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QUALITATIVE ANALYSIS OF THE RELATIONSHIP BETWEEN TEACHERS AND STUDENTS`NOT-KNOWING IN THE PROCESS OF SOLVING REASONING TASKS

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Abstract

Mason and Spence's (1999) work demonstrate a detailed view into the concept of knowing. Although they highlight the importance of not-knowing as a first step, it is a topic that is not well researched. This study aims at expanding that research, by analyzing not-knowing expressions from teacher to student and possible connections to be found. During a course of geometric reasoning student teachers were asked to reason with a tangram while simultaneously recording their expressions of not-knowing and reflecting on it periodically. Student teachers were then tasked to teach this lesson to their students, who would also reflect and express their forms of not-knowing. Findings presented no real link between teacher-student expressions of not-knowing, but two major conclusions were made. Individuals altogether struggle conveying their not-knowing clearly and when they did express it, these expressions leaned heavily on *not-knowing-that* and *not-knowing-how* forms. A discussion follows to interpret said findings. A conclusion is made detailing key points in the study and what comes next for the concept of not-knowing.

Keywords: *knowing, not knowing, secondary school mathematics teachers*

INTRODUCTION

"If only I would have known", is an all too familiar phrase for many of us whether it is as a student or an ordinary individual. Its moments like these were many wish they would have had more knowledge within a situation so that they may have overcome an obstacle in that moment rather than retrospectively. This idea resonates strongly with teachers, as their job primarily deals with in-the-moment situa-

tions aimed at delivering information to their students in the best possible manner. When the “If only I would have known” moment happens, it is already too late. Although one may retrospectively reflect on what they could have done, the same is bound to happen again with a different topic. The experience created from reflecting on “what I could have done” is too narrow to encompass the different topics an educator must teach. Instead of relying entirely on the reflective process to prepare for similar problems in the future, it may be more effective to become aware and strengthen one’s own Not-Knowing.

“Not-knowing” is an underexplored concept defined by an individual’s ability to be aware of what they do not know as a means to plan and more effectively face complex situations. The idea of attention to awareness and Not-Knowing have roots in Mason and Spence’s work (1999). “Awareness of knowing and of not knowing is crucial to successful mathematical thinking” is a line I would like to highlight in Mason and Spence’s (1999) work. If both knowing and Not-Knowing are crucial to successful mathematical thinking, then both topics must be of equal importance, yet most of the research on the topic highlight only knowing. The words of Shah (1968) bring insight to this topic:

*. . . He who does not wish to know, and yet says that he needs to know:
let him be guided to safety and to light.
He who does not know, and knows that he does not know: let him,
through this knowledge, know.
He who does not know, but thinks that he knows: set him free from
confusion and ignorance. . . . (p. 253)*

Even though the entire recital speaks of Not-knowing, sentence two encapsulates what I aim to convey; an individual who does not know and knows that he does not know can use his knowledge to help guide him. The focus lies within that individual’s awareness.

Mason and Spence (1999) agree, “it may require acknowledging the fact of not knowing in order for other prepared strategies to then come to mind. Much good advice offered to students goes unheeded through the student not recognizing that they do not know” (1999). In this light, it is vital to explore and dissect the concept of

Not-Knowing, as it is a fundamental first step in the learning process. This study will serve as an expansion of a previous study, which analyzed student ability expressing Not-Knowing. This time, the aim of this research will serve to analyze the relationship of Not-knowing from teacher to student. Examining connections of Not-knowing from teacher and student may present useful information to help us better understand the concept.

FRAMEWORK

To conceptualize the importance of not-knowing, it is crucial that it be analyzed alongside its counterpart; knowing. For this, the developing framework consists of ideas presented by Ryle (1949) as well as Mason and Spence (1999). While Mason and Spence's work focuses on *knowing-to act* in the moment, "no-one can act unless they have an act to perform"; something they themselves say in their work. In this sense, an individual must first have prior knowledge for *knowing-to* to occur. For the building of this framework, prior knowledge will take the form of Ryle's (1949) *Knowing-about* distinctions. *Knowing-that, knowing-how, and knowing-why* must be readily available in an individual for the possibility of *knowing-to act* to occur. Notice the used of the word *possibility*, as *knowing-to-act* in the moment is a very involved and complex task. With that in mind, I parallel concepts of knowing to not-knowing in an effort to analyze how awareness of not-knowing has an impact in the overall learning process.

Just like Mason and many others have stated, being aware of what one may not know is an important first step in order to plan effectively. Paralleling not-knowing with knowing can help us break down the concept, and study it at different levels. Just as an individual can be *Knowing-that, Knowing-how, and knowing-why*, they can also be aware of *not-knowing-that, not knowing-how, and Not-knowing-why*. These forms of not knowing may serve as building blocks to strengthen an individual's overall ability to express not knowing, and eventually become aware of that *not-knowing in the moment*, paralleling *knowing-to-act* in the moment. This frame should help assess the importance of awareness of not-knowing as an overall concept of learning.

METHODOLOGY

This qualitative study will focus on connections of not-knowing from teacher to student. The study will take place in the southwestern border region of the United States. Three student teachers will be enrolled in a geometric reasoning course where they will learn to reason with a tangram, also known as the 7-piece puzzle. This course will require the students to learn the concept, plan a lesson, teach the concept, and reflect on student learning. Throughout this course, the student teachers will be asked to transcribe recording of their attempt and reflect periodically on what they are not-knowing. Once the student teachers are ready to teach their lesson, they too will have their students transcribe an attempt as well as reflect on their not knowing periodically. This will allow for analysis of teacher to student not-knowing connection. In this case, the focus will be on the different expressions of *not-knowing-about*: *Not-knowing-that* (awareness of not knowing a fact), *Not-knowing-how* (awareness of not knowing a process or an act to perform), and *Not-knowing-why* (awareness of not knowing why a phenomena occurs, lacking of explanation).

RECORDINGS/TRANSCRIPTIONS

Recordings may be the best way to capture expressions of not knowing. As students attempt tasks, they will be asked to voice their thoughts in order to attain a better understanding of their thinking. These recording will then be transcribed in an effort to extract key comments made by the student teachers while attempting to solve the tangram. In the same light, student teachers will transcribe their student's attempts at solving the tangram, which will serve as data for further analysis.

REFLECTIONS

Throughout the course, the student teachers will be asked to construct different tangrams with different number pieces. This will require the student teachers to use prior knowledge to the best of their ability. During the entire process, these student teachers will be asked to reflect on what they don't know during the task, and after the fact. These periodic reflections will serve to inform how often the individual expresses their awareness of *not-knowing-that*, *-how*, or *-why*, and to what extent. Similar to transcriptions, student teachers will also ask their students to reflect on

what they do not know during and after the task. Once these two sets of evidence are gathered, they will be further analyzed.

CODING/ANALYSIS

The focus of the analysis will be to gather data involving expressions of *not-knowing-that*, *-how*, and *-why* between both student teachers and their particular students. Kvale's and Svend's *Interviews: Learning the Craft of Qualitative Research Interviewing* (2009) is used to help with the coding process. First student teacher transcriptions will be analyzed and coded to determine how often expressions of not-knowing occur and which *knowing-about* category they fall into. This will also be done for their reflections. Second, their student transcriptions and reflections will be coded similarly looking for expressions of not-knowing and which category they fall into. I present a line of evidence as an example;

Student teacher: "What lengths do I need?"

This example would fall under an expression of *not-knowing-that*. This is because the individual does not know a fact and is searching for it. The expression of not-knowing is weak, since there is no awareness or acknowledgement by the individual that they in fact don't know the lengths, and could take steps to find said given lengths. Looking at a second example to demonstrate the possibility of two types of not-knowing displayed at once:

Student: "Im having trouble trying to connect the area and see the connections and how they all relate".

The example above shows a student activating both their *not-knowing-that* as well as their *not-knowing-how*. Although the *-how* part may be more evident, the student is displaying difficulty connecting the areas due to lack of facts about those areas, hence also displaying *not-knowing-that*. Again, the expression of not-knowing is weak, as is lacks finer detail such as expressing which particular areas or shapes they do not know.

These are just two examples to demonstrate the coding process for all data gathered. Once Student teacher work is analyzed, then their student work will follow.

Finally, Teacher expressions of not-knowing will be compared to that of their student's. This will inform us if the expressions of not knowing from the teacher impact the expressions of not-knowing of their students. Although it is difficult to observe student's *not-knowing-about* expressions, these recordings, transcriptions, and reflections should circumvent that problem.

FINDINGS

After analyzing the data, there were no clear connections between teachers to student expression of not knowing. However, data did show two things: First, expressions of not knowing were mostly displayed at levels of *-that* and *-how*, and secondly, expression of not-knowing on its own still remains a difficult task for all individuals alike.

For the presentation of data, there will be a teacher 1, teacher 2, and teacher 3 in order to differentiate them. This will also apply to students, but two numbers will categorize them; the first will dictate which teacher they belong to, and the second will represent which student they are.

Teacher 1 expressed almost entirely *not-knowing-that* throughout the study. There were a few instances where they displayed *not-knowing-how*, but nowhere near as much as the former. Student 1.1 displayed little not-knowing altogether, but did exhibit partial *not-knowing-why*, which was surprising but had no clear connection to the teacher. Student 1.2 was almost identical to student 1.1, in that they didn't express much not-knowing, but when they did, it came as an "I wonder" statement. Student 1.3 demonstrated mostly *not-knowing-how* with one display in *not-knowing-why*. Finally, student 1.4 demonstrated only expressions of *not-knowing-how*.

Teacher 2 expressed only *not-knowing-that* and *-how* as well, leaning slightly towards expressions of *-that*. Interestingly, there was almost no expressions of not-knowing from her students, and the little there was involved *-that* and *-how*.

Teacher 3 expressed several short comments of not-knowing mostly on the level of *-that and -how*. Similarly, her students demonstrated on expressions of *-that*

and *–how*, yet the students were able to express their not-knowing in fuller sentences as compared to their teacher.

Once all data was analyzed, it seemed that every individual displayed not-knowing at random and there was no direct connection between teachers and students that could be made. One thing that was evident was the focus on mostly expressing *not-knowing-that* and *–how*. The inclination of these two expressions of not-knowing is further examined in the next discussion.

DISCUSSION

Two highlights that the data demonstrated have been the difficulty for expressing not-knowing (which I have presented in past research), as well as a lack of expressions of *not-knowing-why* across the board.

Difficulty expressing not-knowing was expected, as previous research already found. Individuals seem to have a difficulty detailing exactly what they do not know in clear sentences. This seems to sometimes misdirect the individuals and taking them down an incorrect path, where their thoughts only get more tangled. Several individuals also mentioned the time at some point, conveying their pressure due to time. Although it must be noted that Teacher 1 accommodated students in individual rooms, which lowered their feeling of pressure in early attempts of the task.

Findings demonstrated a heavy inclination towards expressions of *not-knowing-that* and *–how*. This may be because these statements are easier to make than those of *not-knowing-why*. It may also represent that students did not seek to know the “why” of certain ideas conveyed by the tangram. This may have a connection to the current educational climate, where education dwells in procedural tasks as opposed to conceptual ones.

Although teacher-student connections of not-knowing were not present in this study, it cannot be assumed that they do not exist. Overall difficulties expressing not-knowing may be playing a huge part in how these expressions are transferred. How is a teacher supposed to convey not-knowing, when they themselves have trouble expressing it? This is something that needs to be further investigated.

LIMITATIONS

Since the topic of exploring not-knowing is fairly new, there are difficulties researching it. The way the teachers approached conveying not-knowing to their stu-

dents may have had different impacts, possibly affecting some student responses. Even if they occurred, I believe both major findings would still hold. More research needs to be done on the topic for more solid findings to come forth.

CONCLUSION

Although several researchers have pointed out the importance of not-knowing as a first step to knowing, there is little research done for understanding awareness of not-knowing and potential benefits. In an attempt to better understand not-knowing, parallels were created to that of *knowing-about* (Ryle, 1949). These parallels can help us see if awareness of not knowing in these categories boost an individual's ability to more easily be able to *know-to-act* in the moment as well as become aware of not-knowing in the moment.

This research studied expressions of not-knowing between teachers and their students. Through recordings, transcriptions, and reflections, data emerged to be analyzed. Findings presented no true connection between teacher-student expressions of not knowing, but two other conclusions were made based on the data. Firstly all individual displayed difficulty expressing their not knowing clearly. Secondly, when not-knowing was expressed, it heavily leaned on expressions of *not-knowing-that* and *not-knowing-how*. This may show that individuals rarely seek answers of *-why* as it is a more cognitive task.

Finally, although no clear connection between expression of not-knowing from teacher to student was made, it does not mean they don't exist. Difficulties in expressions of not-knowing may be playing a huge factor, as teachers themselves have difficulty expressing their own not-knowing, making it difficult to convey it to their students. This research is only a start at exploring the concept of not-knowing and its potential benefits to learning. More research needs to be done in order to solidify findings and expand the concept.

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