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Teacher-student and student-student interactions in mathematics classrooms reflect what teachers and students value in mathematics teaching and learning respectively. These interactions shape and fine-tune developing values systems, which in turn affect the quality of the students' learning experiences. We propose that these teacher responses represent values alignment processes. We show three examples of teacher strategies, namely, redefining, reprioritising, and complementing. We will argue for the importance of teachers being able to develop strategies to facilitate values alignment in mathematics lessons.

Keywords: Values alignment, values, critical incidents, volition, teacher-student interaction.

INTRODUCTION

'When are we ever gonna use this maths?' (or its equivalent) must have been one of the most commonly posed questions by students all over the world. It seems that students find it important that there is utility in the knowledge or skill they are learning. They may be said to value *application* and/or *relevance* when learning mathematics.

It can also be assumed that the quality of students' mathematics learning will be affected by their teachers' responses to such a question, whether it is one in support of the student's valuing of *application/relevance*, one which implies a valuing of *understanding* ("this knowledge enhances your understanding of related mathematics content"), or one which reflects the valuing of *rationalism* (see Bishop, 1988).

Although it may generally be felt that teacher responses such as those above are guided by cognitive reasoning and/or affective dispositions, we argue here that importantly, these cognitive and affective functions are governed by the volitional variable of values. That is, what the teacher him/herself considers important – and indeed, values – concerning mathematics and mathematics pedagogies are embedded in the response offered to the students.

Accordingly, the teacher-student and student-student exchanges that take place in each and every mathematics lesson represent numerous negotiations of what the students and/or their teachers value, which may or may not result in agreements. Importantly, each of these represents an example of a critical incident (see Tripp, 1993) in that responses and outcomes affect the direction of subsequent classroom discourses and the extent to which planned lesson objectives are achieved. If successful negotiations about such critical incidents require that everyone concerned are satisfied with the outcomes of these negotiations, then the competing values would have become aligned in some way during the process.

This paper draws on empirical data to investigate what such values alignment incidents might look like in mathematics classrooms. We identify and categorise three values alignment strategies. To contextualise this discussion, we first review what is known about values as these relate to mathematics pedagogy and teacher-student / student-student interactions in mathematics classes.

THE ROLE OF VALUES AND VALUING IN MATHEMATICS PEDAGOGY

We consider values in the context of mathematics learning and teaching as a volitional construct. We have proposed elsewhere that:

> values are the convictions which an individual has internalised as being the things of importance and worth. What an individual values defines for her/him a window through which s/he views the world around her/him. Valuing provides the individual with the will and determination to maintain any course of action chosen in the learning and teaching of mathematics. They regulate the ways in which a learner's/teacher's cognitive skills and emotional dispositions are aligned to learning/teaching. (Seah & Andersson, 2015, p. 169)

The philosopher Ayn Rand wrote, "a being of volitional consciousness has no automatic course of behaviour. He [sic] needs a code of values to guide his actions" (1961, p. 97). Values guide decisions and actions (e.g., Park et al., 2011), and people and organisations defend or fight with passion for what they value. That is, values are expressions of will and convictions that provide us with a certain degree of 'stubbornness' to stay motivated and to persevere when we encounter barriers. This is not to say, however, that values are always expressed in the form of observable actions. Rather, the potential for action is the basis for valuing. Whether it is expressed in observable action or not depends on the context. This can be seen in Andersson's (2011) recent study, in which the upper secondary student participants indicated that they disliked – even hated – mathematics. However, Andersson's analysis show that their stories of mathematics learning experiences were connected to the context in which they were told. The students' stories and actions for learning mathematics changed as the contexts evolved.

As volitional variables, values have both cognitive and affective components as well. The cognitive components are visible through the choosing dimension of the valuing process (Raths, Harmin, & Simon, 1987). Valuing also has an affective dimension which can be seen in the way we often find ourselves embracing what we value in a passionate way, supported by associated emotions, attitudes and beliefs.

Considering any classroom interaction, then, what is conveyed (verbally or otherwise) and the subsequent responses would reflect what the teacher or student is valuing. These interactions represent negotiation attempts by all involved; students are aware of their capacities to adopt, resist or reject discursive positions. Given that there exists considerable within-class and within-school diversity of student cognitive and affective variables (Sullivan, 2015), the (mathematics) classroom discourses between teachers and their students – and amongst students – represent pedagogical spaces of contestation and conflicts. This is inevitable, and after all, the consistent domination of one particular (person's) goals and interests in any social gathering is very likely not desirable anyway, as discussed by Gutierrez (2007).

As a volitional variable, values (in mathematics education) not only motivate and guide decisions and actions; they also provide one with the will and determination to maintain courses of action in the face of competing actions and obstacles. In this way, values do more than what motivations do. In Kivinen's (2003) words,

> there is a distinguishing line between volition and motivation. Volition promotes the intent to learn and protects the commitment and concentration from competing action tendencies and other distractions. For example, a student may be motivated to read a book in the evening. He or she is more or less motivated to do so. The student takes the book and starts to read (motivation has done its work). Volitional processes (will) keep him or her reading, in spite of the fact that there is an interesting football match on TV. (pp. 26–27)

It is this sense of will and determination that is associated with valuing which would account for an individual bringing what s/he values to any interaction s/he is involved in. When such an interaction brings together different and potentially competing values that are embraced by teachers and students, this may involve resisting or rejecting decisions or actions representing the competing values. Thus, when a student asks when a particular mathematical concept or skill might be useful, the question reflects his/her valuing of, say, *application or relevance*. In the same way, the teacher's response will reflect particular values too, which demonstrate if these values are aligned with each other or not. In turn, anyone involved in the interaction can choose to pursue what s/he values with regards to the topic being discussed, although this will often be subjected to sociocultural norms and conventions such as power distance (Hofstede, 2011). We suggest that in order for a lesson to 'move forward' productively, teachers would have negotiated about the competing values

such that there is achieved a certain level of alignment amongst the values concerned.

While values may indeed be stable when compared with variables such as interests and beliefs, we argue that the extent to which a value is embraced and prioritised is responsive to one's environment and is thus not fixed. In other words, opportunities for values teaching in mathematics education exist across all school years. Whereas values may be absorbed when one is young (Court, 1991), value priorities continue to be considered and evaluated throughout one's life in school and beyond. This may be seen in the valuing process conceptualised by Raths, Harmin and Simon (1987). Made up of three stages, that is, choosing, prizing, and acting, the first stage is related to choosing freely and amongst several alternatives, bearing in mind the consequences of adopting any one of these alternatives. We believe that it is this choosing activity that is periodically stimulated by phenomena that allows for one's value priorities to be monitored, assessed and fine-tuned.

VALUES ALIGNMENT IN THE MATHEMATICS CLASSROOM

Values alignment is a central feature of Senge's (2006) five disciplines of learning organisations (that is, personal mastery, building shared vision, team learning, mental models, and systems thinking). In particular, the discipline of building shared vision calls for aligned values in an organisation in order for the shared vision of the future to be co-created. The value of values alignment lies in the observation that

> all relationships – between one person and another, between the present and the future, between customer and product, a team and its goals, a leader and a vision – are claimed to be strengthened by aligned values. (Branson, 2008, p. 381)

Thus, for a teacher, being able to facilitate values alignment between what s/he values and what his/her students' value promises to strengthen the relationships, and is one of the keys to nourishing teaching and learning practices. Indeed, MacDonald and Shirley (2009) had proposed that the mindful teacher is one who, amongst other things, is proficient in establishing authentic alignment between his/her own values and professional practice, and is also successful in harmonising these values and policy. If some teachers are 'effective' in different classrooms whereas others perform well in particular classrooms only, this could be because the former have been successful in attaining values alignment in whatever classroom situation they find themselves in.

However, values alignment is not about ensuring that students' values are the same as their teachers'. It is thus different from values inculcation. Rather,

> building ... values alignment is about providing a cooperative and collaborative process whereby the members of the organisation can develop strategies, systems and capabilities that not only support those values that have previously been clarified as being essential for the ultimate success of the group as a whole but also are supported by the majority of the people within the group as acceptable guidelines for directing their behaviour. (Branson, 2008, p. 383)

That is, values alignment facilitates the co-existence of different values that are held by different people interacting together. In so doing, students can perceive that their knowledge, skills and dispositions are valued, and they can also feel inclusive in relation to their learning of mathematics.

IDENTIFYING AND INTERPRETING VALUES ALIGNMENT CRITICAL INCIDENTS

So, how do teachers and students negotiate the differences in what they value generally and in mathematics education in particular, so as to achieve values alignment in order to facilitate mathematics learning? In the absence of prior educational research on this topic, we referred to available data that were collected from a prior research involving values and valuing in the classroom (see Seah, 2005) as seen from the perspectives of classroom teachers of mathematics.

This prior research was conducted in secondary schools across Victoria, Australia. The methodology of the research then involved the identification of critical incidents (Tripp, 1993) in mathematics lessons when the teacher participants and their respective students were observed to be valuing different attributes of mathematics or of mathematics pedagogy. Lesson observations and teacher interviews were the methods employed. The research objective was

to map out the range of strategies teachers employed to negotiate about differences in valuing between themselves and their respective students. The focus was on the various types of actions employed by the teachers, of which there were 7 (e.g., helplessness, amalgamation, appropriation). In the current study, however, the teacher responses to the episodes of values differences in the lesson transcripts were re-examined and re-analysed at a deeper level: instead of listing what the teachers did, here we have been attempting to interpret how the teachers' own valuing changed in the process of their negotiating about and aligning the value differences. The patterns observed amongst the 8 teacher participants suggested three such values alignment strategies, which we name redefining, reprioritising, and complementing. These are presented below.

Values alignment strategy: Redefining

> *Case 1.* Michael (a pseudonym), a mathematics teacher in a secondary school, noticed that his Year 10 students had been unwilling to work with concrete manipulatives such as geoboards and pattern blocks. "These are for young kiddies, sir!" they would say. Yet, Michael felt that learning is more effective when students are able to visualise the relevant concepts. Michael has since found a way round this issue, and his students are now exploring and understanding geometrical concepts using software programs such as dynamic geometry software, as well as online resources such as those hosted by the National Library of Virtual Manipulatives.

In this case, Michael's use of concrete manipulatives reflects his valuing of *visualisation*. However, this teaching approach was resisted by his students whose values were not aligned with the image of teenagers 'playing with blocks'. There was a potential here of a value conflict between Michael and his students, which could possibly result in the students being disengaged in his lessons. Michael resolved the potential value conflict through redefining what he and his students valued, coming to understand that in effect, his valuing of *visualisation* was underlied by a valuing of *exploration*. This was crucial, since the students' values were aligned with *exploration* as well; it was just that they did not want to feel like small kids playing with blocks and teddy bears. By redefining his valuing of *visualisation* with the use of digital learning technologies, Michael was able to plan and execute his lessons such that the dynamic geometry software and the online websites provided the students with opportunities to explore – and thus visualise – the relevant geometrical ideas and concepts in a form that was aligned with what the students value. Michael's valuing of *visualisation* had given him the will to resolve the value difference situation in ways which still allow for student visualising to take place, only that the means of actualising this valuing were now acceptable to the teenage students, who were understandably wanting to behave more adult-like and doing adult tasks. For his students, their positive response to the ICT use was an endorsement of their common valuing of *exploration*.

In this instance, values alignment was achieved through Michael's redefining what he values, such that its expression now is aligned with what his students value.

Values alignment strategy: Reprioritising

> *Case 2* Diane was an immigrant secondary school mathematics teacher from Canada, teaching in a small country town in Australia. When one of her students answered one of her questions about an algebraic equation by saying "just chuck in c, just chuck in the c", she responded that he was being too casual with his use of mathematical language. Diane's own mathematics learning experience in Canada had instilled in her a valuing of the *formality* in mathematics, a tradition that she felt needed to be upheld but which most students today would perceive as dry and boring. Thus she would have preferred her students to talk about "adding the constant, c".

Yet, Diane was deeply aware and concerned that she was teaching a class of mainly disengaged and underperforming students, and that meant that it would not be wise to get 'too caught up in those formal, scary things'. She was mindful that for these students, a valuing of *fun* would be a key motivator for them. In Diane's words,

> We see too many kids that's just, they come to the class and they are beaten already. Because they found it a difficult subject, and they don't enjoy it, they feel frustrated. It makes them, you know, they feel out of their depth, and that's just awful. If you're [i.e. the students] starting out that way, you know, I think we've got to really try. And if

> it's not [about] being so sticky about notations, then, you know, having a bit of fun with it then.

As such, she made a conscious effort to 'sacrifice 'plus c' for 'chuck in c' '.

Here, Diane realised that 'pushing' her students to share her valuing of *formality* and to use formal terminology would be counter-productive. This group of students needed first and foremost to be able to be interested enough in the subject, and to develop some confidence to acquire the skills and concepts required of them. The students' valuing of *fun* was a volitional force, which supported the cognitive and affective growth that they needed. Diane's understanding of this, and her subsequent reprioritisation of her valuing of *formality* and *fun*, resulted in values alignment between herself and her students. This reprioritisation of Diane's values is evident when she talked about the relative importance of notations/formality and fun/enjoyment, and how it would be her willing sacrifice to interchange the order of priority for the sake of facilitating her students' learning.

In this second case, values alignment was achieved when Diane in interaction reprioritised what she valued to achieve a common valuing with her students. Diane had not given up her valuing of *formality*. However, she also shared her students' valuing of *fun*, demonstrated through her provision of space for a different mathematical discourse in class. As a result of this reprioritisation between the two values within herself, Diane had achieved an alignment of what she and her students valued.

Values alignment strategy: Complementing

> *Case 3*. Amy taught Year 7 mathematics in a south-eastern suburb in Melbourne, in an area with a high concentration of Asian migrant professionals amongst its residents. Most of the students in her school were Asian, most of whose parents valued *competition* and *grades*. The school has also embraced the community's valuing of these two orientations. However, Amy had grown up valuing *co-operation* and (conceptual) *understanding*. For Amy, the need to confront the value differences between herself and the school/community was quite urgent, for she knew that she would not be able to teach mathematics effectively and professionally satisfyingly if she did not negotiate these differences soon enough. She talked to colleagues and some parents, and she referred to relevant literature. While she was not ready to give up what she had grown to value, she was also getting to understand how the students' and their parents' values were culturally powerful agents of engagement and motivation. At the same time, she felt that her students needed to learn to value *co-operation* too as a means of humanising competition, and that their developing meaningful understanding of (mathematical) concepts would further enhance their capacity to achieve even better grades in assessments. So in the last two years, Amy has developed mathematics lessons, which reflect the valuing of both *grades* and *understanding*, and more difficultly, *competition* and *co-operation*. Thus, her students strive to understand concepts while/before practising hard to attain proficiency. They are also able to work together and help one other, while enjoying pitting their mathematical skills against one another.

In this case, values alignment for Amy and her students was achieved through an acknowledgement of the different values, and a purposeful consideration of how they could co-exist and indeed, complement each other. Over two years, Amy developed pedagogical strategies that allowed for these pairs of potentially conflicting values to not just co-exist, but also to further support the inculcation of the other value in each pair. This complementarity reflects one of Hofstede's (2001) cultural value continua, *masculinity / femininity*. Here, the students' valuing of *masculinity* in the form of *grades* and *competition* has struck a balance through alignment with Amy's valuing of *femininity*, in the form of *understanding* and *co-operation*.

CONCLUDING IDEAS

In this paper, we have focussed on the day-to-day teacher-student and student-student interactions in mathematics classrooms, envisaging these as potentially critical incidents involving different and possibly conflicting values. We have drawn on empirical data to illustrate how teachers' facilitation of these critical incidents can actually be regarded as involving values alignment.

The examples listed above have been sourced from existing data given that there has not been any values alignment research study in our knowledge, an indication that values alignment in its various forms take place often enough during mathematics lessons. This highlights the importance for teachers' awareness of what they themselves value with regards to mathematics, to mathematics pedagogies, and to school education. With this self-knowledge, teachers are better empowered to respond to value differences/conflicts as critical incidents with effective values alignment approaches, thus maintaining a harmonious environment in the classroom. At the same time, such values alignment episodes also support students' cognitive and affective developments in a different way, that is, through the ways in which their own values systems evolve and mature.

Although it is not within the scope of discussion of this paper, it is also important to remind ourselves that not all values alignments attempt lead to productive learning/teaching. We observed in our data that despite the values being aligned and harmonious interactions being maintained, the aligned values might not support effective or productive mathematics learning/teaching. We also came across situations in which the values alignment attempts failed.

Although the values alignment strategies discussed above may well also take place in lessons other than mathematics ones, it is important that their deployment in mathematics lessons is highlighted to emphasise that the strategies can be as useful in mathematics pedagogy. The contexts within which Michael, Diane and Amy operated were uniquely mathematics educational. More importantly, the cases presented above relate values and valuing to mathematics pedagogies in very different ways. Indeed, the findings here which showcase the three values alignment strategies could well also address similar classroom tensions reported in Wester, Wernberg and Meaney (2015). The research reported here thus calls on the mathematics education research agenda to promote the need for a deeper knowledge of valuing as a volitional variable, and also of the values alignment process in the context of school mathematics pedagogy. Studies in this area represent cutting-edge, innovative mathematics education research; they promise to provide researchers and practitioners with a third, volitional approach to further understanding and improving mathematics learning in schools, complementing and strengthening existing cognitive and affective strategies.

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