East Asian Math. J.
Vol. 37 (2021), No. 2, pp. 245-263
http://dx.doi.org/10.7858/eamj.2021.017

An Elementary Teacher's Journey Through Action Research for Improving Student Responses[1)]

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ABSTRACT. This study describes a sixth-grade teacher's professional development journey through action research for improving students' responses in a mathematics class. In the action research, the influence a teacher's questioning tactics would have on students' ability to determine answer reasonability to mathematics problems was investigated. Drawing on qualitative analysis of the teacher's lessons, reflection journal and interviews as well as the classroom students' questionnaires and interviews, this study examines how action research can affect the teacher and the classroom students. The results suggest the popularization of action research among teachers by teacher training and development programs showing the positive changes in the teacher's performance leading to improved student responses.

I. INTRODUCTION

Teachers often engage in professional development activities such as in-service courses, workshops, lectures and conferences. However, it has been reported that many conventional forms of professional development have limitations in terms of their impact on practice (e.g., Guskey, 2002;

Received February 15, 2021; Accepted February 22, 2021.
2010 Mathematics Subject Classification: 97C70, 97D40
Key Words: action research, professional development, student response, teacher questioning
1) This work was supported by a 2-year Research Grant of Pusan National University.

(pISSN 1226-6973, eISSN 2287-2833)

Uysal, 2012). Action research enables teachers to act as researchers, develop personal goals, values and beliefs about practice (Pine, 2008). Nevertheless, teachers do not generally adopt the role of researcher. Teachers assign this role to outside experts with the notion that they themselves can become subjects to a researcher, but they can not produce research work of their own (Burns, 2010) because the word 'research' often conjures up images of theory building or producing universal findings.

Unlike other types of research which raises concerns about the universality of their findings, action research is concerned with the immediate learning and teaching environment. Focusing within the context of the study, action research encourages teachers to collect data about their teaching, to examine their attitudes, beliefs, assumptions, and their teaching practices, and to use the information obtained as a basis for critical reflection about their teaching (Richards & Lockhart, 1994). That is, action research as a model of professional development differs from regular research forms by its contextualized nature.

The present study aims to show how action research as a professional development strategy influences teachers' teaching practices and attitudes as well as student learning. To do so, this study looked at sixth-grade students' ability to determine if an answer is reasonable after a change in teacher questioning had been implemented. More specifically, this study attempted to answer three research questions as follows:

1. What might happen to students' reasoning and questioning (of themselves and others) related to problem solving after a change in teacher questioning has been implemented?
2. What might happen to student's explanations of their problem solving methods when asked to justify or elaborate on their results?
3. What might happen to the classroom teacher's teaching when the teacher implement probing questioning tactics in response to student's problem solving and solutions?

To accomplish this, students' abilities to question problem solving approaches and results as well as to explain their own problem solving methods were examined. Also, the classroom teacher's questioning tactics were examined.

II. LITERATURE REVIEW

1. Action Research

Action research is a professional development model which involves teachers inquiring into their own practice, studying and reflecting on their own practice, and correspondingly changing their own practice. Richards & Farrell (2005) stated that in the combination of action and research, "the word 'research' refers to a systematic approach to carrying out investigations and collecting information that is designed to illuminate an issue or problem and to improve classroom practice. The word 'action', on the other hand, refers to taking practical action to resolve classroom problems" (p. 171).

Like many other types of research, action research consists of a question, data and interpretation (Nunan, 1992). However, it differs from other types of research in its small scale and localized nature (Burns, 2010). The primary motivation for action research is the more immediate one of bringing about change and improving teaching and learning processes in the classrooms in which the research takes place. It enables teachers to seek for knowledge to improve their skills, techniques and strategies in order to change their instruction methods to impact on students.

Action research involves planning, acting, observing and reflecting more carefully, more systematically, and more rigorously than one usually does in everyday life (Kemmis & McTaggart, 1992). Burns & Rochsantiningsih (2006) explained these four steps as follows:

- Planning: a problem or issue is identified and a plan of action is developed in order to bring about improvements in specific areas of the research context;
- Action: the plan is put into action over an agreed period of time;
- Observation: the effects of the action are observed and data are collected;
- Reflection: the effects of the action are evaluated and become the basis for further cycles of research. (p.22)

According to Elliott (1991), the process of reflection is representative of the action research process. It enables teachers to look back on the teaching and learning that has occurred as a means of making sense of their actions and learning from their experiences. Reflection brings about changes in the way teachers perceive their teaching and their role in the process of teaching

(Richards, 1991) as it makes teachers more aware of their teaching. Being a form of self-reflective inquiry, reflective practices involve teachers as active participants in their own educational process (Farrell, 2004). With all that said, although action research is not necessarily a condition for reflection, reflection is at the heart of action research.

2. The Role of the Teacher

Many recommendations from the mathematics education communities (e.g., CCSSM, 2010; NCTM, 2014) have challenged educators to help students learn with understanding, recognize reasoning as a fundamental aspect of mathematics, and evaluate mathematical arguments. Also, the role of the teacher in the classroom has shifted. According to Peterson et al. (1989), "[T]he teacher's role is one of facilitating the construction of student understanding and knowledge" (p. 37). Through questionnaires and interviews, they studied first grade teachers to understand what effect teachers' pedagogical content beliefs had on their decision making, thinking, teaching, and students' learning and achievement in regards to addition and subtraction. They found that the beliefs of more experienced teachers where closer to a constructivist perspective than that of less experienced teachers. This led them to believe that "teachers' pedagogical content beliefs and their pedagogical content knowledge seem to be interrelated" (p. 38). Fraivillig et al. (1999) conducted a case study of one expert teacher's methods to see how to effectively advance children's mathematical thinking in inquiry-based mathematics classrooms without undermining children's intellectual autonomy. In agreement with the authors of the study on teachers' pedagogical content beliefs, they emphasized that not only does the teacher need to be a facilitator of discourse but she also needs to establish and guide development of social norms and support students' understanding. When this is done, three components will be apparent in the teacher's practices: eliciting student's solution methods, supporting student's conceptual understanding, and extending student's mathematical thinking.

Two things must take place as teachers switch gears from telling students what to do to helping students construct their own knowledge by using what they already know to successfully navigate the waters of the unknown. Teachers must first become better questioners, listeners and responders. Second, they must use explicit strategy instruction and have it become a common practice according to Nicol (1999). Nicol (1999) reports on a curriculum and instruction course that she co-designed and co-taught for prospective teachers. In her report, she discusses the difficulties prospective teachers faced in their efforts to have students actively participate in mathematical thinking and dialogue. Nicol observed that questioning serves one of three main purposes: to learn what students are thinking, to get students to the answer, or to test students thinking. After posing the initial question, the teacher has to have a deep understanding of the mathematics to fully listen and respond to what the student's answer is and where that answer will take the discussion.

In helping students construct their own understanding and use their prior knowledge to do so, the teacher must provide students with explicit strategies that they can employ to be successful. Knowing what needs to be done and how to carry it out in solving a mathematical problem are not innate (Goldman, 1989; Pape et al., 2003). Goldman (1989) examined strategy instruction research in mathematics, more specifically the implications this research held for learning-disabled students. She concluded that procedures that merely instruct the learner in what to do are inadequate; instruction in how to do these things is necessary. Pape et al. (2003) constructed and then implemented a teaching experiment during a two-year professional development program in which they were both participating. They sought to create a learning environment that produced self-regulated learners in one of the authors' pre-Algebra and regular seventh-grade mathematics classrooms with the use of explicit strategy instruction and student record keeping of the strategies that they used. Good et al. (1987) came to a similar consensus in their study of student passivity. They looked across age, ability level, and gender to determine which students where asking questions and what kinds of questions were being asked. The researchers were discouraged by how infrequently academic questions were being asked and suggested that teachers teach students how to ask questions. As teachers are working on becoming facilitators of student learning and classroom discourse, instructors of strategic problem solving steps and behaviors, and expert questioners, it is essential that they also establish classroom norms that create a supportive learning environment. Pape et al. (2003) would agree that it is on the shoulders of the teacher to scaffold and create learning environments that support student participation and mutual respect between all involved parties. With students receiving explicit instruction on how to be successful, teachers can then raise their expectations for all students with confidence, knowing that students are equipped to reach those expectations.

3. Expectations of Students

While the role of the teacher develops from instructor into facilitator and supporter, the role of students is also changing. Students need to move beyond being passive learners to active learners. Passive students do not volunteer or respond when called on, ask few questions, and approach the teacher infrequently (Good et al., 1987). An active learner is one who will "analyze mathematical situations, critically examine their mathematical thinking and that of their classmates, and explain and justify their mathematical reasoning" (Pape et al., 2003, p. 183). Peterson et al. (1989) concur in saying that student's role is one of engagement in active cognitive learning. Students must expect to be actively involved in the mathematics that is taking place in the classroom, not merely regurgitate information, observe, and occasionally record.

One can naturally infer that if teachers are raising their expectations of students' capabilities then students should produce more. Producing more does not mean more paper- pencil work but instead that students should be engaged, explaining and justifying problem- solving methods, making sense of peers' methods, working collaboratively, and challenging the solutions and methods of peers (Fraivillig et al., 1999). Krebs (2005) reported on the experiences of 20 middle grade teachers as they studied the performance of pairs of students working on a challenging mathematical task. In her study, it was readily apparent that students needed to keep complete records of their thinking so that their peers and teachers might fully understand their mathematical processes and reasons. Fuchs et al. (1996) studied peer-tutoring interactions to examine the quality and effectiveness of students' mathematical explanations as a function of student ability. They noticed that the student who constructs the explanation achieves greater understanding than the listener.

As students grow in their ability to fully communicate their mathematical thinking and practice examining the thinking of their peers, they mature into what Goldman (1989) refers to as "good strategy users" or what Pape et al.

(2003) call "self-regulated learners." These are students that have a variety of procedures at their disposal, are flexible with those procedures, actively monitor if the steps they are taking are getting them to their desired end, and understand that academic learning is a proactive activity that requires inner motivation and strategic behavior.

III. METHOD

This study took place in a sixth-grade classroom of 25 students from an elementary school where approximately 750 students attended, located in a large city area during the 2019 school year. The students were of varying ability levels. A few voluntarily participated in a mentoring program after school where students worked with nearby university students to reinforce basic mathematical skill and content retention. The classroom teacher has been teaching for about 10 years. She has heard about action research as a theory but never implemented one on her own. She said she always wanted students to be able to reason through their own actions before determining that they need outside input. She, thus, set the goal of her action research as enhancing her questioning practice so that she could facilitate students in advancing their reasoning and response practices.

To help answer the research questions, a variety of instruments were collected from March through June of 2019. The instruments consisted of teacher's daily notes, weekly teacher journals, student interviews, student questionnaires, and end of chapter test questionnaires. Data was supported with work done by students during the warm-up/exploration activity, daily journaling/note taking, homework checking, and journaling.

Teacher's daily notes generally consisted of the daily topic and intriguing questions or problem solving methods offered by students. The daily notes were very brief and served the purpose of helping the teacher write a more formal journal entry at the end of the week. The teacher's weekly journals contained the following information: the general mathematics concepts focused on for the week, memorable student questions and comments, noticeable changes in students or teacher in regards to the research focus, perceived limitations of the unanalyzed data gathered thus far, and possible ways to improve upon those limitations in the upcoming week. The content of the teacher's journals were supplemented with the work done by students as mentioned above. The work, with the exception of the warm up/exploration activities, was primarily done on marker boards; thus, photographs were taken to preserve them for later analysis. In a daily student questionnaire, students were supposed to respond regarding teacher questioning habits and student explanations. The test questionnaire gave a broader look into student reasoning and their perceptions of peers. The teacher's questioning tactics, classroom practices and philosophy were also addressed on the test questionnaires. Both questionnaires were anonymous. 10 students were chosen for semi-structured interview, which focused on student's reasoning over one of the four main operations with integers. Each interview was 20 to 30 minutes long.

The author of this paper observed the classroom teacher's math classes and watched the video-taped classes when visitation was not made. The author also reviewed all of the collected materials from students. Thus, the author took a role as the complete observer within naturalistic forms of observation to view the classroom teacher acting as naturally as possible, with the observer having minimal influence, and to produce an accurate or true representation of social action within which the environment under investigation can be apprehended (Marks & Yardley, 2004).

IV. FINDINGS

1. What happened to students' reasoning and questioning

The classroom teacher's first mission was to re-implement "why" back into her instructional vocabulary. The teacher responded to any answer or partial explanation given by a student with "why" or with feigned ignorance. For instance, one student discovered that when adding integers it does not matter which number she began with so he preferred to use the number in parentheses to coincide with the order of operations. Another student asked if that would work with subtraction and the teacher replied "I don't know, will it?" Since the teacher was not giving students direct answers to their questions they were forced to reason to answer their own question or lean on the input of their peers to build a more complete understanding.

Many of the students quickly internalized the teacher's actions and became very outspoken about letting their peers know when an explanation a peer gave did or did not make sense. On a student test questionnaire given in

April following the first chapter test, the teacher asked, "If you could only pick 1-3 peers from class to explain how they solved a problem who would it be? Why?" Bo-min[2] responded, "Soo-ji because she can explain very well and makes sense and some other kids make it hard to understand what they're trying to say." Later that same month, two students responded on their daily questionnaire to a question asking who gave a really good explanation in class: "Dong-young, wrote it on the board; it was visual" and "Dong-young because he made it understandable and he explained the 2 differences." Students were able to identify which of their peers gave useful explanations and even identify characteristics of those explanations that made them easier to comprehend. Not only were students able to pick out whose explanations were helpful they could also discern which ones added to their confusion. For example, teacher journal in March following an introductory lesson to integers, the teacher wrote, "The class couldn't define (or give words) for opposite so I made it their homework. Seung-hyun's definition was that positive and negative numbers were mirror images of each other but his classmates argued that mirrors show the same thing." Peers questioning peers and then responding to those questions became an expected aspect of math class.

Students knew that their solutions and problem solving methods would be scrutinized. The teacher found that her students would not offer their reasoning as an absolute; rather they expected that changes would be made. The teacher's daily notes from May provide a snapshot of what this looked like in practice as follows:

"Lisa had measured the four angles and found their sum to be 310°. Students were asked if they believed Lisa was right and explain how they knew. Together Anna, Ji-hoo, and Ye-ji said Lisa was correct and explained their reasoning to the class. After hearing Joo-Eun's reason that together the angles create a full turn which is 360º, the three students changed their previous argument to say that Lisa was incorrect because the sum of angles 1 and 2 were 180° and so was the sum of angles 3 and 4. When I asked students to go to different areas of the room that represented the argument that convinced them of the Lisa's accuracy or inaccuracy, the three students

2) All names are pseudonyms.

amended their position again when Ga-On pointed out that their idea and Joo-Eun's was basically the same. They concurred."

The example described above demonstrates how students were comparing and contrasting peers' explanations in order to synthesize their own understanding and amend previous conclusions. On a test questionnaire given 10 days earlier, students also showed that they were internalizing the belief that initial answers are still a work in progress. The following are student responses to one of the questionnaire question "After solving a problem do you ask yourself if your answer makes sense?":

"Yes, because sometimes it won't."

"Yes, because if it doesn't then it wrong." "Sometime it could be big or small"

Their responses support the assertion that students do not believe their initial answers to be final.

In an interview conduced in April, Ga-On contemplated the answer to two integer subtraction problems. "Five minus negative two is three because if I subtract two I get three. But if I subtract negative two I get seven. But I think it is three because it is subtracting." Earlier he had solved $5+(-2)$ so I wrote $5-(-2)=3$ and $5+(-2)=3$. In seeing this he said "I'm sticking with this [$5+(-2)=3$] ... subtracting go to the left but since you have a negative it would just go to the right and you end up at seven." He too was able to take the information, rethink his previous work, and come to a new solution that made more sense when presented with the written equations. Students were beginning to understand that problem solving in mathematics was similar to writing an essay in language arts class. They both required outside input, editing, and revising. An initial solution or method was not final but by hearing peers' comments and questions, students became more able to formulate clear and accurate explanations.

After the classroom teacher changed her questioning tactics, students began to expect to be questioned by their peers, as well as their teacher, upon volunteering an answer to a problem. A constant theme in her class centered on showing your work. One of the questions on the student test questionnaires was, "which is valued more math class, right answers or explaining/showing what to do to get the answer?" From test questionnaires that were collected from three chapters, 80 out of 92 student responses marked explaining/showing as more valued. Sample student responses in May and June included:

"Explaining, anybody can know but only aware people can know how."

"Explain/showing because our teacher always said How or Why or Show you work."

"No one knows how you did it without the work."

"If you say the right answer you've learned just the right answer but if you're wrong but have it explained, you might not only learn the right answer but a different way of getting it as well."

Students were internalizing that answers alone were not enough in mathematics. It was the explanations behind the solution that gave the answer validity. In the teacher's conversations with students it could also tell that students were becoming used to offering explanations. During an interview with the teacher, the teacher said:

> I do think [the students] are getting used to showing work and [my asking] why? I asked Chan-hwe a question, he answered. I said why, he answered again. I said why [again] then he said almost the same thing just using a full sentence.

Even though Chan-hwe responded politely by the third round of the teacher asking "why", being probed for more did not agitate him. His actions alluded to the fact that it was becoming routine for students to respond to questioning from the teacher. Backing up answers with an explanation became so commonplace in her math class.

2. What happened to the classroom teacher's mathematics instruction

Implementing probing questioning tactics in response to students' problem solving and solutions influenced the teacher's mathematics instruction. Students gave more value to the reasoning behind answers because the teacher give more weight toward how students arrived at answers as opposed to the answer they got. On the test questionnaire from March one student replied that they knew explaining/showing what to do to get the answer was more important in their math class "…because our teacher says she understands us better when she sees work and explanation."

The teacher let students know by her words that their reasoning was what was of more importance. In her daily notes from April the teacher wrote:

> In class we were going over a homework problem, asking students which given series of integers were ordered from least to greatest that I noticed many of the students had missed. We began with the choice A and students told me why it was incorrect. On choice B [Joo-Eun] said it was the right one. When I asked her why she knew the answer was B she said, "Because you didn't mark it wrong". I replied, "That's not good enough."

The way that the teacher responded to students' answers changed. On a test over geometric shapes, Sung-jun asked the teacher if his answer was correct. Instead of saying yes or no the teacher asked him, "why do you think so?" After he provided an explanation the teacher responded by saying that his reasoning sounded good. The teacher affirmed his problem solving process rather than the accuracy of his solution. The teacher's words were supported by her actions. For another example on a test over geometry, Gun-hee wrote that the measurement of one angle in a regular quadrilateral is 90˚. This answer appears correct, but on the next problem a similar question was asked about a regular triangle. Her answer was 180˚. Further probing lead the teacher to find out that she had solved the quadrilateral problem by dividing 180 by 2 since two triangles where formed within the quadrilateral after drawing a diagonal. Her answer was the result of truth mixed with error that never would have been brought to light if the teacher did not adhere to her standard that process is worth more than product.

Another change to the teacher's mathematics instruction was that she would ask more open-ended questions and allowed students to affirm, reject, or amend methods and solutions, rather than herself. On the test questionnaires one of the questions stated, "How can you tell if your answer is wrong or right on your own?" The majority of the students responded with some form of double checking their work or noticing that the answer looks odd. Response of this type appeared on about 74 of the 92 questionnaires from three chapters. 76 out of the 92 included a written response that was not "I don't know." Of those 76, only two responded with a method that would require an action by their teacher, "Our teacher will mark it wrong" and "Our teacher will walk over to you." One student questionnaire from May had the response, "Looking at the answer and comparing it to the question." The student's response shows that they were looking back at the problem to determine if their solution made sense.

In an interview session from April, Joo-ha gave the following solutions to the addition problems with integers.

$3+9=12 \qquad -3+9=-12 \qquad -3+(-9)=12 \qquad 3+(-9)=-12$

After being given the same problems in story format, he decided to change a few of his answers to:

$3+9=12 \qquad -3+9=6 \qquad -3+(-9)=-12 \qquad 3+(-9)=-6$

He had mistakenly applied rules for determining if the answer should be positive or negative in multiplication and division problems to addition. However, once the problem was imbedded in context, Joo-ha concluded that two of his original solutions did not fit the situation and was very comfortable changing them. Joo-ha's behavior is an example of how students were becoming more flexible with their understanding, willing to modify their reasoning and solutions as new information was presented.

Another interview transcript from April with Dong-young gave a combination of open-ended questioning and student selected solutions. The teacher asked Dong-young if he could think of other problems besides $2+(-5)$ whose solution was also -3 [using only addition or subtraction and the digits 2 and 5]. He came up with $(-5)+2$, $2-5$, and $-5-(-2)$. He reasoned that these where the only solutions because anything else would require going "to the left too much or too little or going to the right too much or too little from where you start at." With minimal restrictions, the teacher had left Dong-young open to come up with as many responses as he could and allowed him to justify why those were the only possible answers. In her daily notes the teacher recorded that:

> The warm up question I wrote for the students gave a fictitious student's solution to a problem to which they were asked to agree or disagree and give a supporting argument. Once students shared their reasoning with the class each student had to choose the reason that was the most sound and convincing to them.

The teacher left it open to students to accept or reject the solution to the given problem. The warm up was a prime example of how the teacher began to see ways to deviate from assigning students problems to solve to giving students solutions and having them justify or reject the solutions based on their reasoning. Changing questioning tactics led to a change in the teacher's instruction and how the teacher interacted with students regarding the mathematics. Not only did the teacher show an active belief in her philosophy that process is more important than product, but a belief that her students need to create and take ownership of the process that leads to the product began to manifest as well.

V. DISCUSSIONS & CONCLUSIONS

The findings of the study re-show and confirm that teacher-questioning habits have an influence on student actions and perceptions. At the beginning of the year the teacher was very frustrated with the seemingly helplessness of her students. Her students needed her to confirm every step they took while problem solving, every answer they got as a result, and the accuracy or relevancy of peer comments. However, the teacher was not aware that her responses to their questions and actions enabled their helplessness. Her yes/no responses essentially told students that their teacher did not expect them to think for themselves and that their teacher did not believe they were capable of accurately doing so. Good et al (1987) noticed this also in their study of student question asking behaviors. Their study results suggested that differential expectations lead to student passivity and that low teacher expectations resulted in low production from students. Once the teacher began reintroducing "why?" into my instructional vocabulary and redirecting student questions towards their peers, she no longer became the sole source of authority and knowledge. Fuchs et al (1996) stated, "children do not naturally develop constructive interactional patterns without explicit instruction" (p. 635). To be explicit, the teacher modeled the questioning of students explanations so that their peers could see what to say and know that questioning one another was acceptable. At one point during the study, the teacher had to very directly let students know that "I don't know" or "I don't get it" were not adequate verbalizations of confusion. The phrase "I don't get it" does not provide sufficient information to know where communication or understanding broke down for the student giving the explanation. By the end of the study students could give more specific vocalizations of their misunderstandings.

Fraivillig et al. (1999) support this conclusion that it is important for students to learn how to become better explainers of what does not make sense to them. These authors state that it is the student's role to be engaged, explain and justify solution methods, make sense of peers' methods, work collaboratively, and challenge peers. Through critically examining others' reasoning and participating in the resolution of disagreements, students learn to monitor their thinking in the service of reasoning about important mathematical concepts (Pape et al., 2003). When students present their interpretations to the class so that peers and the teacher can question, contradict, or build upon them, a classroom that is focused on reasoning is created.

At the last interview, the classroom teacher said, "From embarking on this action research I now have 'why' back in my vocabulary and I plan on giving it a permanent home. Beginning on Day One in my mathematics courses I will put forth the message through my words and actions that students will be expected to reason and push their peers to do so also. My research and literature show that students are able to engage in and initiate intellectual mathematics discussion about solutions and methods if given the tools and opportunities." She also stated that, "My students became adequate at giving verbal explanations of their problem solving but struggled to do so in written form. One student stated with frustration while trying to complete her Friday journal that it is much easier to say what she means than to write it down. In the future I will need to incorporate more writing so that my students are effective in both modes of communication. I already have a tool in place, the students' math journals, which can be used to develop students' writing skills. Along with note taking the journals can be used for students to dictate explanations or problem-solving strategies presented that they understand and use. It will also be beneficial to incorporate more sharing of explanations in pairs."

The findings discussed above suggest that action research can be an effective tool for bringing about improvements in a teacher's teaching practices and beliefs and attitudes. The teacher's statements show that she had useful experiences while conducting action research. This study is contributory to the literature of teacher research, which is not necessarily bound by the constraints of traditional research paradigms (Young et al., 2010).

Action research also facilitated meaningful thought in the teacher in terms of plan for the next step. She had thought that in a large group discussion some voices got lost or were never heard. She thus said that she would only need to look back on student responses on the questionnaires and in her journal to see who the more vocal students were. She recognized that having a student explain to one other person would help create a less intimidating atmosphere and increase engagement of all students. When observed, she had students partner up before responding to a Friday journal prompt. It gave her a glimpse into what could be if students shared in pairs. Students who were normally quiet were verbalizing their understandings and drawing unique examples to support their explanations. She wanted to continue to implement new questioning habits into her instruction and demonstrated a firm belief about allowing opportunities for students to explain and validate problem solving would help to create the kind of classroom that supports student construction of knowledge. She stressed on such an opportunity as it also would provide students with the ability to justifiably respond that their solutions are reasonable or not. Interviews with the classroom teacher indicate that the reflection stage of action research enabled the teacher to become more aware of what was going around the classroom and the way she performed during the classes.

Although action research produces results which are not generalizable and lacks scientific rigour in that its objective is situational (Cohen & Manion, 1990), generalizability and reliability should not be issues of concern in action research. Because action research produces results which focus on immediate practical concerns within a specific context, its reliability and validity should be measured in terms of its usefulness in providing solutions to classroom problems. By conducting action research, teachers become the investigator of their own classrooms rather than being the tool of an outside researcher. Guskey (2002) states that it is not enough that teachers' work should be studied, they need to study it themselves. Therefore, simply informing teachers about research is unlikely to bring about change (Mills, 2007). By starting with a training requirement, teacher training and development programs can provide teachers with opportunities to learn about and to conduct action research.

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