"Is that right?": Asking questions and appealing for help in mathematics

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Students, particularly older children, generally do not ask questions or seek academic assistance from teachers in class or their peers. Reasons include concerns about perceptions of incompetence amongst group members, a lack of confidence in helpers to give accurate help or communicate ideas clearly, and self-beliefs that seeking help threatens a student's independence. Findings are similar for both face-to-face situations and within online learning communities.

Appealing for help when attempting to solve a mathematical problem can be a daunting task for a student. Asking for help requires the ability to articulate a question. It involves a student acknowledging they are unsure about what to do, and could imply an admission of perceived inability or confidence in mathematics to fellow students. This may apply to any student asking for further clarification of a problem, or when appealing to their teacher or other students for help.

When working within an online learning community, the dynamics of student-teacher and student-student relationships are often different to those encountered during face-to-face interactions. In most instances, the majority of communication takes place in written form. Those students who are less able to articulate themselves in writing may find that the task of asking questions or appealing for help is incredibly daunting, and may not warrant the effort required to do it. This is especially applicable for younger students, or students with special needs, who may need to overcome limitations in relation to the level of writing and typing skills required to participate meaningfully within an online learning community.

Many of the anecdotal cues afforded to face-to-face teachers are not present when teaching by distance. These include the ability to make judgements about a student's body language, observe facial expressions, engage in ongoing verbal communication, and respond to these cues in the present time. In a distance education setting, teachers largely rely on written communication from students to highlight their understanding or confusion about a topic, as well as gaining feedback from the student's supervisor. This could involve asking questions of students and their supervisors, or looking closely for cues posted in discussion board messages, along with examining samples of student work. It is not always possible for a teacher to correctly gauge whether a student feels confident and is working at an appropriate level, or is actually struggling and requiring more support.

This paper seeks to examine the questions posed by primary-aged students when appealing for academic assistance, clarifying mathematical problems with their teacher and peers, and working together to solve a common problem. It will begin by examining literature relating to student questioning within a classroom setting, as well as exploring possible perceptions and concerns held by students who are seeking academic help. It will analyse a written transcript from a series of interactions between children working collaboratively within an online mathematics learning community and seek to make links with relevant research and literature. The paper will conclude by summarising the issues raised from the project findings and posing possible topics which could be explored in

future research projects.

Literature Review

Questioning in the classroom generally occurs in two main forms: questions which are asked by the teacher to prompt learning, and those asked by a student. According to Breen (2001), students rarely initiate talk with their teachers. Instead, they spend most of their time responding. Considering that much of a teacher's instructional speech consists of questions (Manouchehri & Lapp, 2003), and that children generally appear willing to answer these questions, Thomas (1992) suggests that children may be unwilling, or even unable, to ask questions in return or of one another. Even when working in small groups, very few classroom interactions are initiated by students.

Thomas's (1992) research explored ways and means children can be encouraged to engage in meaningful discussion within groups. However, results showed that while the majority of group discussion was topic-related, only a small minority of interactions involved asking a question or requesting clarification of a mathematical idea. Most questions asked by students are seeking guidance with procedures or clarification of task management, (Thomas, 1992; Jeurissen, 2005). As a rule, students do not usually ask questions in school (van der Meij, 1988).

Biddulph (1996) asserts that children's questions provide useful diagnostic and formative assessment information. Student questions can highlight their understanding, or lack thereof, of a mathematical concept, guiding the teacher when planning future educational objectives and allowing them to make adjustments to current teaching programmes. However, if students feel inhibited or unable to ask questions and raise concerns, the teacher is potentially losing a valuable source of information about their students' learning and understanding in mathematics.

van der Meij (1988) refers to question-asking by students as *academic help seeking*. This forms part of a larger questioning process, which begins with puzzlement, perplexity, or cognitive conflict, and is affected by factors such as a student's level of knowledge, task commitment, and their tolerance of uncertainty. There are two key stages in academic help seeking; to begin with, a student must formulate or *raise* their question. This is usually an internal process which is externalised by *asking* or *presenting* it to someone else. In doing so, the student needs to decide whether the advantages of asking the question are greater than the disadvantages or risks associated with not asking it.

When appealing for academic help within an classroom setting, two obvious sources of information are the teacher and other students. However, there are various issues for a student to contemplate when asking a question of either of these sources, including a range of perceptions and concerns held by the learner which may prevent them presenting the questions they have raised. Many of the concerns held are of a sociological nature. Higgins (1992) suggests that children construct social knowledge through peer interactions. Therefore, the working and social contexts of a group can influence how confident students are in actively seeking help. Factors such as dominance or conflict within a group can significantly affect whether students are likely or prepared to ask questions (Thomas, 1992).

Even in small group discussions, where considerable support is able to be offered and provided by both teachers and peers, learners do not necessarily respond readily with questions when invited to do so (Biddulph, 1996). Questions asked tend to take the form

of, “do you mean…?” when assistance is sought, or, “does that mean…?” when confirmation of an idea is required.

There are a range of additional perceptions and concerns held by students which appear to influence whether or not they will ask questions in class, either of a teacher or their peers. Biddulph (1996) suggests that children do not ask questions simply because they are not used to questioning forming a part of their learning programme. This implies that the basic structures from which students can model their own questions may be missing. A lack of teacher expertise in facilitating the asking of meaningful questions could also be a contributing factor.

van der Meij’s (1988) research closely examined students’ concerns and found that the perception of a helper’s competence has a great effect on whether a student will ask them a question or not. More than 60% of students in the study said that they would hesitate to ask a question of someone else if they had doubts about the helper’s knowledge of subject matter, or their ability to instruct others, even if the help was from their classroom teacher. Concerns were also raised about the helper’s willingness or inclination to give assistance. Often, a perceived reaction, perhaps as being negative or as a form of rebuke, can prevent students from asking questions, even if the teacher has assured them of their willingness and inclination to provide assistance. Other inhibitors and concerns involve the length of time it may require to receive a reply, concerns about adhering to classroom rules, either explicitly or implicitly stated, and an overwhelming desire for students to become or remain independent. For some students, seeking assistance is seen as potentially threatening to their ability to appear independent and is, therefore, best avoided.

A significant factor affecting a student’s willingness or ability to seek academic help is related to the social culture present within a group. Many students express a fear of appearing ignorant or incompetent in front of their peers. While this reaction is more prevalent in older classes than in the early years of schooling, is appears that seeking help is sometimes tantamount to an open admission of failure on the part of the student (van der Meij, 1988; Biddulph, 1996). For children who are wanting to gain access and acceptance into a peer group, appearing incompetent in front of fellow students is a very real threat to their ability to appeal for academic assistance (Higgins, 1992).

Visible requests for help are also more likely to hinder the question-asking process for those students who are concerned with impression-making amongst their peers. van der Meij (1988) suggests that some children would be more inclined to appeal for academic help if the processes were less visible and offered more privacy.

It should also be considered that students do not tend to ask questions once they have found an answer (Humble, 2005). In order to enhance the learning process in mathematics, students should be encouraged to continue asking questions, even if they believe they have arrived at a solution. Teachers can facilitate this process by modelling responses such as “what else could you do to solve this problem?”, “what other solutions could you find?”, and so forth (Reinhart, 2000). Patterns of questions should be used and modelled to promote deeper thinking in mathematics, rather than simply finding solutions to problem (Herbel-Eisenmann & Breyfogle, 2005).

Background and Rationale

The Correspondence School provides online and paper-based distance education programmes of learning for early childhood, primary, secondary, and adult students.

Students are either enrolled on a full-time basis, where all of their schooling is provided by The Correspondence School, or as a dual enrolment. Dually-enrolled students attend their local school but may study one or two subjects by correspondence. All school-aged students are expected to have a supervisor who oversees their work, provides assistance with necessary, and liaises with the student's teacher.

Online programmes offer the opportunity for students to work collaboratively with other students, regardless of their geographical location. Students access their e-learning programmes via Blackboard, a web-based learning environment. Blackboard also offers students the ability to interact and communicate with each other and their teacher, either asynchronously or in real-time. As a primary e-teacher, I have held responsibility for establishing online learning communities for Y4-6 students who have been identified by their schools being as gifted and talented in one or more subject areas.

Having taught by distance online for more than four years, I wanted to investigate some of the anecdotal observations I had formed about the interactions occurring between students within an online learning community. In particular, I was interested in finding out what students do if they need help with their work. When teaching by distance, it can be difficult to decipher whether students are not asking for assistance simply because they feel confident about their work and don't need help, or if there are inhibitors preventing them from seeking academic support. This project was designed to explore what my class are currently doing to seek help when solving a mathematical problem.

Methodology

This research project focuses on the online discussion occurring between six Year 5-6 students during their attempts to collaboratively solve a stimulus question posed by their teacher. The five boys and one girl involved in this project had been identified by their schools as being gifted and talented in mathematics and were all able to work competently at Levels 4-5 of the *Mathematics in the New Zealand Curriculum* document (Ministry of Education, 1992). That is, each student were capable of working at levels between two and four years above what is expected for their age group. This led to their being dually-enrolled at The Correspondence School as part of an online learning community to enrich and enhance their development in mathematics. The students, each from different schools, were working together online to solve a challenging mathematical problem requiring the use of proportional reasoning. The discussion took place asynchronously over a period of three weeks.

Observing and analysing the content of an online discussion between this group was deemed the most suitable method of data collection for this project. As all group members are geographically distributed in schools throughout New Zealand, the primary means of communication takes place within an asynchronous discussion board setting. Although communicating online requires participants to have the ability to express their thoughts and ideas in written form, many supervisors assist their students by typing their messages into the discussion board for them. Therefore, this removes a student's keyboarding skills from becoming a limitation of this methodology.

The mathematical problem posed to the group reads as follows: "You have a fish tank containing 200 fish and 99% of them are guppies. You will remove guppies until 98% of the remaining fish are guppies. How many will you remove?". I chose a particularly challenging problem which did not offer an immediately obvious solution and would

therefore take a reasonable amount of time for the children to solve.

The students were asked to post their thoughts about how they would go about calculating each of the proportions. This was intended to then lead into discussion about appropriate strategies to use when solving the problem, while determining the most suitable approach to use. Throughout the course of the discussion, I posted further stimulus questions and asked some students to clarify or explain their solutions in more detail.

In order to analyse the types of messages posted within the discussion forum, I devised a series of categories with which to classify the contents of each posting. Occurrences of questions asked, appeals for help, responses to other messages, giving solutions, explaining methods, and so forth were recorded. In order to protect the identities of the children involved in the discussion, any responses directly quoted will be referred to only by the students' first initials and the teacher by the letter "T".

Results and Discussion

Forty-seven messages were posted in total, with seventy-two separately categorised incidences of responses given. Four messages were posted by myself as the teacher. My postings included the initial question, two requests for students to clarify their responses early on in the discussion, and an overall summation of the task and solutions at the end. For the most part, the online discussion flowed freely among the students and independently of the teacher.

Of the remaining forty-three messages posted by students, sixty-eight points contributing to the discussion were raised. These are summarised as follows:

Table 1
Categories and numbers of messages posted

Type of message	Number of occurrences
Answer given by student	11
Student asking for help	1
Student admitting difficulty	5
Student admitting they are stuck	2
Direct response to another student's message	8
Method explained by student	11
Student asking for response/affirmation	4
Alternative method given in response to student method	7
Clarification asked of students by other students	3
Clarification given by other students	5
Student affirmation given	2
Teacher administrative posting	2
Teacher question posted or clarification sought	2
Response to further teacher questions	1
Other comments	8
Total	72

The correct answer to the problem is "100". Of the six children's responses, eleven solutions were directly stated. Some were correct; others were incorrect attempts which were revised during the course of the discussion. As a teacher, I did not give feedback about the accuracy of answers during the course of the discussion; instead, I left the students to check each others' responses for accuracy and strategies used while monitoring all responses from a distance.

I was somewhat surprised, and almost disappointed, to note that, although five

students had admitted they were having difficulty with the problem, two of whom proclaimed to be "stuck", only one child directly asked for help:

> A: I don't know what to do. How are we meant to answer this?

Two other students briefly responded to this appeal; one by clarifying the question and another by presenting their own possible solution. As the discussion continued, student A rejoined the forum and presented more ideas, later seeking affirmation by asking, "is that right?".

By far, the two most frequently-occurring message types included students either directly stating answers or supplying a supporting method (eleven occurrences for each). Not all solutions were immediately supported by a possible method; some of these were elicited by other students seeking to clarify a particular method or provide an alternative solution. Three students simply repeated their initial answers within postings; these were challenged, mostly by two other students, who both presented alternative solutions after first clarifying the task's requirements. An example of a student clarifying the problem in response to another student's message reads as follows:

> F: Hi Z. If you take out 2 fish you are not following the rules — you had to take out guppies. If you take out the 2 fish you have 198 guppies left. This means 100% of the fish in the tank are guppies. It had to be 98% of the fish left in the tank were guppies.

Alternative methods proposed in response to another student's message were presented on seven occasions. For example, one student had incorrectly stated that the answer to the problem was "2". A second student responded by explaining the mathematical error in the first student's reasoning and, once again, clarifying the task's requirements. The discussion progressed as follows:

> N: Hi A. If you take out 2 guppies you will have 196 guppies out of 198 fish. This is actually 98.989898%. It had to be 98% of the fish left in the tank were [*sic*] guppies.
>
> A: Oh, if you took out 100 guppies is that right [*sic*]. Then you put them back in when you have finished with them.
>
> N: No, we only remove guppies. This means we are not adding fish or guppies.

The four occurrences of affirmation-seeking involved short sentence fragments or questions, namely, "please reply", "is that right?", "did anyone else get this?", and "maybe this is it?". No students in the group posted messages directly responding to any of these appeals for affirmation.

One student contributed 17 of the 43 student messages to the discussion. These contributions were in the form of presenting an answer (3), directly responding to another student's message (5), asking other students for clarification (2), clarifying the actual problem solving question (4), and other unrelated comments (3). One on occasion, this student admitted that the problem was a difficult one to solve, but did not appeal for any help or affirmation from the group. Considering that dominance or apparent conflict can adversely alter the dynamics of a group's interactions (Thomas, 1992), it is not clear whether this student's apparent dominance of the discussion affected the rest of the group's inclination to seek academic assistance.

An interesting interaction occurred between two students, the first of whom was seeking affirmation or clarification for the responses posted so far. Their discussion reads as follows:

B: Do you think we've got it right?

J: I doubt it - we would have heard from T by now if we did.

B: Oh yeah. Well, let's keep going. She probably wants us to explain how we got our answers.

It was heartening to realise that these two students understood my general expectations for online discussion and were prepared to keep working on a problem, even after several solutions had been presented. This contradicts Humble's (2005) research, which found that students do not tend to ask questions once they have found an answer. However, further investigations would need to be carried out in order to determine whether this was an actual behavioural pattern for these students, or whether the discussion would have continued until I had stated that somebody was correct, effectively concluding their collaborative problem solving process.

Even though the discussion was reasonably active, messages posted were generally very brief and to the point. I was impressed by the students' ability to stay focused on one problem over the duration of almost three weeks, returning to it regularly and further developing their ideas, all in addition to their other mathematics work.

Implications for Further Research

This research project has highlighted a number of interesting points for me as an online teacher. However, it has also raised many possibilities for further research projects and investigations. All students contributed at least three messages each. Further research could examine the exact nature of these messages to determine whether some students were more likely to contribute particular types of responses. Determining exactly which student posted each type of message, such as providing direct solutions or an affirming reply and so forth, could help teachers and researchers explore the effects of group dynamics on a student's likelihood to contribute to an online discussion.

If time and circumstances had allowed, it may have been beneficial to interview each of the children involved in this project to find out their feelings about working online collaboratively to solve common mathematical problems. To follow up the number of messages in which the students admitted they were having difficulty solving the problem, it would have been interesting to further investigate van der Meij's (1988) suggestion that children may be more inclined to ask for help within a less visible context. For this reason, I communicate privately via email with individual children and their supervisors when giving specific feedback about student work. I would like to investigate and test a hypothesis, based on my own observations and experiences, that students would generally be more inclined to appeal for academic help via personal email than within a more public discussion board setting.

I would also like to question or interview the students in order to further explore the challenges presented and feelings they faced as they went about solving a collaborative mathematical problem online. Considering that none of the group had never met in a face to face situation, and had only communicated with each other via our group's discussion board, the dynamics of the discussion may have been varied in alternative circumstances or if the students had different levels of language capability.

Perhaps the lack of questions presented was due to the fact that they were not actually being raised by the students in the first place? Student and supervisor interviews or questionnaires might be helpful in seeking this information. In addition, van der Meij's

(1988) research notes that there was no apparent difference in question-asking perceptions and concerns between boys and girls. Would a group consisting of equal numbers of boys and girls, or exclusively boys or girls, have affected the numbers and types of questions asked and comments made?

Summary and Conclusion

Children are generally unlikely to appeal for academic assistance in classroom situations, even when help is needed (van der Meij, 1988). Although some of the children involved in this online research project admitted to be struggling with solving a collaborative mathematical problem, they were not forthcoming in asking their teacher or peer group for help. Instead, they tended to post messages containing possible solutions, followed by an appeal for affirmation. These appeals suggest that the students' greatest concern was to find the correct answer to the problem.

By modelling questioning strategies and establishing a positive and secure learning environment, it may be possible for a teacher to encourage students to more willingly and freely appeal for academic help when needed.

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