"Math is not for us, not an indigenous thing, you know": Empowering Taiwanese Indigenous Learners of Mathematics through the Values Approach

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The South-eastern region of Taiwan, Taitung, is home to the highest concentration of indigenous communities. Their status on indicators such as education level, SES, and life span are worse than other ethnic groups. They are also found to underperform in school mathematics. This paper reports on a study that had been designed to understand more about the indigenous students' want to learn, embodied by what they value in mathematics learning experiences. Eight Grade 4 indigenous students from a carving class were interviewed. It was found that the indigenous students do not value mathematics learning, although they value innate intelligence at the same time that they value effort and out-of-school support. Of concern is the resultant belief that doing well in mathematics is out of reach of the indigenous people.

The Indigenous People of Taiwan

The indigenous people of Taiwan refers to those who have been living in Taiwan before the ethnic Han Chinese migrated there from South-eastern China in the 17th century. They currently make up about 1.5% of the total population of Taiwan (Tsou, 2010). According to anthropologist research, they are one of the Austronesian peoples sharing the same linguistic and cultural ties. Within Taiwan, they also exhibit cultural diversity. Belonging to different tribes, these indigenous Taiwanese speak different languages and observe different cultural rituals and living styles. Their dwellings are also spread across diverse terrains, ranging from high altitude mountains to coastal areas and islands.

Like many other indigenous groups around the world, the history of the indigenous Taiwanese is marked by different periods of colonization, involving the Portuguese, Spanish, Dutch, Japanese and the Chinese. Over these various colonization periods, the indigenous peoples have not only gradually lost their languages, traditions, and cultural rituals (e.g., hunting, weaving, embroidering, carving), but also their identities and willpower (see, for example, Hsieh, 2013).

The Taiwanese government's concern for the welfare of the indigenous population led to the establishment of the Council of Aboriginal Affairs in 1996, which then became the Council of Indigenous Peoples in 2002. The number of officially recognized indigenous tribes has also increased from 9 (in the Japanese colonization period) to 16 in 2014. Over the years, much governmental investment has been made into indigenous people's affairs, in such forms as affirmative action, stipends, scholarships as well as counselling and remediation programs in schools. Yet, the outlooks of the indigenous peoples' employment rate, SES, and life spans are less than rosy. Lee, Chao, Lee and Chang (2011) as well as Tsou (2010) provide relevant context for this.

The same may also be said of the performance of the indigenous students in schools, whether this might be school attendance, dropout rates, education level, motivation, or achievement. For example, the dropout rates of indigenous students are higher than other ethnic groups at all levels of schooling. The education level for the indigenous students in general is much lower than that of the other ethnic groups. Their test results also fall way behind their non-indigenous peers (Taiwan Ministry of Education, 2014). Indeed, many indigenous students from early on in school dislike mathematics and experience difficulties learning it.

It does seem that the government's various attempts at improving the educational attainment of indigenous Taiwanese have not paid off. Critics may say that whatever the Taiwanese government does now is too little, if not futile. On the other hand, the approaches might have been a case of treating the symptoms but not addressing the roots, as reflected in a Chinese saying, "heal the head when experiencing headache, and heal the foot when the foot hurts" (頭痛醫頭腳痛醫腳).

This paper reports on a research study that explores the root causes of under-achievement in mathematics of indigenous Taiwanese students. To do so, we will next argue for the need to consider the volitional approach, rather than the usual cognitive and/or affective

approaches. The empowering nature of students' want to learn (Kytle, 2004) will be discussed, and we will argue that values underpin this want to learn. With this values framework, the study was designed and executed. The data analysis will be presented, and we will explore the participants' values that contributed to the ways the indigenous Taiwanese students regarded mathematics and mathematics learning, and to the ways they perceived mathematical performance.

The Want to Learn

Utterances such as the one cited in the title of this paper reflect culturally-based volitional perspectives not just about one's own potential to succeed in (mathematics) education, but also one's own agency and empowerment in life. These perspectives are volitional because they stimulate actions, such as being engaged in mathematics lessons, employing home tutors, or planning for more personal daily mathematics practice. This (co-) construction of and participation in one's own life reflects a sense of willpower to persevere with what one finds to be important, and which one values. If a learner believes that she and/or members of her community has no access to mathematical knowledge, or that the mathematical knowledge she has acquired is not going to enable her to control aspects of her life, then it is reasonable to argue that she is not likely going to keep on trying to make a difference in the livelihood of herself and of her community. Without this will, the cognitive tools that she might have acquired would not be of much use. Similarly, her emotional wellbeing might be affected as well.

This sense of willpower is an expression of a learner's want to learn, and paves the way for cognitive and affective tools to play their respective roles in facilitating (mathematics) learning and teaching. Following from Seah and Andersson (2015), we assert that the things which learners value in their pedagogical activities embody this want to learn. That is to say, the drivers for our want to learn are the values which we subscribe to. These values reflect what we emphasise and regard as important, and they shape the way our own wants to learn looks like, in terms of motivation, engagement, and perseverance. For example, one may value *obligation*, such that her want to learn is shaped by the importance she accords to doing well at school in

order to bring honour to her family. On the other hand, another student who might value (relational) *understanding* (see Skemp, 1976) is likely going to develop her want to learn in a rather less instrumental manner.

Values in Mathematics Learning

Indeed, Seah and Andersson (2015) define values as:

> 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 in any given educational context. (p. 169)

In this context, we have adopted the perspective of empowering the mathematics learning experiences of the indigenous students through fostering in them the valuing of enabling convictions related to the nature of mathematics, the pedagogy of mathematics, and education in general. This categorization of values in mathematics education has been based on Bishop's (1996) conception, in which he had labelled these as mathematical values, mathematics educational values, and general educational values respectively.

In particular, Bishop's (1988) seminal book, "Mathematical enculturation: a cultural perspective on mathematics education" had proposed three pairs of complementary mathematical values which he believed underpin the discipline of "western" mathematics, which would have included the mathematics that is taught in schools across Taiwan. These mathematical values are *rationalism* and *objectivism*, *control* and *progress*, and *mystery* and *openness*.

Mathematics educational values reflect what are being regarded as important in the process of mathematics learning, and are thus much more exposed to cultural influences than mathematical values. In the Taiwanese context, mathematics educational values include

achievement, practice, and *relevance* (Seah et al., 2014). Of particular importance here is the recognition that the *relevance* that is valued in one culture may not be similar to what is considered relevant in another culture, such as the indigenous Taiwanese culture.

The third category of values that may be found in mathematics classrooms, general educational values, would include the range of convictions that are embraced in the local mathematics curriculum and in the wider society. Such values might include *creativity, problem-solving* and *achievement*.

Bishop's (1988) notion of complementarity, as well as Hofstede's (1997) conceptualization of value continua, both suggest that convictions are not valued in an either-or manner. Thus, for example, even though *process* and *product* may be opposite ideas which we may imagine to occupy two ends of a value continuum, it is rare for us to come across any student or teacher who values either of these only. It is more probable that we see the importance of both *process* and *product* in our mathematics work, although our valuing of one of these may be more dominant than that of the other.

Given the relative infancy of values research in the context of mathematics education, and the subsequent dearth of systematic research into what are valued by indigenous mathematics learners in Taiwan, we seek here to open up an enacted research agenda for the improvement of mathematics education in the Taiwanese indigenous communities, by establishing baseline understandings of what are being valued (and not valued) by indigenous Taiwanese mathematics learners.

Research Design

Given that we do not yet have much knowledge of what indigenous students (in Taiwan or anywhere else) value in their mathematics learning experience, this exploratory study has chosen to adopt the interview as the research method. After all, a strength of the interview method is its adaptability (Bell, 2005). The affordances to probe further, to attend to non-verbal reactions, and to respond to any culturally-based misunderstandings are seen to be important features for the purpose of our study. Yet, we are mindful of the power asymmetry that is likely to exist in the interview context (Kvale, 2006), possibly

arising from the difference in social status (teacher-student, adult-child) and in ethnicities. As such, the first author spent considerable amount of time in the research site, both to allow for the student participants to get familiarized with her, and also to socialize herself to understand the indigenous culture more.

This study was conducted in a primary school in Taitung, in the South-eastern region of Taiwan. Taitung is home to the highest concentration of indigenous Taiwanese communities. This school had been selected for the value it places on the preservation and celebration of indigenous culture, as evidenced through such programs as the inclusion in its school curriculum of indigenous language classes, traditional arts and craft teaching, as well as hunting rituals. Concerts would also be organized to celebrate ethnic cultural events such as the annual harvesting season. The school was physically located in a tribal village in Taitung.

Data sources were the eight Grade 4 indigenous students (6 boys and 2 girls) attending the weekly after-school carving class in the school. The carving master teaching this class was a respected elder in the tribe who has dedicated his time to the preservation of the indigenous culture. Indeed, he was also often found using the indigenous language in his interaction with his students. According to him, he wanted the children to learn the indigenous language as well as the traditional skills. The first author had spent a few months in the class, observing the lessons and interacting with the students.

Most of the boys in the school had chosen to join the baseball team, while most of the girls chose to take part in the traditional cross stitch activity. Indeed, culturally-based gender roles with regards to the learning of traditional skills were still strong. Boys were expected to observe their fathers or other male elders in the tribe to learn carving skills, whereas girls would expect themselves to learn how to weave or do cross-stitch. Nevertheless, the gender equity education that was introduced in the school might have gone some distance in explaining why girls were found in the carving class at all!

The interview was in the form of a semi-structured, focus-group session. The interview protocol was made up of the following main questions:

1. What do you consider to be important in mathematics learning?

2. What are important factors contributing to a poor performance in mathematics at school?
3. What do you consider to be important if one wishes to improve one's mathematics learning?
4. What do you consider to be important to be good at mathematics in school?

The interview session was audio-recorded, and the audio file transcribed thereafter to facilitate analysis by the researchers. The content analysis of the interview transcript was guided by a three-stage coding process that was conceptualised by Strauss (1987), made up of open coding, axial coding and selective coding.

Results

All the 8 student participants did not see the value of learning mathematics. They questioned the need to study the discipline, given that calculators and computers were so inexpensive and accessible these days. In addition, they also found mathematics to be boring. In fact, if given a choice, they would rather clean the toilet than do any mathematical activity! The indigenous students also shared that they could neither see nor imagine any relationship between – and the benefit of – mathematics learning on the one hand, and a sense of joy or any prospect of improving the quality of life on the other. Subsequently, mathematics teachers and mathematicians were not their role models. In fact, in the indigenous Taiwanese culture, singers were role models. The indigenous peoples were generally good at singing and dancing, and becoming a singer has since become an avenue to fame and riches, these being symbols of success in the indigenous culture. As such, for the indigenous student participants, they were learning mathematics because it was part of the school curriculum which they could not avoid. Otherwise, they could not see much connection, if at all, between learning mathematics and preparing themselves for a better life in the future.

The interview also invited the student participants to think about the important factors that would contribute to poor mathematical performance. This was a topic that brought out a lot of liveliness in the students, with the initial response being a fair bit of laughter and

pointing to one another as being a living example of someone who did poorly at school mathematics. In fact, they seemed to be extra eager to contribute their opinions! They all agreed that a poor performance in mathematics implies lack of intelligence. In other words, mathematical competency equates intelligence. But what did intelligence or smartness mean to the indigenous students? When they were asked if they thought they were smart, they either looked down or simply avoided eye contact with the interviewer. Yet, when they were asked if anyone of them was good at something other than mathematics, such as dancing or singing, the students were quick to act out different poses and to voice mimic their singer idols. They didn't agree that one needed to be smart in order to be good at something. Smartness seems to have been engrained in their minds as being associated with schoolwork, of which mathematics was the most prominent. In this regard, none of the students considered that they would ever be intelligent. Not that any of them wanted to be intelligent, since it would be related to excelling in mathematics, which was in turn associated with being nerdy and not being cool.

But, what did it mean to them to be poor at school mathematics? All the focus group student participants attributed the reasons to "don't study" and "don't care". Student perception of lack of intelligence was to be a contributing reason. In the words of a male student, "because if you're not smart and not good at math, why care and why study? It won't change anything. Why waste time? Fool!" This response was met with signs of agreement (e.g. approving nods) by his peers in the focus group.

On the other hand, the student participants were able to articulate what could be done to help somebody who had performed poorly in mathematics. They emphasised the importance of providing the person with extra help at home. These out-of-school assistances would include the provision of the financial means to employ a private tutor and to participate in after-school programs. When the students were asked why they nominated *out-of-school assistance,* they referred to their observation that the "good" mathematics students in school had access to such support mechanism.

The student participants were also asked what would be valued when they considered the improvement of their own mathematical ability. All of them felt that mathematical ability can't be changed, and thus it can't be improved. One of the boys' parents had in fact

told him that "math is not for us, not an indigenous thing, you know"! When the student shared this in the focus group, his peers went into a discussion on this with him, ending up with all of them agreeing that this was a real possibility. The students were then asked further if mathematical ability might become better if one studies harder, concentrates in class more, is more careful, and practices harder. They did not seem to think so, judging by the low groans we could hear, followed by silence while a few of them shook their heads.

What did the student participants consider to be important factors of being good at mathematics in school? Only the girls in the focus group responded that *studying hard* and *listening* carefully were important factors. However, all of them considered one's innate ability to be smart to be important, and that this was not gender-biased in any way. Attendance of after school programs was also valued by all the student participants.

Other values were also mentioned, and these referred to teachers and schools. In particular, being good at mathematics was also related to a valuing of school *effectiveness*, of teacher *competency,* and of teacher-student *relationship*.

One of the students had nominated as one of the important factors the assistance given by family members. It worth noting that the other students did not mention this valuing because they had considered it to be unrealistic in the context of the indigenous Taiwanese communities. Just like in many parts of rural mainland China, one or both parents was likely to have moved into the cities where there were greater employment opportunities, leaving behind the grandparents and young children in the tribal villages. Thus, in the indigenous Taiwanese communities, the major caregivers in families were often single parents or grandparents (Lee, Chao, Lee & Chang, 2011).

Discussion

It was striking to notice that even though the student participants did not feel that they were as intelligent as other peers, they were at the same time wanting assistance to support their mathematics learning. These students desired to learn mathematics and to do well in it. They appeared to place importance on – and value – *nature* (intelligence as a given), but one which reflects a belief in what Dweck (2007)

called the growth mindset rather than a fixed mindset. That is, at the same time that the students valued innate *intelligence* as a condition for mathematical performance in school, their growth mindset has also led to a valuing of convictions such as *change*, *development* and *effort*, achieved through such means as out-of-school support structures such as home tutoring. While what one is endowed with might be important, what one tries to develop and accomplish with what one is endowed with also plays a role in defining how good one gets to be in mathematics learning. This reflects our understanding that what one values can be located along value continua, as we discussed above. Here, the students' valuing was positioned somewhere along the *nature / nurture* value continuum.

The students' valuing of *nature* was also reflected in their belief that mathematics is "not an indigenous thing, you know". We found ourselves asking what might (their) mathematics teachers do to alter this student belief. Assuming that a mathematics teacher does not subscribe to a similar value, current literature suggests that it is in the professional interest of the teacher to establish some form of values alignment in class (Seah & Andersson, 2015). Yet, the valuing of *nature* is probably shaped over time and rooted in the wider society, in this case the indigenous Taiwanese culture. It is not clear if teachers with the time and resources they have at hand would be able to align the values in their classes in ways which minimize further the valuing of *nature*, and more importantly from our perspective, how they might successfully do that. At the same time, it appears that values alignment processes within the classroom might benefit from parallel efforts at the institutional and societal levels. In other words, we challenge any notion that values alignment processes at the classroom level alone might be sufficient when we seek to shape students' valuing, and we can imagine the contribution at the institutional and the societal levels as well.

It is also of interest to note that the values that were identified by the indigenous students in this study were all mathematics educational ones (Bishop, 1996), these including *nature, nurture, effectiveness, competency, relationship, listening,* and *out-of-school support*. There was no (explicit) reference to mathematical and general educational values, even though we can imagine some student referring to the importance of *rationalism* (a mathematical value) or of *creativity* (a general educational value in many educational systems) in being good at the

subject. Is this dominance of mathematics educational values due to the difficulty for (primary-aged) participants to identify other categories of values, or is it possibly specific to the indigenous cultures only?

Conclusions

Taiwanese students in general may be leading the world in their mathematics performance; with a mean score of 560, Taiwan is positioned joint third in PISA 2012 (OECD, 2013). However, it can be tempting for us to overlook that within these highly performing education systems, there are communities of students who might be underperforming, and whose qualities of lives in future might be at stake. The exploratory study on which this paper is based was conceptualized to provide baseline information on what were considered important by indigenous Taiwanese students with regards to mathematics learning, given that their underperformance in this subject has been a concern for educators and in the wider community. The researching experience has also provided us with invaluable ideas on how the next phase of this study, involving a greater number of schools and indigenous students, might be operationalized. Nevertheless, the qualitative nature of the study has meant that regardless of participant numbers, findings are understood in the context of particular schools and particular (groups of) indigenous students. Thus, the findings are not generalizable.

The analysis suggests that amongst the eight Grade 4 indigenous students at least, mathematics as a school subject was not valued for its own sake. There was the general valuing of *nature* (involving innate intelligence) in the context of doing well in mathematics. At the same time, there was also a valuing of *out-of-school support*, such as home tutoring and family support, although the latter was impacted somewhat by the realities of single-parent and grandparent families in the indigenous Taiwanese communities. The girls amongst the student participants also valued personal *effort*, further supporting the prevalence of what Dweck (2007) called the growth mindset amongst the indigenous Taiwanese students.

This raised for us a question of the extent to which gender (or gender roles) may regulate the indigenous students' valuing. As discussed briefly in the previous section, we are also interested to explore

the extent to which the dominance of mathematics educational values (over mathematical and general educational values) might be culturally-related. We suggest here that future research studies might benefit from the parallel collection and interpretation of data from Han Chinese students in Taiwanese schools as well, to facilitate comparison.

As noted above, only a few of the student values were related to teachers. Indeed, Chen and Lee (2013) had reported that students in the Eastern region of Taiwan (an area with a high concentration of indigenous communities) placed lesser demands on teaching sequence and teaching support, when compared with their peers from other parts of Taiwan. We are thus interested in how teachers practicing in indigenous communities deal with differences in what they and their indigenous students value in mathematics and mathematics learning, and how their attempts at aligning the value differences might affect student valuing along continua such as *nature/nurture*. Of concern here is the observed belief amongst the indigenous Taiwanese students that doing well in mathematics is out of reach of the indigenous people, and as a result, they might have given up hope to study and to do well in mathematics. Future research into the role of teachers' values alignment practices in shaping what indigenous Taiwanese students value in mathematics and mathematics learning is expected to go a long way in helping us empower the younger generations of this group of people.

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