



## Challenges with Implementing Oral Exams in Post-Secondary Mathematics Courses

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### Abstract

In this study, seven mathematics professors and instructors were interviewed to share their thoughts about implementing oral assessment in mathematics courses in Canada and the United States, where oral assessment in mathematics is not part of the educational system. Four out of seven mathematics professors and instructors were educated in Poland, Romania, Bosnia, and Ukraine, and they are currently teaching mathematics at a university in Canada. The other three professors were educated in Canada, Germany, and the United States, and they are currently teaching at a university in Germany. Five participants had previously experienced oral examination in mathematics, while the other two had never been exposed to oral examination in mathematics throughout their schooling. The results showed that implementing oral assessment in mathematics courses at the university level in Canada and the United States might raise some students' and professors' concerns.

**Keywords:** beliefs, culture, mathematics, oral assessment, oral examination

### INTRODUCTION

The study presented in this paper is an extension of the research presented in Videnovic and Liljedahl (2018), where seven mathematics professors and instructors shared their personal experiences with teaching and studying mathematics in Poland, Romania, Bosnia, Ukraine, Germany, Canada, and the United States. The results showed that in Canada and the United States, mathematics professors and instructors face many constraints within their assessment practices and teaching of mathematics, such as the issue of finding the time to administer oral exams; students' expectations and behaviors; institutional and mathematics department norms; school cost; professors' teaching evaluations; the adopted mathematics curriculum and mathematics textbooks.

In this research, the same seven participants were interviewed and asked to share

their thoughts about implementing oral assessment in mathematics courses in Canada and the United States, where the educational systems are dominated by closed-book, written examinations. Many countries maintain an oral assessment in most academic subjects as an important part of their assessment practice (Brown & Knight, 1994; De Vita & Case, 2003; Forrest, 1985; Hubbard, 1971). Some of these countries are Hungary, Italy, Germany, and the Czech Republic. On the other hand, the primary assessment method in the mathematics classrooms in the USA and the UK is strictly based on the closed book written examinations (Gold, 1999; Iannone & Simpson, 2011; Nelson, 2010).

This paper begins with presenting the literature on oral assessment. Next, it introduces the theoretical framework, along with the methodology of this study. The last part of the paper provides the results and discussion of the

results, concluding with some recommendations for possible future research.

## LITERATURE ON ORAL ASSESSMENT

There is very little literature examining the use of oral assessment. In the UK comprehensive review of the literature on innovative assessment, it shows that of 317 papers considered, only 31 dealt with ‘non-written assessment’, which includes: oral examination, group and individual oral presentation, debate, artifact, audio or video recording, and role-play. Within this category of non-written assessment, only four papers addressed the use of oral examinations (Hounsell, et al., 2007). Most of the research on oral assessment focuses mainly on liberal arts subjects.

This section takes a look at a brief description of types of oral assessment and the disadvantages and the advantages of oral assessment.

### Types of Oral Assessment

Joughin (1998) defines *oral assessment* as “assessment in which a student’s response to the assessment task is verbal, in the sense of being ‘expressed or conveyed by speech instead of writing’ (*Oxford English Dictionary*).” In terms of different types of oral assessment, according to Joughin (2010), they can be categorized into three forms: presentation on a prepared topic (individual or in groups); interrogation (covering everything from short-form question-and-answer to a doctoral oral exam); and application (where candidates apply their knowledge live in a simulated situation, e.g., having trainee doctors undertaking live diagnoses with an actor-patient).

This paper focuses on *oral examination*, with elements of both presentation and dialogue from the interrogation form of oral assessment, and combines oral medium with writing on a paper and board. The term *assessment* is used to

represent a broader range of evaluation activities, but also, as most assessments in undergraduate mathematics are exams, in this paper, terms *assessment* and *exam* are used interchangeably.

### Positive and Negative Aspects of Oral Assessment

The main topic that has been discussed in oral assessment literature is related to the disadvantages and advantages of oral in comparison to written assessment. When it comes to the disadvantages of oral assessment compared to written ones, there are two major concerns: fairness and anxiety. Videnovic (2017b) notes that the mathematics professors, who were interviewed in her study, believe that it is not entirely clear which type of an exam, oral or written, can be considered to be more or less fair in comparison to each other, and which can cause more or less anxiety among students. There is a perception that oral assessment may make students more anxious than other forms of assessment for two reasons: oral assessment anxiety may be primarily related to its unfamiliarity, and oral assessment anxiety is associated with the conception that an oral task requires a deeper understanding and the need to explain to others (Henderson, Lloyd & Scott, 2002; Hounsell et al., 2007; Huxham, Campbell & Westwood, 2012; Joughin, 2007).

When it comes to the advantages of oral assessments over the written ones, Videnovic (2017a) notes that the mathematics professors interviewed believe that written exams can mostly assess procedural knowledge and instrumental understanding. In contrast, oral exams can better assess conceptual knowledge and relational understanding of mathematics. Furthermore, the literature on oral assessment in mathematics classrooms reports that oral assessments in mathematics: provide immediate feedback and immediate grade; prevent plagiarism; help develop better oral communication skills; promote deep

comprehension of the learned material; encourage students to deeply and actively engage with the course material; help students gain ownership of the learned material; help students learn to express technical material clearly and concisely; allow for probing knowledge through dialogue; provide long-lasting mathematical knowledge; are authentic; help prepare students for their professional careers; help develop better presentation skills; help students build the confidence; are reactive to students' needs; encourage students to put more effort and time in preparing for it (Boedigheimer, et al., 2015; Lianghuo & Mei, 2007; Iannone & Simpson, 2012, 2015; Nelson, 2010; Nor & Shahrill, 2014; Odafe, 2006).

## THEORETICAL FRAMEWORK

Green (1971) introduced three dimensions of belief systems: *quasi-logical relationship*, *psychological strength*, and *isolated clusters*. In a *quasi-logical relationship*, beliefs can be either *primary* or *derivative* (a belief derived from a primary belief). For instance, if a student believes that learning mathematics is useful for his/her life, this would be considered a primary belief. If a student thinks it would be important to work hard in mathematics class and try to relate problem-solving exercises to everyday life, these would be considered derivative beliefs. In a *psychological strength* dimension, beliefs can be either *central* or *peripheral*. Central beliefs are held most strongly, where the peripheral beliefs are held less strongly and can be changed more easily. For instance, an experienced teacher holds more central, deep-rooted beliefs, where the newly hired teacher holds more peripheral, changeable beliefs. In *isolated clusters* dimension, beliefs are held in clusters, where “nobody holds a belief in total independence of all other beliefs. Beliefs always occur in sets or groups” (p. 41). An example of this would be when we talk about mathematics; we could broadly classify beliefs about

mathematics concerning the nature of mathematics, teaching and learning of mathematics, the nature of mathematical knowledge and understanding, etc.

This paper focuses on studying the relationship between the mathematics professors' beliefs about the current constraints that exist within mathematics assessment practices and teaching of mathematics in Canada and the United States, and possible future concerns that might arise with implementing oral assessment in Canada and the United States in post-secondary mathematics courses. For this purpose, out of these three dimensions of belief systems, the *quasi-logical relationship* dimension is selected as a theoretical framework of this study.

## METHOD

The research design for this study is qualitative. As already mentioned at the beginning of this paper, seven participants were selected for this study. These participants were selected based on the following criteria: each participant has been exposed to oral assessment either as a student and/or professor. In terms of recruitment, the researcher used snowball sampling methodology, a technique for finding research subjects. One subject gives the researcher the name of another subject, who provides the name of a third, and so on (Vogt, 1999). Therefore, the researcher started with mathematicians, whom the researcher knew professionally, and then asked them to recommend others in the mathematics department or elsewhere. They suspected that they might have a history of experiencing or using oral assessment.

The following mathematics professors and instructors were interviewed: Melissa, Elisabeth, Van, Nora, Dave, James, and Jane. Melissa, Elisabeth, Van, and Nora were born and educated in Poland, Romania, Bosnia, and Ukraine, respectively, and are currently teaching

at a Canadian university. In contrast, Dave, James, and Jane were born and educated in Canada, Germany, and the United States, respectively, and are currently teaching at a university in Germany. Concerning familiarity with oral assessment, Van, Melissa, Nora, and Elisabeth had been previously exposed to oral examination in mathematics prior to moving to Canada. In contrast, Dave and Jane, who were educated in Canada and the United States, had never been exposed to oral examination in mathematics prior to moving to Germany. James was born in Germany and educated in Germany and the United States, and thus, he has had much exposure to oral assessment in mathematics. The audio recordings of interviews were transcribed, and transcriptions were used for data analysis.

## RESULTS AND DISCUSSION

The implementation of oral assessment might raise some concerns among the students and professors at universities in Canada and the United States. Based on the participants' responses, the implementation of oral assessment might raise the following concerns:

- Issue of finding the time to administer oral exams;
- Adopted norms in teaching institution and mathematics department;
- Issue of fairness in oral exams;
- Issue of anxiety and making oral examination public for students;
- Students need to be trained on how to deliver the material in mathematics orally;
- Professors need to be trained on how to conduct oral exams in mathematics.

When it comes to an issue of making oral examination public for students, this was referred to as the students having greater anxiety if they were about to perform oral exams publicly in front of their class peers and/or professor(s). Van commented on this:

When I'm thinking about doing

this, I'm thinking rather about weaker students giving them a chance to present themselves in a better way. And, it is difficult to say, I can tell you that I have, or I had students in my classes that would just freeze during this written examination. And you know another problem that I'm having with this idea is, can we make this public? Can we do this in this moment of time, in this place? Can we do a public oral examination for undergraduate students?

In response to an interview question, 'If you are about to implement oral assessment in your current mathematics courses, what could you predict?' the participants expressed their concern that if an oral assessment were about to get implemented, the students would certainly need to be provided with training on how to deliver the mathematics material orally. Nora explained that in order for the students to adopt the oral exams in their mathematics classes, it would take some time for the students to accept a different method of assessment in their classes than what they are already used to:

They need to go through the training to deliver the material that they learned. The students need to be prepared for this, and at least for the first few years until it becomes a tradition, I would give them the option. You can have only the written exam, or you can have part of the exam written and part of the oral exam. I would do that because, again, they're conditioned in high school for many years [...] we had oral exams from grade five every year. It was very stressful, but in some way, we were already dealing

with this [...] again, it would take a while for the students to get reconditioned.

In this process of the possible students' adaptation to the oral exams, Jane commented that the students might express their resistance for this change to happen:

I mean, especially at lower level courses, the students would be very, very upset. Because, you know, students like to complain about their grades, and when they have something in hand, they can say I wrote this, but you said this, and I think I deserve more points. But if that's not possible, if it's just kind of like there are a couple of little notes that someone wrote down on an oral exam and the professor says you get a particular grade [...] yeah, I feel like there is kind of some sense of entitlement, especially in the U.S. from the students, and I think that would not go very well.

The prior experiences tend to make most people have a hard time adapting to any change, a positive or a negative one. Dave explained this when he commented on possible future concerns that might arise with implementing oral assessment in Canada:

I think that you'd see a lot of variation. There would be some professors who would say, "Yeah, finally," and some students who would say, "Yeah, this makes sense. I always hated the written examinations. I look forward to

having an alternative." And you would have some people who would say, "I've never done this. Nobody I know has ever done this. Why should we change?" A parallel might be at university where I was teaching in Nova Scotia just before I started there, so this would now be 20 years ago. The president of the university said, "We're going to become a laptop university. Every student is going to have a laptop, a computer with them in their classrooms, every teacher is going to use computers in their teaching." And some people said, "Yes, finally I can do interesting things with technology," and other people said, "Come on, I'm a mathematics professor. Mathematics professors have been teaching mathematics using chalk and chalkboards for 500 years, and why on earth should I change.

The goal of this paper was to identify the *quasi-logical relationship*, based on Green's (1971) concepts of *primary* and *derivative* beliefs, between the participants' beliefs about the current constraints that exist within mathematics assessment practices and teaching of mathematics in Canada and the United States, and possible future concerns that might arise with implementing oral assessment in Canada and the United States in university mathematics courses. This relationship is presented in Figure 1.

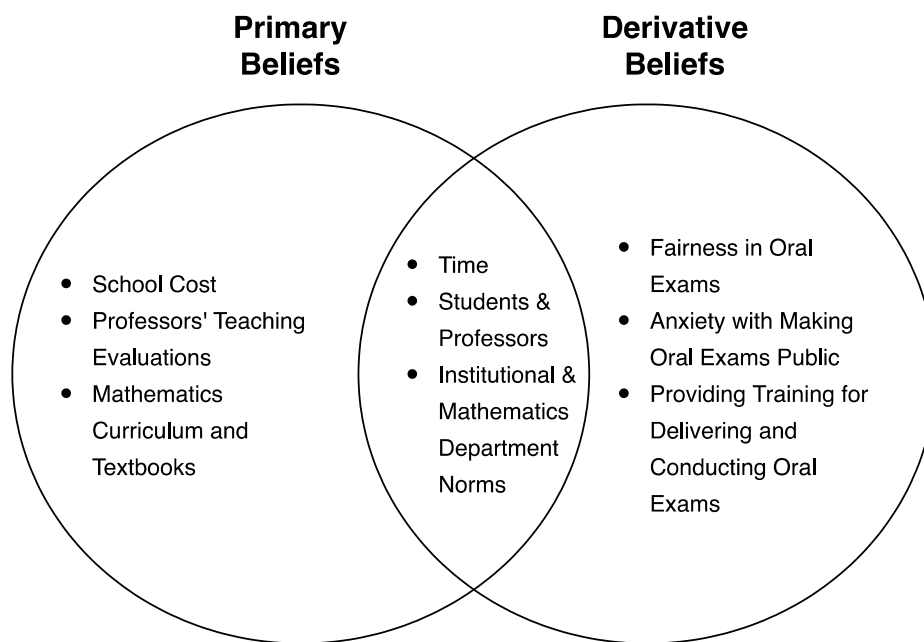


Figure 1. Relationship between Current and Future Concerns with Implementing Oral Assessment in Mathematics Classrooms

Figure 1 represents the relationship between current constraints within assessment practices and the teaching of mathematics and future concerns with implementing oral assessment in mathematics classrooms in Canada and the United States. Primary beliefs represent the participants' beliefs about current constraints, while derivative beliefs (derived from the participants' beliefs about current constraints) represent the participants' beliefs about future concerns that might arise with implementing oral assessment in mathematics classrooms.

In Figure 1, the intersection of primary and derivative beliefs represents the common concerns shared between the current constraints that exist within the mathematics assessment practices and teaching of mathematics in Canada and the United States, and possible future concerns that might arise with implementing oral assessment in mathematics classrooms in Canada and the United States. These common

concerns are the issue of finding the time to administer the oral exams, the issue of having students and professors adjust to new assessment practices, and the issue of changing the accepted norms about mathematics assessment within the teaching institution and mathematics department.

When it comes to implementing oral assessment in mathematics classrooms, the need for the students as well as for the professors to be trained on how to deliver the material orally and to successfully conduct the oral assessment in mathematics classes came up as an important concern. Moreover, the data show that the examiner should have specific skills in order to be able to administer the oral assessment successfully.

The participants, Dave and Jane, who were educated in Canada and the United States, and had never been exposed to oral examination in mathematics prior to moving to Germany, believe that having intuition is a crucial skill for conducting the oral assessment. This intuition

needs to come from the cultural background of someone who had already been exposed to the oral assessment in his/her previous schooling or teaching. On the other hand, the other five participants, who had been previously exposed to oral examination in mathematics prior to moving to Canada, believe that everyone already has the skill within himself/herself, so it is just a matter of practicing it.

In the literature on oral assessment section, it is already mentioned that there are very few research studies that address the concept of oral assessment, and these studies mainly focus on the disadvantages and advantages of oral in comparison to written assessment. This paper provides insight into the relationship between the mathematics professors' current concerns with mathematics assessment practices and teaching of mathematics in Canada and the United States, and possible future concerns that might arise with implementing oral assessment in Canada and the United States post-secondary mathematics courses. No previous research discusses any of this.

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## CONCLUSION

From this study, we can see that at the university level in Canada and the United States, students do not have the option to be orally assessed in mathematics courses even though many countries maintain an oral assessment as an important part of their mathematics assessment practices. However, instead, they are expected to assimilate prescribed mathematics assessment practices that exist within particular university culture.

An exciting continuation of this paper would be to study other countries, apart from Canada and the United States, that also do not use oral assessment practices in post-secondary mathematics courses. Therefore, the recommendation for possible future research would be to perform a quantitative study to understand whether the beliefs identified in this study expand to a larger population of mathematics professors from different schooling and teaching cultures.

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