

# Chapter 8

## The Role of Value Alignment in Levels of Engagement of Mathematics Learning



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**Abstract** Low levels of student engagement in mathematics education has been a growing concern in the Australian context and internationally. In this chapter, we will explore how value alignment strategies (Scaffolding, Balancing, Intervention and Refuge) could be used to rework conflict, resentment and disengagement of students in the mathematics classroom. When students are encouraged to discuss their individual thoughts and opinions, ideas and approaches, students' values and identities become more apparent. We also begin to explore the notion of identity as an extension to the completed work on value alignment strategies. We propose a possibility that value alignment strategies could be the catalyst in many more students proclaiming that 'mathematics is my most valuable subject!'

**Keywords** Values · Value alignment strategies · Student engagement · Student disengagement · Mathematical identity

### 8.1 Introduction

There are some things in life that appear logical such as 'don't play with fire' or 'never run with scissors in your hands'. Then there are other things that might seem equally natural to us as individuals, or as members of a family, but which we might not expect other people to agree with, such as 'voting in a referendum' or 'leaving our shoes at the door' (Rowan et al. 2007). In some contexts, decisions even around these seemingly personal decisions might be based on community driven ideologies. The things that we believe in, shape the way we view our world and the way we act within the world, through the decisions we make, indicate our values.

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Values are abstract qualities that we recognise when we see them in action, through the decisions that people make, the way they react in a critical incident (Tripp 1993), and their engagement with any particular situation. Values move out of the abstract when we admire particular behaviours, attitudes and dispositions (Clarkson and Bishop 2000). There will always be differences in how people in a community interpret the same value, and the relationship between our values and life choices are not always transparent. Hence values, in many ways, are often implied rather than explicit. Therefore, it is not an easy process to identify with certainty, an individual's specific values. Raths et al. (1987) regard successful attainment of a value as involving all of seven criteria; choosing freely, choosing from alternatives, choosing after thoughtful consideration of the consequences of each element, prizing and cherishing a value, prizing a value through affirmation to others, acting on the choice of value made, and acting repeatedly to enact a value which gives rise to some pattern in life.

Values are acquired over time and that the negotiations of values between and amongst activity systems leads to values being challenged and refined. Due to this inevitable presence of competing and overriding values (Seah 2005), one value is not articulated in all situations. For the assessment and identification of valuing, some kind of triangulation is needed through the observation of multiple supporting activities (Seah 2018). This suggestion echoes (Raths et al. 1987) seventh criterion involving the rise of a pattern to life. In other words the realization of a value is always, necessarily a process of comparison (Graeber 2001).

Mathematical ideas develop everywhere even though people live in different cultures (Bishop 1988). We can find literally hundreds of different counting systems, using different symbols or no symbols, objects and materials varying with the cycles, or bases, used to deal with large numbers. Even in single countries like Papua New Guinea, a land of four million people but 800+ languages, there is a myriad of counting systems (Owens et al. 2018). The symbolic and religious properties of geometric figures are of more interest in some societies than others, as are the predictive powers of certain numerological practices, myths and ideologies around their symbolic importance.

Although many of these various ways of doing mathematics grew up in relatively isolated communities, today it is rare for communities to remain isolated. The movement of people across borders is taking place in unprecedented levels due to reasons such as armed conflicts, globalisation and regionalisation of trade and business (Seah and Andersson 2015). Thus, we are seeing growth in eclectic intersections of cultures that have not readily occurred in the past. Clearly this means different ways of doing mathematics are intersecting, and hence the values embedded in these different mathematic systems are also intersecting.

At quite a different level, any mathematics classroom can be seen as a community made up of diverse cultures and identity politics. Therefore, classroom interactions between mathematics teachers and students, and those among students themselves, are sometimes sites of contestations and conflicts. Values in mathematics education are inculcated through the nature of the mathematics studied and individual experience, and thus become the personal convictions that an individual regards as

being important in the process of teaching and/or learning mathematics (Seah and Kalogeropoulos 2006).

Decisions and actions relating to the learning and teaching of mathematics in schools are linked to values amongst other aspects of the mathematics classroom. A student who values achievement, will study hard to pass an exam, and a student who values understanding perhaps will question theories until meaning has been constructed. Of course a student might value both achievement and understanding. Teachers also make decisions in mathematics classrooms depending on their values: For example, how often will the teacher provide a choice of activities in class, and how much routine practice is important? These teacher decisions could be embraced, simply accepted or maybe rejected by the students and this is usually indicated through student engagement. The student who values achievement may comply with the teacher's requests in order to receive a good grade, but the student who values understanding most may object or withdraw from the task if they do not see the value for furthering their understanding in it. How teachers respond in these situations can be useful indicators in turn to their valuing.

Mathematics classrooms are diverse learning environments. They always have been of course, but today such diversity is being recognized and in many classrooms at least tolerated if not celebrated. Hence if a teacher and students have moments when their views are not in agreement, this is now often dealt with openly. For example, a traditional-style teacher may value the automatic and rapid recall of number facts (e.g. single digit multiplication questions) and formulae and therefore teach mainly through closed-ended questions commonly found in mathematics textbooks. However her/his students may value relevance and communication more, hoping for inquiry-based tasks. In such a context the value alignment is at odds.

But it is not always like that. For example, a teacher who values group work in mathematics education will create experiences in his/her classroom for students to work together. However, a student who values independent work style may be troubled in these classroom situations. The way the teacher and the student react to this critical situation could also unveil another layer of values. The teacher may also value respect of preferred learning styles for each student, and therefore allow the student to work independently. On the other hand, the teacher may decide to hold onto this tension as they value disagreement as a fruitful space for learning (in this case, the child learning to work with others). The engagement of the student could be an indicator of whether their value has been compromised or neglected.

Since values and valuing are sociocultural in nature (Seah 2018) it is reasonable to argue that teachers and students cannot expect that the other party will 'always' share their valuing. However, in most classroom environments teachers and students will want to co-exist harmoniously and therefore they will adapt strategies to exhibit tolerance, respect and acceptance (general educational values and good character traits) without compromising their own values in mathematics learning.

From the above examples some very pertinent questions arise. How is harmony and engagement maintained in a mathematics classroom environment amidst the range of values present? How do teachers and students negotiate the differences that inevitably exist, so as to facilitate and maximise the learning of mathematics? If

engagement is about inclusiveness, how do we help teachers perceive diversity as a positive? Let us assume a team teaching environment, which is a common practice in Australia. One teacher encourages problem solving in mathematics learning whilst the co-teacher prefers teacher modelling of mathematical procedures and quiet working environments. How do teachers negotiate such professional and pedagogical valuing conflicts?

Rather than trying to deal with all of these questions, this chapter focuses on strategies that four teachers have used to achieve value alignment with their students during critical incidents in mathematics learning. The value alignment strategies are part of the findings of the first author's recent PhD study conducted in Melbourne, Australia (Kalogeropoulos 2016). Values alignment strategies were observed to be used by the teachers to form a compromise, a negotiation or a change in mathematics learning for student engagement or re-engagement. Four such value alignment strategies were identified in the study and are perhaps one beginning to addressing the issue of students who show low levels of engagement in mathematics learning. The chapter then turns to an additional issue, that of mathematical identity, which also impacts on engagement in mathematics learning and requires consideration in value alignment.

## **8.2 The Four Value Alignment Strategies**

There are a number of ways in which alignment of values between teacher and students can be achieved in the mathematics classroom. Kalogeropoulos (2016) used classroom observations particularly of critical incidents in the flow of teaching in lessons, student and teacher questionnaires, and interviews to collect data from four teachers and their 10–11 year old students in the same school in Melbourne, Australia. The data obtained was analysed using a grounded theory approach. From these analyses, four strategies of value alignment emerged: the scaffolding strategy, the balancing strategy, the intervention strategy and the refuge strategy. The four teachers consistently employed these four strategies during the three observed lessons (per teacher, hence 12 in total), when similar critical incidents arose.

### ***8.2.1 The Scaffolding Strategy***

The scaffolding strategy was adopted by the teachers observed when they came to their mathematics lesson with some type of preparation to scaffold the learning of the intended learning objectives. In one episode noted from the research observations, a teacher asked their 10/11 years old students to complete a challenging mathematics word problem independently. The set task included different types of information that seemed to confuse the students:

**Ice cream task: Double scoops**

Can you think of 7 different flavours?

You want to buy a double scoop with 2 different flavours.

Which different combinations could you choose?

You cannot repeat a combination.

The students attempted the task but soon complained about the difficulty of the task and their inability to solve it on their own, consequently disengaging from their mathematics learning. In an attempt to re-engage the learners in their mathematics learning, the teacher offered the students an enabling prompt (Sullivan 2018). Instead of 7 different flavours, the teacher modified the task for the students to think of 3 different flavours. The teacher also provided an option for the students to work with a peer for further support or scaffolding. In similar critical incidents, the four teachers were observed to frequently use these two approaches; value peer-support when they encouraged students to work together and to share ideas and propose solutions, and the teacher suggesting that solving a less complex task would help the student to understand the original more complicated task.

In order to maintain a functioning classroom environment amidst the range of values present, it helps when teachers and students understand one another's values and seek to bring them into alignment (Seah and Andersson 2015). This was achieved by the teachers when they scaffolded the task through an enabling prompt and/or offered peer support. On the other hand, tension was also maintained as the students helped each other to solve the word problem, allowing a fruitful space for learning through the use of a challenging task (Sullivan 2018). In both instances students and teacher are valuing task completion.

The teacher usually takes the leading role and uses her/his teaching craft in facilitating values alignment during classroom critical incidents (Tripp 1993). A shared vision (as seen in the example above) needs to be co-created, although in actuality the students could subscribe to these goals to different degrees. Thus, when a teacher is able to facilitate values alignment between what he/she values and what his/her students value, this promises to strengthen the relationship, and is one of the keys to nourishing teaching and learning practices (Seah and Andersson 2015) and ultimately ensuring students' engagement in mathematics learning. This is achieved through adopting new values for harmony but staying in the tension for learning growth.

### ***8.2.2 The Balancing Strategy***

The balancing strategy refers to a teacher accommodating student values that the teacher had not anticipated would be evident during the lesson. One example of this balancing strategy occurred during a critical incident that arose when students requested a calculator to check their answers in class. The crucial part of this incident unfolded as follows:

Student Can we use the calculator to check our answers?

Teacher No. You will not have a calculator during NAPLAN (state-wide testing) so you are just doing a disservice to yourselves.

In the first part of her response, the teacher refused to provide the students with a calculator. But to meet her value of accuracy, she decided to collect and correct the students' work at the end of the lesson, something she had not originally planned to do. Her response seemed to satisfy the demands of the students as they then continued to complete their work and submit it to the teacher for correction. The student's value of accuracy was not ignored by the teacher. In contrast, the value of accuracy was indeed accommodated by the teacher, suggesting that the teacher also shares this value with his/her students.

This example suggests that there can often be differences in how the same value can be interpreted and displayed in different ways (Rowan et al. 2007). The students valued accuracy by asking for a calculator to check their answers, but the teacher used an alternate approach to accommodate this value by collecting the workbooks for correction purposes. In this situation, the teacher has once again used her/his teaching craft in noticing the students' re-engagement with their mathematics learning, indicating that the value of accuracy has been negotiated and accepted in different terms.

It is worth noting that value alignment is not about facilitating a classroom situation in which everyone subscribes to the same interpretation of the value. This is a dynamic interaction when shifting positions from both parties is to be expected. In other cases, it could include the adoption of new, shared values. The deployment of a particular value alignment strategy depends on the situation, the learners and of course the values!

### ***8.2.3 The Intervention Strategy***

There were times in mathematics learning when the teachers were required to put their values aside and respond to the students' values that were being exhibited and required attention for student engagement. The extent to which a value is embraced and prioritised is always circumscribed by the lesson situation and hence responsive to the learning environment and the context of a conflict situation. For example, a student described their distress when they felt isolated and daunted during a particular mathematics lesson. The student was unable to complete their work and as a result their mathematical anxiety and emotions took over and left them feeling helpless and overwhelmed. The teacher intervened by offering the student one-on-one assistance. The intervention strategy used was to first provide immediate emotional support, closely followed by intensive teaching to help the student reengage with their mathematics learning. The teacher's humane values of care and compassion prevailed and when the student was eventually soothed, the mathematics learning was readdressed with a focus on understanding and success instead of the initial teacher value

of independent work style (the student working independently to complete work). This example shows that students' stories and actions for learning mathematics can change as the contexts evolve (Seah and Andersson 2015).

Values have both cognitive and affective components. In this situation, the teacher has temporarily suspended what he/she initially valued in this context (independent work style) and allowed his/her overriding humane values (care and compassion) to deal with the situation and re-engage the student with their mathematics learning. Thus, valuing provides an individual with the will and determination to act in particular ways. In the above situation, values played a significant role in transforming a negative situation into a positive outcome in mathematics learning.

### **8.2.4 *Refuge Strategy***

The refuge strategy was a value alignment strategy used when the teacher put most (if not all) of their values to one side and used their authority in a manner that postpones their proposed lesson planning and instead focussed on the value orientations of the students. In this situation, the teachers found new values that aligned with their own and those of the students.

In one of the observed mathematics lessons, the students became 'stumped' by a problem-solving task that the teacher had planned. Even after the teacher attempted to explain the mathematical task numerous times, the students became agitated and disruptive. In an effort to reengage her students, the teacher made a spontaneous decision to play a mathematical game with the students. The chaotic classroom reformed to an enthusiastic environment as the teacher's and students' value of fun was embraced and aligned. Value alignment can therefore involve a teacher displaying flexibility and making detours from their intended lessons to accommodate new areas of interest (Kalogeropoulos and Bishop 2017).

Student engagement can therefore also be seen as an indicator for value alignment. As seen in this example, the teacher's prioritising of the valuing of fun was successful in maintaining classroom control. The teacher was conscious that the complexity of the given task was the trigger that led to student disengagement and therefore used his/her professionalism to adopt a value alignment strategy in an attempt to reengage the learners with a mathematical game.

### **8.2.5 *Classifying the Four Strategies***

The four value alignment strategies described above were classified based on the extent to which the teachers retained their values after value negotiations had taken place with the students (see Fig. 8.1). They were deployed when a teacher began to notice signs of disengagement in her/his students. The teacher typically made small changes to the lesson when the scaffolding strategy was adopted and hence to their



### 8.2.6 Summary

The value alignment strategies support the notion that value priorities are dynamic and malleable although what is prioritized is in part contingent on the classroom context. What we value in the moment, also reflects our years of learning, influences from our historical experiences, and social interactions as members of the cultures to which we belong (Seah 2018). In the classroom, pedagogical activities provide interactions of what students, teachers and indirectly what the wider community value. Such interactions can expose what the students, the teachers and the community value similarly or differently. In effective classrooms, values are aligned or agreed upon by the different parties to maintain functioning activities in interaction. Therefore, values are acquired over time (in sociocultural contexts) and also challenged and refined on an ongoing basis, depending on interaction opportunities (Seah 2018).

During critical incidents within the flow of a lesson, a teacher often needs to choose amongst several alternatives. It is during this choosing activity, which may well be the employment of a particular value alignment strategy, the teacher's value priorities often become more clearly visible to an observer. Depending on the situation, teachers may be required to re-prioritise particular values. This requires teachers to firstly be aware of their values and personal convictions when the different values of teachers and students come together in interactions, resulting in value differences and value conflicts (Seah and Andersson 2015). When value alignment strategies are used effectively to reengage students in mathematics learning, teachers also demonstrate a capacity to acknowledge students' values, culture, knowledge, skills and dispositions, in an attempt to optimise and empower mathematical learning.

## 8.3 Mathematical Identity and Value Alignment

As can be seen from the above study pedagogical activities take place, in part, through the interactions of what teachers and students value. It is also clear that there can be misalignment between the teacher's values and those of the students, and indeed between students. The four teachers in the study utilised value alignment strategies and these sometimes introduced the co-creation of values that could be perceived as the agreed-upon, aligned values that facilitated the continued functioning of the activity systems in interaction (Seah 2018). However, is it too great a hope to expect value alignment will always be possible in the context of a mathematics classroom?

For example, when students are asked to complete a challenging problem, students may complain and begin to show signs of disengagement but a teacher's value of student perseverance may dominate and (s)he may decide to continue with their planned lesson, encouraging students to remain in the zone of confusion for a certain amount of time. In essence, the teacher is encouraging the 'complaining' students to accept and hopefully adopt the value of perseverance, similar to a parent encouraging a child to try a new food that they 'may' enjoy! In this instance, students' valuing

can be and are being shaped in the mathematics education process with the teacher playing the role of value agent in mathematics teaching (Seah 2018).

Interestingly value alignment strategies may not always be so significant. For high performing students who really value achievement, the way mathematics is taught at school may have little impact on them., For them, their cultural values dominate, and possibly lead to decisions such as home tuition or enrichment classes to achieve the high performance that is desired. But in this instance, values, be they students, teacher, school or cultural, may not be the only consideration.

On reflecting on the results of the first author's doctoral thesis, and considering the preliminary statement to potential authors for this volume that in part asked that authors consider questions that would open up further lines of enquiry, we wondered whether the notion of identity (Cobb 2004; Lerman 2012; Sfard and Prusak 2005) may be another fruitful idea to explore concerning value alignment. Although both are formed through social interaction and developed over one's lifespan, identity represents an individual's subjective perspective of the self (Gatersleben, Murtagh and Abrahamse 2014). The extent to which a value is embraced and prioritised is responsive to one's environment and is thus not fixed (Seah and Andersson 2015). So can someone's mathematical identity influence their values in a mathematics classroom? If so, what implications does this have for the four value alignment strategies to successfully reengage students in mathematics learning, when there are other ongoing social, political and gender issues?

Others have indeed suggested a linkage between values and identity, and see values as an integral and indeed central aspect of identity (Gatersleben et al. 2014). Seah and Andersson (2015) propose that values are the convictions that an individual has internalised as being the things of importance and worth. Identity, however, is regarded as a broader concept that encompass many aspects of the self, including psychological processes (including behaviours) which people may adopt for maintaining and protecting the self (Breakwall 1986).

Identity may mediate the relationship between values and behaviour: a teacher who values understanding in mathematics learning will be motivated to plan lessons that support this value through the inclusion of challenging problems, real-life investigations and group discussion opportunities to discuss ideas and solutions. The identity of this teacher could be labelled as 'contemporary' and their value alignment strategies will probably differ to a teacher with a 'traditional style of teaching' identity.

However, the notion of identity is a contested one. Its fluidity of meanings makes it problematic when one is after clear guidelines that teachers might follow. And yet the fluidity of the identity notion mirrors that to some degree of the fluidity and problematic of the very notion of values and valuing: such fluidity can easily be seen when the various meanings of values and valuing used in the various chapters of this volume are compared. Hence seeking an interaction of the two notions, values and identity, may well be useful as they both impinge on the dynamic of the co-creation of teacher—students/students—students learning situations in mathematics classrooms.

Clearly the notion of identity does bring into play ideas of individuality, such a strong aspect of the western culture. But the counter surge to that in the classroom is a pressure to see all players as part of a community, which in some way has a shared identity; the classroom culture we strive for is not based on notions of the teacher and the students, or other multi-chotomies that can be envisaged, but a sense of a shared identity. Teachers and hopefully students are normally looking for ways so that there is trust, cooperation and support offered for those who are in need in the mathematics classroom context. Indeed that is the aim of the four value alignment strategies. But the ever-present individual identities that are in the classroom also bring into play the histories of all players, their ethnicities, their genders, their ideologies, their sexual orientations, and more (Chronaki 2016). Such diversity is brought into relief by noting the stereotypical images that are often portrayed in student aids such as textbooks (Clarkson 1993). Thus we see the interplay of values and identity, in all their meanings, as scope for broadening the questions that we ask.

## 8.4 Conclusion

Andersson et al. (2015) showed that changes in the contexts of teaching and learning can motivate students, even those who disengage either in the moment, or for longer periods of time, to productively re-engage with mathematics. As part of this process, value alignment strategies are employed by teachers to maintain a sense of harmony in a mathematics lesson and to help students develop a positive and active relationship with mathematics. Perhaps we must invest more of our time in helping students value mathematics by engaging their interest in the subject, helping them to identify their strengths and their weaknesses and focusing on making mathematics meaningful. More research is required in values, value alignment and alternative identity-work that pursues reconfigurations of mathematical subjectivity. The notion of dialogical mathematical education, where both teachers and students are required to reflect on and discuss their individual thoughts and opinions, ideas and approaches, embraces and acknowledges the mathematical identity of both parties. These interactions reveal values for consideration and value alignment may be the catalyst for facilitating meaningful mathematics learning.

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