned with incidents that had occurred in their classrooms (Moon, 2001) and used Schön's (1983, 1987) "reflection-on-action." Their aim was to "[make] a set of practices work more smoothly and achieve the consequences intended for them" (Brookfield, 2009, p. 294). Specifically, they reflected to resolve problems related to the implementation of some DI strategies more effectively so as to achieve the student learning outcomes outlined in the Ontario curriculum. This attention to the practicalities of teaching may be indicative of the immediate concerns the PSTs had during the practicum: survival and student learning (Schulz & Mandzuk, 2005). Moreover, it is possible that these two concerns occurring simultaneously triggered reflection in order to make sense of the problems and seek solutions. The levels of reflection among these PSTs were not discreet; they overlapped and were interactive and dynamic.

Additionally, none of the participants demonstrated that they engaged in transformational reflection whereby they reflected critically on the process of learning or the assumptions on which the mandated learning outcomes are based (Brookfield, 2009). Their reflections were focused on the "nuts and bolts" of teaching, leaving unquestioned the broader issues related to power structures, hegemony, and personal beliefs (Brookfield, 2009). This phenomenon is not surprising as they were being evaluated by the associate teachers on their knowledge of the curriculum and their ability to execute technical skills. Therefore, these PSTs were mainly concerned with improving their mastery of instruction and classroom discipline during their brief time in the classroom. According to Ward and McCotter (2004), PSTs rarely reflect at the transformational level, where it is only observed in very long placements in schools. Hence, it was understandable that the PSTs whose practicum was 4 or 4.5 weeks long did not appear to engage in critical reflection.

Two of the four PSTs (Lisa and Toni) seemed to find that collaborative reflection with the teacher educator on various classroom challenges and possible solutions was helpful. As noted by Hatton and Smith (1995), research shows that PSTs prefer to reflect with a supervisor rather than a peer as coaching and modelling is provided through scaffolded dialogue. During the weekly discussions, it is possible that the participants revealed concerns they had been mulling over in order to gain another perspective on them. Moreover, the teacher educator was not in a supervisory or evaluative role and talking with her likely seemed “safe” to the participants (Hatton & Smith, 1995). The other two participants (Karl and Jane) preferred to solve problems on their own. Teacher educators should therefore be sensitive to the willingness of their PSTs to reveal classroom problems and engage in collaborative reflection.

The role of the teacher educator in facilitating classroom inquiry and reflection

In this study, each of the four PSTs and the teacher educator formed a dyad in which they worked together on the classroom inquiry. The PSTs encountered their own authentic, practical problems during the practicum and for three of them, they were centred on implementing DI effectively. Jane’s reflections on how to manage student behaviour during transitions were categorized as routine and technical in nature. However, that is not to suggest that her planning was not guided by a concern for student needs and interests. Collaborative reflection with the teacher educator provided further support for two of the PSTs, particularly to help them gain insight into their problems and explore alternative actions.

The teacher educator served as the knowledgeable other who modelled reflection through dialogue to address the PSTs’ own concerns about their instructional efficacy (Palinscar, 1986). It was a form of situated cognition in which one participates in a community of learners and learns skills and concepts by doing what the experts in the area do (Lave & Wenger, 1991). In this case the PSTs did not have a lot of classroom experience and could not recognize patterns they had experienced before and match them to possible solutions. Essentially, they did not have elaborate mental models to permit such inferences. It was the teacher educator who refined their analyses of situations and made suggestions about possible courses of action based on her knowledge and experience. This process appeared to help them resolve problems with their classroom practice, in part due to the accurate analyses and appropriate solutions provided by the teacher educator.

In this study, collaborative reflection was clearly focused on problem-solving to improve practice and student learning outcomes, and the oral and written comments of the PSTs did not suggest an inclination to participate in critical reflection. Additionally, the teacher educator did not press the PSTs to reflect on power dynamics, hegemony, and their own reflections (Brookfield, 2009) or to engage in critical self-reflection of assumptions (Mezirow, 1998).

Moreover, the data collection forms were directed at the implementation of DI strategies and the weekly conversations centred on improving practice. The teacher educator deliberately adopted a consultative approach (Brookfield, 2009) and her role was to assist the PSTs in engaging in classroom inquiry and model problem-solving through reflection. She did recognize that their authority was the knowledge of their contexts and that hers was experience and qualifications. It is acknowledged that, in the short-term, classroom inquiry and reflection with the purpose of professional problem-solving was useful, but, in the longer term, the PSTs must engage in critical reflection whereby they question institutional and societal assumptions and power structures (Brookfield, 2009; Mezirow, 1998).

IMPLICATIONS

The findings of this study demonstrate that Ward and McCotter's (2004) framework is useful for understanding PSTs' reflections. Additionally, they add to the literature supporting the assertions that teacher educators have a role to play in focusing PSTs' thinking on their students and classroom practice and modelling reflective practice (Alger, 2006; Anderson & Stillman, 2013; Goldman & Grimbeek, 2015; Russell, 2013). Specifically, in this study, the teacher educator provided prompts to guide the inquiry and individual reflection (data collection form and the description of DI strategies) and engaged in collaborative reflection to help the PSTs clarify their thinking, suggest alternatives, and offer different perspectives. The findings therefore demonstrate how teacher educators can support the inquiry and reflective activities of PSTs and with their assistance, PSTs can resolve classroom problems and construct their own understandings about the interaction of their instructional practice and student learning. However, teacher educators should be mindful of the needs and wishes of the PSTs, as some will be open to collaboration and others may want to solve problems on their own.

Emphasis in teacher education programs should be placed on using classroom inquiry and reflection to solve authentic problems encountered during practice teaching or internships. Teacher educators should be available to support PSTs as they work through the process of becoming researchers and be willing to model the reflective component. As shown in this study, teacher educators can support PSTs' classroom inquiry and reflection and help them develop technical competence and understandings about the relationship between the quality of their teaching and student learning. Future research should include longitudinal studies of PSTs into their years as beginning teachers in schools to examine the further development of skills in classroom inquiry and reflection, particularly at the transformational level. The results will inform teacher educators how they may best prepare PSTs become teacher researchers who develop personal, practical knowledge about their own classrooms.

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