

INTEGRATING ORAL PRESENTATION INTO MATHEMATICS TEACHING AND LEARNING: AN EXPLORATORY STUDY WITH SINGAPORE SECONDARY STUDENTS¹

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Abstract: *This paper introduces an exploratory study on the integration of oral presentation tasks into mathematics teaching and learning in Singapore school settings. Five classes taught by different teachers in two secondary schools participated in the study. Data reported were mainly collected through classroom observations, teacher interviews, and field-notes. The study revealed that although both teachers and students encountered initial difficulties and challenges, after gaining necessary experiences and skills they can overcome these difficulties and challenges and become more positive and effective in using oral presentation in their teaching and learning. Moreover, teachers' beliefs, behavior, reaction and verbal responses to students' speech attributed to the effectiveness of using oral presentation in mathematics teaching. The results suggest that, given necessary help and guidance for teachers and students, it is meaningful and feasible to integrate oral presentation tasks into mathematics teaching and learning.*

Key Words: Communication skills; Oral presentation; Mathematics assessment; Alternative assessment; Singapore mathematics education

Introduction

Developing students' communication skills has been widely believed to be one of the important goals in the international mathematics education community (e.g., Cai & Jakabcsin, 1996; Morgan, 1999; Sfard, 2001; National Council of Teachers of Mathematics, 1989 & 2000). In Singapore, the national mathematics syllabus explicitly states that one major aim of mathematics education in schools is to enable students to "use mathematical language to communicate ideas and arguments precisely, concisely and logically" (Ministry of Education, 2001, p. 9) and "develop the abilities ... to communicate mathematically" (Ministry of Education, 2006, p. 1). According to the syllabus, developing students' ability to illustrate, to interpret, to explain, and to discuss mathematical ideas and their experiences in learning mathematics has its unique value in mathematics instruction, and students should be given the opportunities to speak and write in mathematics classrooms, although very often mathematics learning has been viewed to focus mainly on computational and procedural skills.

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This study is part of a larger research project on integrating new assessment strategies into mathematics teaching and learning under the Centre for Research in Pedagogy and Practice, National Institute of Education, funded by the Ministry of Education, Singapore. The main research introduces four alternative assessment strategies into daily learning and teaching in Singapore's primary and secondary mathematics classrooms. These four alternative assessment strategies are based on the use of communication assessment tasks, performance assessment tasks, project tasks, and student self-assessment tasks. The study presented herein reports the results from two secondary schools whereby teachers and students used oral presentation as one form of the communication assessment tasks.

For the larger project, we classified communication tasks into two types: written communication tasks and oral communication tasks. More specifically, the larger study employed the use of journal writing tasks as written tasks and oral presentation tasks as oral tasks. Although journal writing and oral presentation are both not prevalent in the context of Singapore schools, results from some small-scale structured research works using written and oral communication tasks in the mathematics classrooms (e.g. Yeo, 2001; Yazilah & Fan, 2002; Seto, 2002) seem to suggest the increasing recognition and interest in the use of these alternative strategies. However, available research document in this line is also found to have most focused on students' written communication skills. Research documentation, particularly classroom-based, of how mathematics teachers can efficiently engage students in meaningful learning with focus on students' oral communication skills is lacking (e.g., see Fan et al., 2006).

Research Objectives and Questions

This study aims to investigate how oral presentation can be effectively integrated into classroom teaching and learning in Singapore school settings. More specifically, there are three main research questions:

1. What are the impacts of using oral presentation tasks on teachers' teaching methods and behaviors?
2. What are students' general perceptions and attitudes toward the use of oral presentation tasks in their mathematics learning?
3. How oral presentation tasks can be effectively integrated into the process of classroom teaching and learning?

By addressing the above three research questions, we hope to provide research-based evidences concerning the implementation of oral presentation tasks in Singapore secondary mathematics classroom settings, explore practical ways for teachers to effectively integrate oral presentation tasks into students' learning of mathematics, and offer useful suggestions for teachers to develop students' oral communication skills.

Theoretical Framework and Perspectives

The theoretical background for this study is, to a degree, drawn on three major theorists that are identified to have highlighted the crucial role that students' activity plays in students' learning: socio-cultural, constructivist and multiple intelligences.

In brief, the socio-cultural perspective gives the priority to social and cultural processes over individual thought processes and attempts to reform classroom practice by promoting less hierarchical, more interactive, and more networked forms of communication within the classroom (Goos, Galbraith, & Renshaw, 1999). Constructivist theorists believe that a learner's knowledge is constructed by the learner, and social discourse is one of the powerful ways students come to change or reinforce conceptions and knowledge construction. Student-to-student dialogue or teacher-to-student discussion are ways whereby a communicative culture can be fostered, encouraging effective meaningful sharing of information and learning (Brooks & Brooks, 1993, pp. 101-118). In addition, multiple intelligence theory claims that

different students have different learning styles, strengths and experiences, and not all students learn in the same way (also see Adams, 2000), therefore students should be provided with a multitude of learning opportunities, including verbal communication opportunities.

This study views the use of oral presentation tasks from two perspectives. First, it is regarded as an alternative mode of assessment for teachers to gather information about their students' learning of mathematics and hence make relevant instructional decisions. Second, it is also viewed as a tool for developing students' communication skills. While there is no one formal definition of what oral presentation is, it is evident in the literature that oral presentation is an activity of sharing ideas and clarifying understanding verbally. One general purpose of oral presentation in mathematics classroom is to allow teacher to hear what students are thinking about mathematics, and how they express mathematics and their understanding of mathematics in their own words. Furthermore, according to the *Communication Standard for Grades 6-8* by the National Council of Teachers of Mathematics (NCTM), teachers using oral presentation tasks must provide opportunity for students to think through questions and problems; express their ideas; demonstrate and explain what they have learnt; justify their own opinion; and reflect on their own understanding and on the ideas of others (NCTM, 2000, p. 272).

We generally classified oral presentation tasks into two categories: pre-structured oral presentation tasks and impromptu oral presentation tasks that are not pre-planned but impromptu (i.e. tasks are carried out without being planned earlier or rehearsed). The following gives a brief description of what impromptu and pre-structured oral presentation tasks are:

Impromptu oral presentation tasks	Pre-structured oral presentation tasks
<p>Specific tasks:</p> <ul style="list-style-type: none"> • Questions that are posed during instruction; • Students' responses to questions that are posed or asked; • Students' work that are represented on the board during instruction; • Students' work that are given in the homework, class work, worksheets, or textbooks; • Students' summary of a lesson. 	<p>Specific tasks:</p> <ul style="list-style-type: none"> • Questions that are pre-designed and given to students prior to lessons; • Students' previous writing tasks on their learning reflection or perceptions; • Students' previous solutions to test questions; • Students' previous writing tasks about mathematics; • A selected topic that is pre-agreed before discussion; • To report results or findings of a project work; • To report pair or group work discussion.

To illustrate how a pre-structured oral presentation task could look like, take for example the topic of Hire Purchase, a teacher could ask students to bring in newspaper cuttings and advertisement about purchase of items that involved both cash and hire purchase scheme. The questions that teacher wants students to think and work on before the presentation may look like this:

- (a) *Discuss and write down that is agreed among yourselves in the group the understanding about hire purchase.*
- (b) *Find an advertisement which has both cash and hire purchase scheme. Cut out and paste the advertisement on the worksheet.*
- (c) *Suppose you are to advice your parents about purchasing the product (that you have cut out earlier in part (b)), what would you say to them and what advice would you give?*

In another example, a teacher may want to collate the common mistakes that students have made in a test or examination about the expansion or factorization in algebraic expressions. The worksheet should contain the work examples of students that have made mistakes in their test/examination, a column for

students to work out the correct solutions, and a column for students to write out how mistakes pertaining to the specific questions could be prevented. After some time of either individual or small group work, students can therefore present and discuss about their work and ideas.

An impromptu oral task, for example, is that a teacher could elect a student and ask the student to summarize the day's lesson. Other students could help to 'fill-in' the gap the student may have missed out. In this way, others would also be given the opportunity to voice their opinions and ideas although they are not the one to give the summary.

It should be emphasized that in this study, our focus was on the integration of oral presentation tasks into the daily classroom teaching and learning, therefore it is our perspective that the topics of presentation chosen should closely follow and support the current instructional content and syllabus.

Research Method

1. Schools

Two secondary schools were randomly selected to participate in the study. One secondary school was identified as a high-performing school because it was selected from the 50 best performing secondary schools that offered both Express and Normal Academic streams³, based on the year 1999-2002 GCE "O" Level Examination results released by the Ministry of Education (MOE), Singapore. The other secondary school was identified as a non-high performing school because it was not in this top 50 school ranking. The main reason for us to select a high-performing and a non-high performing school was to observe the possible similarities and differences among different types of schools about the use of oral presentations concerning the research questions described earlier.

2. Classes and students

In each school, one first year secondary (Grade 7) class in Express Course and one in Normal (Academic) Course, each taught by a different teacher, were selected to participate in the study. The study needed to follow up the students for a period of about 18 months, that is, students were tracked as they moved from Secondary One level (Grade 7) to Secondary Two level (Grade 8). However for the second year schooling, the students from the non-high performing school were streamed at the end of their first year. As a result, some students were lost due to streaming. In addition, due to some unforeseen reasons, one teacher in the non-high performing school was replaced by another teacher who was also teaching another parallel class; therefore that class was also included in the study but only the students who were involved in the first year were tracked and data analysis included only these students. Nevertheless, the study was able to track slightly more than 50% of the students.

All the classes had about 40 students, a standard size of all Singapore secondary classes. The participating teachers had a variety of teaching experiences in terms of the number of years they had taught. All the classes were observed and all the teachers involved were interviewed for data collection.

3. Data collection and analysis

There were mainly four instruments designed for data collection in this study: oral presentation tasks, students' questionnaire surveys, structured classroom observations, and interviews with teachers. Field-notes were also taken during the study.

³ In Singapore, there are four types of courses for secondary school students to take, which are Special Course, Express Course, Normal (Academic) Course, and Normal (Technical) Course. The academic achievements of students in the first two courses are generally better than those in the other two courses.

As mentioned earlier, in the larger research project, both journal writing tasks and oral presentation tasks were introduced into the mathematics classrooms. However, due to the fact that both of them were new tasks for teachers as well as students, therefore, for teachers and students to better manage the relatively new strategies, only journal writing tasks were used in the classrooms during the first nine months of the intervention period. Oral presentation tasks were mainly introduced in the second year of the study as an integral part of teaching and learning process for a total period of two school terms (about six months). The oral tasks were first designed mainly by the researchers, then gradually by the teachers with the help of the researchers, based on the theoretical framework and perspectives discussed above. The tasks were also designed based on teachers' scheme of work. On average, four to five oral presentation tasks were done in each of the experimental classes.

Structured classroom observation was intended to document the instructional practices occurring in the classes. During the period of about 18 months, each class was observed for an average of 12 times, and each observation period was about 60 minutes. Field-notes were taken in all the classroom observations. At times, researcher was also in the classroom to video tape the teachers implementing oral presentation tasks. One of the aims was to provide teachers with feedback, advices and guidance about the use of the new tasks, as well as to communicate with the teachers and students constantly. The other reason was to gain more ideas from the classroom observations so that subsequent tasks could be constructed or designed.

In the larger research project, experimental students were asked to take a pre-questionnaire survey just before the start of the main study, and a post-questionnaire survey after the end of the intervention period. Both the questionnaire surveys were intended to measure students' attitudes toward mathematics and their learning of mathematics. For this study, we will focus on the last 16 question items in the post-questionnaire survey that were constructed to measure students' general feelings, beliefs and perception about their own ability to perform oral presentation tasks. To respond to these items, students had to agree or disagree on a nine-point Likert-type scale format with the following anchors: *1 = Disagree totally*, *2 = disagree a lot*, *3 = Disagree*, *4 = Disagree a little*, *5 = Neither disagree nor agree*, *6 = Agree a little*, *7 = Agree*, *8 = Agree a lot* and *9 = Agree totally*.

Interviews were conducted with all the five participating teachers. The interviews focused on their experiences in carrying out oral presentation tasks during teaching, the difficulties and challenges they faced, the specific actions they took to help their students, and the measures they developed to improve the integration of the task more efficiently. Each interview took about 30 minutes and was audio-recorded and then transcribed.

Qualitative method was mainly employed to analyze the data which were collected from the classroom observations, students' questionnaire surveys, and the teacher interviews, with the purpose of documenting the teacher's instructional behavior and providing general descriptions about the integration of oral presentation tasks during mathematics teaching.

It should be pointed out that this study is exploratory in nature. The study was designed to follow up with students and teachers for a period of about 18 months. A limitation is, however, during this long period of intervention, there were certain variables which were difficult to predict and/or control. For example, in one school, the administration had decided to stream the Secondary One students at the end of the year. Thus, students in both the experimental and other parallel classes were changed at the beginning of the second year of the study, i.e., when students began their academic year of Secondary Two. As a result, students who had received or not received intervention right at the beginning of the study were all mixed up. Thus, a number of students were 'lost' in the experimental classes. Nevertheless, the study managed to track about 50% of the original students from the beginning of the study in that school. In another case,

the teacher in the experimental Express class was not able to follow up with the experimental class because she had to go on a long term maternity leave, and therefore the teacher had to be replaced. Hence, the changes of administration policy in school regarding the issue of streaming and teacher transfer were some variables that were beyond the control for this research.

Another limitation of the study was related to participating students' attitudes and behavior. Although gathering evidence from students' performing on oral presentation tasks was intended to be an alternative way of assessing students' learning and understanding of mathematics, but throughout the whole intervention period, none of the teachers' evaluation on students' work on these new assessment tasks was taken into account as part of students' final school achievement grades. This arrangement is understandable because participating students should not be disadvantaged and disconnected from the schools' normal assessment practices; otherwise, these students would be negatively affected for their grades and reports. However, researchers believed that this could lead to some students not seriously attempting the oral presentation tasks, especially the pre-structured ones. Moreover, the participating teachers were observed to have tried to make time from their usual pre-planned teaching schedule to do the new tasks and this often led to teachers doing the new tasks only when they were reminded or told, which as one can see might have generated some negative influences on the results of the study.

Results and Discussions

Below are the main findings obtained from the data we collected, in accordance with the three aforementioned research questions.

What are students' general perceptions and attitudes toward the use of oral presentation task in their mathematics learning?

As mentioned earlier, a total of 16 questionnaire items were constructed to measure three aspects of students' general attitudes toward the use of oral presentation tasks: (a) perceptions about their own ability to perform, (b) beliefs in the usefulness, and (c) acceptance of oral presentation tasks. We shall now first report results from the high-performing school, followed by results from the non-high performing school.

The data revealed that students in the experimental Express Course responded positively to only four items pertaining to oral presentation. Table 1 showed that although students did not generally have positive acceptance towards the use of oral presentation (Q38 & Q51), students had positive beliefs about the usefulness of doing oral presentation. For instance in Q42, 45% of the students believed that *'doing mathematics oral presentation helps me to be more aware of my understanding of mathematics'* (vs. 32.5% who disagreed), 42.5% of the students believed that *'doing mathematics oral presentation makes me think broader and deeper about mathematics'* for Q47 (vs. 35% who disagreed), and more than 70% of the students also had the same opinion that *'listening to other classmates' oral presentation is helpful for me in learning mathematics'* (Q49).

Table 1
Percentages of experimental Express students (from high-performing school) responding to the 16 items in the questionnaire survey

	Disagree totally	Disagree a lot	Disagree	Disagree a little	Neither disagree nor agree	Agree a little	Agree	Agree a lot	Agree totally
General beliefs about oral presentation									
Q40: Doing mathematics oral presentation helps me to learn mathematics.	10.0%	7.5%	10.0%	15.0%	17.5%	15.0%	15.0%	5.0%	5.0%

Q42: Doing mathematics oral presentation helps me to be more aware of my understanding of mathematics.	7.5%	5.0%	10.0%	10.0%	22.5%	20.0%	20.0%	2.5%	2.5%
Q43: Oral presentation skill is important in mathematics learning.	12.5%	7.5%	12.5%	12.5%	22.5%	10.0%	17.5%	10.0%	5.0%
Q47: Doing mathematics oral presentation makes me think broader and deeper about mathematics.	2.5%	2.5%	15.0%	15.0%	22.5%	17.5%	17.5%	2.5%	5.0%
Q49: Listening to other classmates' oral presentation is helpful for me in learning mathematics.	2.5%	10.0%	2.5%	10.0%	12.5%	20.0%	32.5%	7.5%	12.5%
Q52: Doing mathematics oral presentation makes me learn mathematics better.	7.5%	15.0%	7.5%	5.0%	20.0%	20.0%	17.5%	5.0%	2.5%
Q53: Doing mathematics oral presentation is a waste of time.	10.0%	7.5%	7.5%	2.5%	37.5%	5.0%	12.5%	5.0%	12.5%
Q44: I am able to express about my feeling through mathematics oral presentation.	7.5%	5.0%	20.0%	15.0%	20.0%	12.5%	12.5%	5.0%	2.5%
Q45: I am able to tell others about my understanding of mathematics through mathematics oral presentation.	7.5%	10.0%	20.0%	10.0%	17.5%	20.0%	17.5%	2.5%	5.0%
Perceptions about own ability to do oral presentation									
Q39: Doing mathematics oral presentation is easy to me.	15.0%	10.0%	17.5%	15.0%	20.0%	12.5%	5.0%	5.0%	10.0%
Q41: I am not afraid of doing mathematics oral presentation.	15.0%	2.5%	15.0%	17.5%	12.5%	7.5%	25.0%	5.0%	10.0%
Q46: I don't know how to get started when I am doing mathematics oral presentation.	2.5%	10.0%	15.0%	7.5%	30.0%	22.5%	7.5%	5.0%	10.0%
Q48: I feel lost when I am doing mathematics oral presentation.	2.5%	5.0%	10.0%	15.0%	22.5%	20.0%	15.0%	7.5%	2.5%
Q50: I can do mathematics oral presentation well.	10.0%	7.5%	20.0%	15.0%	25.0%	12.5%	7.5%	2.5%	10.0%

General acceptance towards oral presentation									
Q38: I like to do mathematics oral presentation during mathematics lessons	25.0%	12.5%	12.5%	10.0%	20.0%	7.5%	10.0%	.0%	2.5%
Q51: I would like to have more mathematics oral presentations for my mathematics lessons.	25.0%	12.5%	7.5%	12.5%	22.5%	7.5%	5.0%	2.5%	2.5%

Interestingly, the data for the experimental Normal Academic students also revealed somehow similar results as to the experimental Express students’ responses to these 16 items. Table 2 showed that the Normal Academic students did not show very positive responses to items corresponding to their acceptance towards the use of oral presentation. However, the data did reveal that most students generally believed in the usefulness of oral presentation. For instance, more than 60% of the students ‘agreed’ that *‘listening to other classmates’ oral presentation is helpful for me in learning mathematics*’.

Table 2
Percentages of experimental Normal Academic students (from high-performing school) responding to the 16 items in the questionnaire survey

	Disagree totally	Disagree a lot	Disagree	Disagree a little	Neither disagree nor agree	Agree a little	Agree a lot	Agree totally	
General beliefs about oral presentation									
Q40: Doing mathematics oral presentation helps me to learn mathematics.	23.1%	5.1%	17.9%	2.6%	28.2%	10.3%	10.3%	2.6%	0%
Q42: Doing mathematics oral presentation helps me to be more aware of my understanding of mathematics.	23.1%	2.6%	10.3%	7.7%	23.1%	17.9%	7.7%	5.1%	2.6%
Q43: Oral presentation skill is important in mathematics learning.	17.9%	2.6%	10.3%	7.7%	25.6%	17.9%	7.7%	0%	10.3%
Q47: Doing mathematics oral presentation makes me think broader and deeper about mathematics.	17.9%	5.1%	7.7%	10.3%	23.1%	15.4%	12.8%	2.6%	5.1%
Q49: Listening to other classmates’ oral presentation is helpful for me in learning mathematics.	12.8%	2.6%	0%	5.1%	10.3%	30.8%	17.9%	5.1%	15.4%
Q52: Doing mathematics oral presentation makes me learn mathematics better.	25.6%	0%	15.4%	5.1%	17.9%	20.5%	10.3%	2.6%	2.6%
Q53: Doing mathematics oral presentation is a waste of time.	10.3%	2.6%	10.3%	10.3%	23.1%	12.8%	2.6%	5.1%	23.1%

Q44: I am able to express about my feeling through oral mathematics presentation.	15.8%	5.3%	18.4%	5.3%	28.9%	10.5%	10.5%	2.6%	2.6%
Q45: I am able to tell others about my understanding of mathematics through oral mathematics presentation.	17.9%	5.1%	15.4%	5.1%	25.6%	15.4%	10.3%	2.6%	2.6%
Perceptions about own ability to do oral presentation									
Q39: Doing mathematics oral presentation is easy to me.	28.2%	10.3%	5.1%	17.9%	20.5%	10.3%	5.1%	.0%	2.6%
Q41: I am not afraid of doing mathematics oral presentation.	15.4%	5.1%	10.3%	.0%	30.8%	7.7%	15.4%	.0%	15.4%
Q46: I don't know how to get started when I am doing mathematics oral presentation.	7.7%	2.6%	12.8%	2.6%	17.9%	20.5%	10.3%	5.1%	20.5%
Q48: I feel lost when I am doing mathematics oral presentation.	10.3%	2.6%	10.3%	5.1%	20.5%	15.4%	17.9%	5.1%	12.8%
Q50: I can do mathematics oral presentation well.	25.6%	10.3%	12.8%	12.8%	17.9%	10.3%	7.7%	2.6%	.0%
General acceptance towards oral presentation									
Q38: I like to do mathematics oral presentation during mathematics lessons	30.8%	7.7%	10.3%	17.9%	17.9%	5.1%	7.7%	.0%	2.6%
Q51: I would like to have more mathematics oral presentations for my mathematics lessons.	38.5%	5.1%	10.3%	10.3%	20.5%	10.3%	5.1%	.0%	.0%

In the non-high performing school, somehow similar results to those from the high-performing school were also observed. Table 3 revealed that the experimental Express students had responded quite negatively about their acceptance towards the use of oral presentation in the mathematics classroom. For instance, only 33.4% and 14.4% of the students 'agreed' to item Q38 '*I like to do mathematics oral presentation during mathematics lessons*' and item Q51 '*I would like to have more mathematics oral presentations for my mathematics lessons*' respectively. However, data revealed that more than 60% of the students believed that '*doing mathematics oral presentation is not a waste of time*' (Q53) and that '*oral presentation skill is important in mathematics learning*' (Q43). In addition, there were high percentages of students who believed that doing oral presentation helped in their learning of mathematics. For example, 62% and 52.3% of them 'agreed' that '*doing mathematics oral presentation helps me to learn mathematics*' (Q40) and '*learn mathematics better*' (Q52); 71.4% felt that '*doing mathematics oral presentation helps me to be more aware of my understanding of mathematics*' (Q42); 57.2% 'agreed' that '*doing mathematics oral presentation makes me think broader and deeper about mathematics*' (Q47); and over 80% 'agreed' that '*listening to other classmates' oral presentation is helpful for me in learning mathematics*' (49).

Table 3
 Percentages of experimental Express students (from non-high performing school) responding to the 16 items in the questionnaire survey

	Disagree totally	Disagree a lot	Disagree	Disagree a little	Neither disagree nor agree	Agree a little	Agree	Agree a lot	Agree totally
General beliefs about oral presentation									
Q40: Doing mathematics oral presentation helps me to learn mathematics.	4.8%	4.8%	0.0%	9.5%	19.0%	28.6%	28.6%	0.0%	4.8%
Q42: Doing mathematics oral presentation helps me to be more aware of my understanding of mathematics.	4.8%	4.8%	0.0%	0.0%	19.0%	38.1%	19.0%	4.8%	9.5%
Q43: Oral presentation skill is important in mathematics learning.	4.8%	0.0%	9.5%	0.0%	23.8%	23.8%	23.8%	4.8%	9.5%
Q47: Doing mathematics oral presentation makes me think broader and deeper about mathematics.	9.5%	0.0%	4.8%	0.0%	28.6%	33.3%	14.3%	4.8%	4.8%
Q49: Listening to other classmates' oral presentation is helpful for me in learning mathematics.	0.0%	0.0%	0.0%	0.0%	14.3%	19.0%	42.9%	9.5%	14.3%
Q52: Doing mathematics oral presentation makes me learn mathematics better.	4.8%	9.5%	4.8%	0.0%	28.6%	19.0%	19.0%	4.8%	9.5%
Q53: Doing mathematics oral presentation is a waste of time.	28.6%	4.8%	9.5%	19.0%	19.0%	4.8%	4.8%	0.0%	9.5%
Q44: I am able to express about my feeling through mathematics oral presentation.	9.5%	0.0%	23.8%	19.0%	23.8%	14.3%	9.5%	0.0%	0.0%
Q45: I am able to tell others about my understanding of mathematics through mathematics oral presentation.	9.5%	0.0%	23.8%	4.8%	23.8%	23.8%	4.8%	9.5%	0.0%
Perceptions about own ability to do oral presentation									
Q39: Doing mathematics oral presentation is easy to me.	23.8%	14.3%	14.3%	14.3%	23.8%	4.8%	4.8%	0.0%	0.0%
Q41: I am not afraid of doing mathematics oral presentation.	19.0%	9.5%	9.5%	9.5%	33.3%	14.3%	0.0%	4.8%	0.0%

Q46: I don't know how to get started when I am doing mathematics oral presentation.	0.0%	0.0%	4.8%	4.8%	23.8%	4.8%	19.0%	23.8%	19.0%
Q48: I feel lost when I am doing mathematics oral presentation.	0.0%	4.8%	0.0%	9.5%	38.1%	9.5%	14.3%	9.5%	14.3%
Q50: I can do mathematics oral presentation well.	23.8%	14.3%	4.8%	23.8%	23.8%	0.0%	4.8%	0.0%	4.8%
General acceptance towards oral presentation									
Q38: I like to do mathematics oral presentation during mathematics lessons	23.8%	4.8%	14.3%	9.5%	14.3%	23.8%	4.8%	4.8%	0.0%
Q51: I would like to have more mathematics oral presentations for my mathematics lessons.	19.0%	9.5%	14.3%	9.5%	33.3%	4.8%	0.0%	4.8%	4.8%

In the same sense, Table 4 showed that the experimental Normal Academic students also did not appear to have very positive acceptance towards oral presentation but 33.4% 'believed' (vs. 29.2% who 'disbelieved') that *'oral presentation skill is important in mathematics learning'* (Q43) and about 50% 'agreed' that *'doing mathematics oral presentation is not a waste of time'* (Q53). Furthermore, the students had a general consensus that oral presentation helped in their learning of mathematics. For examples, item Q42 *'doing mathematics oral presentation helps me to be more aware of my understanding of mathematics'* (Q42) had received 58.2% of students 'agreeing' to the item; 50.1% of the students 'agreed' that *'doing mathematics oral presentation makes me learn mathematics better'* (Q52); and 41.7% of the students 'believed' (vs. 25% who 'disbelieved') that *'doing mathematics oral presentation makes me think broader and deeper about mathematics'* (Q47).

Table 4
 Percentages of experimental Normal Academic students (from non-high performing school) responding to the 16 items in the questionnaire survey

	Disagree totally	Disagree a lot	Disagree	Disagree a little	Neither disagree nor agree	Agree a little	Agree	Agree a lot	Agree totally
General beliefs about oral presentation									
Q40: Doing mathematics oral presentation helps me to learn mathematics.	16.7%	0.0%	8.3%	8.3%	25.0%	16.7%	20.8%	0.0%	4.2%
Q42: Doing mathematics oral presentation helps me to be more aware of my understanding of mathematics.	16.7%	0.0%	4.2%	4.2%	16.7%	20.8%	20.8%	8.3%	8.3%
Q43: Oral presentation skill is important in mathematics learning.	16.7%	0.0%	4.2%	8.3%	37.5%	16.7%	12.5%	4.2%	0.0%

Q47: Doing mathematics oral presentation makes me think broader and deeper about mathematics.	16.7%	0.0%	0.0%	8.3%	33.3%	12.5%	25.0%	4.2%	0.0%
Q49: Listening to other classmates' oral presentation is helpful for me in learning mathematics.	12.5%	0.0%	0.0%	0.0%	8.3%	12.5%	37.5%	8.3%	20.8%
Q52: Doing mathematics oral presentation makes me learn mathematics better.	16.7%	0.0%	0.0%	12.5%	20.8%	12.5%	29.2%	4.2%	4.2%
Q53: Doing mathematics oral presentation is a waste of time.	12.5%	8.3%	20.8%	8.3%	33.3%	4.2%	0.0%	0.0%	12.5%
Q44: I am able to express about my feeling through mathematics oral presentation.	16.7%	0.0%	8.3%	12.5%	33.3%	8.3%	16.7%	4.2%	0.0%
Q45: I am able to tell others about my understanding of mathematics through mathematics oral presentation.	16.7%	4.2%	4.2%	8.3%	25%	8.3%	20.8%	12.5%	0%
Perceptions about own ability to do oral presentation									
Q39: Doing mathematics oral presentation is easy to me.	20.8%	4.2%	20.8%	8.3%	20.8%	12.5%	4.2%	4.2%	4.2%
Q41: I am not afraid of doing mathematics oral presentation.	25.0%	4.2%	12.5%	25.0%	4.2%	12.5%	12.5%	0.0%	4.2%
Q46: I don't know how to get started when I am doing mathematics oral presentation.	8.3%	12.5%	12.5%	8.3%	25.0%	16.7%	4.2%	0.0%	12.5%
Q48: I feel lost when I am doing mathematics oral presentation.	4.2%	4.2%	16.7%	12.5%	25.0%	16.7%	0.0%	4.2%	16.7%
Q50: I can do mathematics oral presentation well.	25.0%	0.0%	12.5%	4.2%	41.7%	8.3%	0.0%	4.2%	4.2%
General acceptance towards oral presentation									
Q38: I like to do mathematics oral presentation during mathematics lessons	20.8%	4.2%	20.8%	8.3%	33.3%	4.2%	0.0%	4.2%	4.2%
Q51: I would like to have more mathematics oral presentations for my mathematics lessons.	29.2%	4.2%	20.8%	8.3%	20.8%	8.3%	4.2%	0.0%	4.2%

To summarize, the results tabulated above suggest that overall students did not appear to accept more of oral presentation tasks to be done in mathematics classrooms, which is to a large degree understandable, given the fact that it is challenging as a new type of task⁴, it takes away time from their regular classroom teaching, and moreover student’s work in oral presentation was not taken into account in their final grading and report, as mentioned earlier. However, the data also showed that overall students were actually rather positive in their beliefs about the benefits and usefulness of doing oral presentation task. In particular, students did by and large agree that doing oral presentation task “helps [them] to learn mathematics”, “helps [them] to be more aware of [their] understanding of mathematics”, and “makes [them] think broader and deeper about mathematics”.

How oral presentations can be effectively integrated into teachers’ mathematics teaching?

The data from classroom observations and teacher interviews revealed that, to effectively integrate oral presentation into the process of mathematics teaching and learning, both teachers and students should take various roles and responsibilities during the engagement. Under the two broad categories: pre-structured oral presentation tasks and impromptu ones, Table 5 provided a framework about teachers’ and students’ responsibilities when using these oral presentation tasks in mathematics classrooms, based on the data collected from classroom observations and teacher interviews in this study.

Table 5
A framework about teachers’ and students’ responsibilities when using oral presentation tasks in mathematics classrooms

When using Impromptu oral tasks:	When using Pre-structured oral tasks:
<p>Students’ responsibilities include</p> <ul style="list-style-type: none"> • to answer teacher’s impromptu questions; • to critique and discuss peers’ solutions and questions posed; • to express, comment, explain and correct peers’ work by using own ideas. <p>Teacher’s responsibilities include</p> <ul style="list-style-type: none"> • to give wait time for students’ discussion; • to elicit and guide further thinking by questioning; • To check answers and reinforce correct solutions. 	<p>Students’ responsibilities include</p> <ul style="list-style-type: none"> • to express and present own ideas; • to construct knowledge with whole class and teacher; • to decide presentation format; • to design, create and invent solutions, responses, etc. <p>Teacher’s responsibilities include</p> <ul style="list-style-type: none"> • to help and monitor from a distance; • to facilitates discussion; • to summarizes each presentation and reinforce concepts learnt.

The data also suggest that teachers’ beliefs, behavior, reaction and verbal responses to students’ speech also played an important role in enhancing the effectiveness of using oral presentation tasks in mathematics classrooms. For example, students reported in their feedback that more instructions and guidance should be provided, with suggestions including “train us to be more brave to speak up”,

⁴ In relation to this aspect, the reasons commonly given by students for not enjoying an oral presentation task included ‘I will feel nervous and blur’, ‘I would panic and forget what I want to say’, ‘I feel embarrassed when other laugh’, and ‘I feel uneasy presenting in front of many people because I have not much experience in presenting’.

“provide a guide dialog on how to present”, “give us some hints when we are in doubt”, “tell students and remind students in the middle of the presentation what is lacking or insufficient, and repeat what’s expected” and “encourage us to elaborate our answers and speeches”.

Table 6 summarizes a list of questioning techniques/prompts and measures that teachers can adopt for creating proper instructional environment for oral presentation activities.

Table 6
Teachers’ questioning techniques/prompts for oral presentation activities

Teachers’ questions	Teachers’ responding to student’s speech
<ul style="list-style-type: none"> • Why do you think the answer makes sense (or does not make sense)? • Do you agree with the solution? You can disagree you know, no worries, just tell me what you think is not correct? • Did you all as a group (or as a pair) derived the same solution earlier? Did any one of you change your mind after discussion? Why did you change your mind? • How can you help him/her to elaborate his/her explanation? • You mentioned “.....”. May you tell us why you said that? • Who/Which group has a different solution or has a different way of deriving your answers? • What do you think [the student’s name] would probably have done and therefore made the mistake? • Do you have any questions for him/her/this group? 	<ul style="list-style-type: none"> • Please elaborate further/more. • Don’t worry about giving the wrong answers; just say what’s on your mind. • Let’s focus on what your friend has said and see if you get his/her idea. • That is a great presentation; we should encourage him/her further! • Doesn’t matter if you’re wrong, just say it! • Please think again! I am confident you know! • I know you can do better than this! Let’s try again. • Don’t just blindly do, the explanation is the most important part of this exercise. • You have done a great job! But is there anyone who thinks differently? • You are doing fine, please carry on. • It is indeed not easy to go out there and speak, but you did well! • You are doing well, just speak louder.

In addition, the interviews conducted with teachers also revealed helpful information about how teacher can better facilitate and help improve students’ performance in doing oral presentation tasks. According to the teachers, their students’ ability in their command of the language (English) was a crucial factor in determining their ability to perform well in oral presentation tasks. From their daily classroom observations, teachers had identified some of the problems students had: “language problem; they can write down or use mathematical notation but not explain in English form”, “they can’t express themselves well, from the thought to the words portion. They do not know how to express what they don’t understand”, and “they are shy and reserved; they are terrified to have to speak to the whole class, and they are afraid of making mistakes”. The suggestions given from them included managing students well in class, explaining clearly the expectations to students, and providing appropriate teaching instruction. For examples, some teachers pointed out that: “teacher has to speak the right language”, “give them a pleasant environment, a non-threatening environment with peers’ support, an environment that they can speak freely”, and “give students a positive and supportive environment. Tell clear rules and respect [students’ ideas]”.

It should be emphasized that most teachers believed that encouragement was a key factor to better give confidence to students who were engaging in something that was not previously the focus in their learning. For example, teachers pointed out that: “you’ve got to encourage them, you’ve got to convince them”, “they need to know that it’s ok to make mistakes, everyone is learning”, and “it takes a change in the

students' mindset, encourage them, do more often, and practice more". In addition, teachers also expressed that because doing oral presentation tasks were relatively a new experience and new emphasis in mathematics classrooms, we should not expect perfect results from both teachers and students.

The data collected from teachers' interviews also suggested that teachers felt the need to change the assessment for mathematics so as to accommodate the smooth integration of using oral presentation task in daily teaching. One teacher especially noted that in order to encourage both teachers and students to use oral presentation tasks, then one of the assessment criteria must also focus on student's performance in oral tasks. This teacher gave an example stating that although sometimes it could be very difficult to grade oral tasks but teacher's observations and statements commenting about students' competence in doing oral tasks should be taken as important information and this information should be credited as part of students' current formal mathematics assessment.

What are the impacts of using oral presentation task on teachers' teaching methods and behaviors?

It was noted in the study that the teachers encountered some initial difficulties and challenges, and needed time to get familiar to the use of oral presentation because using this type of tasks in the classroom was a new experience to them. The difficulties and challenges that the teachers faced were often the time factor, i.e., teachers felt that they did not have time to implement oral presentation task in class. This was quite understandable because most teachers felt that oral tasks were just some additional work for both their teaching and students' learning. That was to say, oral tasks were seen as add-on to the regular tasks that they had to do which were already pre-decided in their scheme of work that was planned earlier on. However, after some time with more experiences and, in this study, also help from the researchers, teachers had generally become more comfortable in using oral tasks; they did not express any extreme or apparent problem or concern. For example, teachers indicated during interviews: "After sometimes, you actually get quite familiar... know what to do." "Later on, I am clear what to look for, what to ask."

The teachers interviewed generally felt that as long as an oral task was appropriately designed to measure students' specific learning outcome, then the oral task could be used as a measurement about students' learning. These teachers also felt that some of the conventional tasks could be replaced by oral presentation tasks. For instance, one teacher pointed out that "[oral presentation tasks are] a reliable source to find out from students whether they had internalized what they had learnt rather than just solve questions. I think [a bit] less than 10% of those regular exercises should be replaced with oral tasks".

The data collected from the study also revealed that teachers made changes to their instructional procedures to cater to and address students' needs accordingly after finding out about students' understanding and learning of mathematics through the use of oral presentation activities. Initially, this was viewed as one of the difficulties faced by the teachers because class time was spent on giving students feedback. The teachers felt that it was a great challenge to make changes in their pre-planned teaching instructions as reflected in their scheme of work. However, after sometime when they gained more experiences, integrating oral tasks in their daily classroom teaching became easier.

Moreover, the results from the interview data revealed all the teachers except for the teacher teaching the Normal Academic class in the non-high performing school developed positive views towards the use of oral presentation in their daily teaching because they felt that the new task had given their students the opportunity to engage in learning mathematics in-depth. Although there was a general consensus that students who were weak in the command of the English language might be disadvantaged at the beginning, but with proper guidance and practice, they should be able to overcome this weakness. It also appears that the participating teachers had developed a better appreciation for the importance of oral communication skills in mathematics teaching and learning, and some argued that students who were weak in speaking and expressing should be given more help and chances in developing and improving themselves in this aspect in mathematics classrooms, because mathematics learning should not be seen

merely as “solve and answer”. Consistently, they generally expressed optimistic beliefs about the advantages of using oral presentation task on students’ learning, as one teacher pointed out: “Oral task develops students holistically because you must think through on what you want to say and then how you say it; it is a higher learning skill compared to writing.”

Concluding remarks

In this paper, we introduced an exploratory study on the integration of oral presentation tasks into mathematics teaching and learning in five classes taught by different teachers in two Singapore secondary schools over a substantial period of time.

From the results obtained from this study, it appears that although both teachers and students encountered initial difficulties and challenges, with necessary experiences and skills over time they can overcome them and become quite effective in using oral presentation in their teaching and learning, therefore oral presentation can be reasonably implemented in mathematics classrooms.

The results also showed that both teachers and students overall developed positive views about the benefits and usefulness of using oral presentation tasks into their daily mathematics teaching and learning. We think these positive views are related to the nature and pedagogical values of oral presentation activities.

It was also observed in the study that, to effectively integrate oral presentation into the process of mathematics teaching and learning, both teachers and students should take various roles and responsibilities during the engagement. In particular, teachers’ beliefs, behavior, reaction and verbal responses to students’ speech attributed to the effectiveness of using oral presentation in mathematics teaching. Teachers need to recognize that opportunity for students to be involved in active and meaningful verbal communication is an essential process for their learning and knowledge acquisition. They also need to give students necessary guidance (including make clear the expectations) especially at the initial stage, and more importantly, create encouraging classroom environment for students to engage themselves in such communication.

Finally, given the fact that the use of oral presentation tasks is relatively new to many teachers and students, and in fact, to the general school system about teaching and assessment in Singapore classroom settings, it seems clear that timely evaluation, fine-tuning work and systemic reform in school assessment are important for the effective integration of oral presentation in teaching and learning in the long run, and this may take a long time to develop. Nevertheless, from this study we believe that given necessary help and guidance for teachers and students, it is not only meaningful but feasible to integrate oral presentation tasks into mathematics teaching and learning.

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