Ewing, Bronwyn (2004) *Teacher communication, student identity and classroom participation*, in McWilliam, Erica and Danby, Susan and Knight, John, Eds. *Performing educational research: Theories, methods and practices*, pages 137-150. Post Pressed, Flaxton

Teacher communication, student identity and classroom participation

"I belonged in a way that no one understood anything that we were learning"

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This paper draws on research in progress with early school leavers and non-completers of schooling to argue that mathematics classrooms can be usefully considered as communities of practice. In these communities of practice, social relationships are negotiated and identities are formed which can be critical for these students' long term success or failure in learning mathematics. In such social settings, processes of participation and non-participation are crucial to the construction of group and individual identities, and the social skills of the teacher and her ability to communicate and engage effectively with such students can be as important as her knowledge of content.

A long-standing concern of mathematics educators (see Schoenfeld, 1994; Romberg & Kaput, 1999; Zevenbergen, 2001; Education Queensland, 2003 for example) has been the non-participation of many mathematics students in the pedagogic practices and activities intended to promote mathematical learning. This paper draws on research in progress with early school leavers and non-completers of mathematics (see Ewing, 2004), and Wenger's (1998) framework for understanding community and identity, to argue that mathematics classrooms can be usefully regarded as communities of practice (cf. Wenger, 1998) in which processes of participation and non-participation can be critical for students' long-term success or failure in learning mathematics. In such settings, their identities as participators or non-participators in the classroom community can be substantially affected by the form/s of teacher communication "in play", and it is these processes on which this paper is focussed.

In this regard, Goos (personal communication, 2004) drawing upon Richards (1991) and Boaler (1999), has proposed a useful schema for classifying types of participation:

1. identification with open/inquiry mathematics, where the student knows, accepts and plays by the rules of this type of classroom community (this is the aim of current mathematics curriculum documents in Australia and the U.S.);
2. identification with closed/school mathematics, where the student knows, accepts and plays by the rules of this type of classroom community (for example, students succeed by learning rules and procedures);

3. resistance to open/inquiry mathematics (this often happens when students who were happy in cell 2 are asked to move to cell 1);
4. resistance to closed/school mathematics (illustrated by the students who took part in the author's research).

		Learning		
		Identification	*Resistance*	
Curriculum Pedagogy Epistemology	*Open/inquiry mathematics*	1	3	
	Closed/school mathematics	2	4	

Source: Goos, M. (2004). Personal communication

Table 1: Model for classifying participation in mathematics classrooms

In such a frame, it would seem reasonable to class the students in this study in cell 4. However, this cell implies that these students were resistant to school mathematics, and this was not always found to be the case. Thus, I propose to extend this analysis with a model presenting the assumptions, processes and consequences of psychological, social psychological and socio-cultural approaches to teaching and learning in mathematics classrooms. This model draws substantially on the work of Renshaw and Brown (1997), Wenger (1998), Goos, Galbraith and Renshaw (1999), and Renshaw (2002) on learning communities.

Characteristics	**Psychological** ⟷	**Social psychological** ⟷	**Socio-cultural focus**
Pedagogy	Behaviourist/ transmission model	Developmental	Social theory of learning
Curriculum	Isolated discrete steps	Process orientated, meta-cognitive	Collaborative & experientially relevant
The teacher	Authority, deliverer of knowledge	Student focussed, facilitator and scaffolder of learning	Experienced senior member and leader of community of enquiry
The learner	Passive and externally directed	Staged movement towards self-regulation, individual enquiry	Participant in community of enquiry—developing from new to full membership
Form of communication	Authoritarian, didactic, teacher to student/class	Constructivist: teacher to individual and small groups and vice versa	Collaborative, co-constructive: teacher to student/s, student/s to teacher, students to students
Student identity	Participation: passive, prescribed, conformist	Participation: self-managing — self-regulated, self-guiding & self-responsible	Participation: movement from peripheral to full community membership
Community of practice	Members are limited participants; personal experiences not accountable to the regime of competence because they are repressed or ignored.	"Privatised" & "marketised"; competitive and performance/ outcomes orientated	Strong community, frequent interaction, ownership of meaning, personal experience of engagement, members share a common identity and purpose; competence incorporated into an identity of full participation

Table 2: Teaching/learning, identity and participation in mathematics classroom communities of practice

This model is not intended as a critique of the four perspectives of Table 1 *per se*; rather, it seeks to clarify the issues involved in the success or failure in learning mathematics of the particular group of students on which this study is based. From my analysis of their accounts, as outlined later in this paper, their mathematical learning experiences were predominantly addressed from a psychological focus as outlined in the first column. However, a more substantive focus on the classroom as a community of practice, and more collaborative forms of teacher communication which accept and build on student competencies and experiences, would appear to be a prerequisite for their successful engagement in learning mathematics. In such a context, social relationships are negotiated and identities are constructed which can be critical for students' long-term success or failure in mathematics. Here, the social skills of the teacher and her ability to communicate and engage effectively with students can be as important as her knowledge of content.

When these students' mathematical experiences are limited to authoritarian and didactic forms of teacher communication, where solutions of routine problems from textbooks, memorising facts and formulas and scoring well in tests are the expected outcomes, they fail to see the connections between these processes and the world in which they live (Boaler, 1998, 2002; Steinbring, 1998; Romberg, & Kaput 1999). Such an approach, which neglects the application and enactment of mathematics in learners' daily lives (Lave & Wenger, 1991; Wenger, 1998), fails to capture their interests. Thus, for these young people who see mathematics as irrelevant and boring and for whom there is little sense of belonging, there is a danger of shaping an identity of non-participation in which they both exclude themselves and are excluded from that learning community or, worse, school (Cotton, 2002).

A SOCIAL THEORY OF LEARNING – IDENTITY AND PRACTICE

As espoused in this paper, a social theory of learning views learning as an ongoing process of social participation (Wenger, 1998). In this context, teacher communication is collaborative and co-constructive of students' mathematical knowledge. Students and teachers become active participants in the practices of mathematics communities and construct their identities in relation to these communities (Wenger, 1998, p.4). Learning and knowing consists of structured engagement with students' relevant background

experiences and participation in the actions of the classroom and the wider community (Eckert, 2000; Renshaw, 2002). In such contexts, learners reflect on their learning and shape their identities as members of a classroom community of mathematical practice.

Shaping an Identity of Participation

The approach taken by identity perspectives differs substantially from much earlier work (see Erikson, 1968 for example) which has focused on the individual rather than a social community of learners. More specifically, a theory of identity of participation locates learning as a vehicle for the inclusion of newcomers and for the development of identities. Its focus is not primarily on the cognitive attributes of the individual. Rather, it is upon the ways the person relates with others, where the experiences and competencies that are constitutive of an individual are applied in order to identify and be recognised as a member of a community (Wenger, 1998). Membership and recognition in a community of practice like mathematics thus become a

> locus of engagement in action, interpersonal relations, shared knowledge, and negotiation of enterprises[.] [S]uch communities hold the key to real transformation – the kind that has real effects on people's lives. (Wenger, 1998, p. 85)

For learners of mathematics, such a community gives rise to an experience of meaningfulness where there is the invitation to engage and share experiences and incorporate that competence into an identity of participation. Learners who develop and share ways of doing things, talking, and creating meaning in and about mathematics are united in such a community. However, social relations in such communities involve both participation and non-participation, with identities shaped by the two processes.

Here Wenger (1998) argues that experiences of non-participation can be of two forms, peripherality and marginality, with each producing very different experiences and identities. In the case of peripherality, non-participation is a kind of participation that is less than full. That is, newcomers to a community move inbound to future full participation (Wenger, 1998). Here, the initial non-participation provides an opportunity for learning and becomes an "enabling aspect of their participation because full participation is not a goal to start with" (p. 166). With marginality, however, the negative or exclusionary aspects of non-participation dominate and prevent full participation. In this context, non-participation may be so ingrained in a community's practices that they close opportunities for the future. Hence, rather than mathematics learning communities offering joint enterprise and full membership, the students in this study were found to be restricted by a

non-participation of marginality, which did not allow them to become members of their community and kept them in marginal positions. However, as discussed shortly, their experiences of the Youth Reconnected Program in a TAFE College setting were quite different, allowing them to develop into full members of that mathematics community.

Communities of Practice

As already indicated, communities of practice are social contexts where teachers, utilising an understanding of their students, their experiences and their interests, communicate their knowledge of and commitment to mathematics to these students. In turn students learn and negotiate mathematical meaning through mutual engagement with the teacher and amongst themselves (cf. Wenger, 1998). Such practice is not located in books, rather it resides in a "community of people and the relations of mutual engagement by which they can do whatever they do" (p. 73). Membership of such a community is achieved through the negotiation of joint enterprise; a process skilfully guided by the wise and inclusive teacher. It is defined by the participants (again including the teacher) in the process of pursuing it.

Being included in what matters in such communities is a requirement for being engaged in a community's practice. The resources or repertoire, such as routines, ways of doing things, and gestures that are created from such engagement gain coherence from the fact that they belong to the practices of communities pursuing an enterprise (Wenger, 1998, p. 83). For example, the teacher and student/s may work together to solve joint open-ended mathematical problems; similarly a meaningful context for learning mathematical content is provided when communication is open between all members of the community including the teacher. Such a community is constituted as members communicate with one another about the world. Teacher communication is critical to the success or failure of this enterprise.

TEACHER COMMUNICATION

Engagement and belonging to a mathematics learning community generates an ability to make interpretations and make use of the repertoires of that community (Wenger, 1998). For example, engaging in a joint enterprise provides a context for the creation of resources, such as different ideas or plans for mathematical constructions, or different solutions to mathematical problems, and negotiating the meanings that arise from such enterprise. This kind of interaction provides a context where the teacher, who has full membership in the practices of a mathematics community, is able to give life to the classroom through sharing

her repertoire of mathematical experiences. Thus, as indicated above, the manner in which all members, and in particular the teacher, communicate and make meaningful statements about mathematics (Clark, 1998; Fonzi, & Smith 1998; Steinbring, 1998) is crucial to the development of a mathematics community of practice.

The work of Bernstein (1990), whilst not related explicitly to mathematics education, is highly relevant to understanding pedagogic practices such as communication in mathematics classrooms. In developing an understanding of the social relations of different pedagogic practices, Bernstein (1990) found that two types of pedagogic practice, visible and invisible, act selectively on the content of such practice, and upon those who can successfully acquire the content. For example, a visible pedagogy makes the criteria for successful learning explicit so that the learner is aware and recognises what the teacher wants. In this context, learning is performance-based with students moving towards achieving the stated outcomes. In the case of an invisible pedagogy however, the criteria are implicit and therefore invisible to the students because they are known only to the teacher. Bernstein found these pedagogies are the very mechanism responsible for the inclusion and exclusion of particular groups of students in classrooms. In summary, visible and invisible pedagogies affect *what* is to be acquired, and *how* it is to be acquired, and the *context* in which it is to be acquired.

The work of Schoenfeld (1994) provides a further explanation of pedagogic practice in the context of mathematics classrooms. In his studies of the teaching and learning of mathematics, Schoenfeld found there are epistemological and pedagogical issues involved with doing mathematics. The epistemological issues relate to how students make sense of mathematics and communicate their understanding. The pedagogical issues relate to the ways mathematics is taught and communicated. When teachers and students attempted to communicate about mathematics, Schoenfeld found few students had much if any practice at doing so. Rather than understanding the connections in mathematics and sharing those connections with a learning community, students learned there was only one correct way to do mathematics, usually by the rule the teacher had most recently demonstrated to the class. Similar concerns are echoed by Romberg and Kaput (1999), who suggest that traditional teaching and learning of mathematics has not allowed students to learn mathematics with understanding, and that the first step must be to redefine mathematics as a human activity that reflects “finding out why given techniques work, inventing new

techniques and justifying assertions" (p. 5). Underpinning such concerns is the role of the teacher in communicating mathematics in such a way that is inclusive of all learners, and which provides opportunities for them to engage in the joint enterprise of a learning community of mathematics scholars. These matters are exemplified in the study from which this paper is drawn, and to which I now turn.

METHOD

Forty-three early school leavers and non-completers of school participated in individual semi-structured interviews of their experiences of teacher communication in mathematics classrooms. These young people attended a Youth Reconnect Program at a TAFE College. This program was designed to support young people who were early school leavers and non-completers of school, by improving their literacy and numeracy skills so they could access further education or enter the workplace (DEST, 2002). The interviews took place at a TAFE College in an office set aside for this purpose. Interviews were of 20-30 minutes duration and took place over a period of six weeks. All interviews were transcribed. Selected transcripts of audiotaped interviews have been chosen to emphasise the effect teacher communication has on the shaping an identity of participation in mathematics learning communities. The analyses of the data for this study, utilising the content analysis program Nvivo (QSR, 2000) drew on the principles of symbolic interactionism, that is that meaning is constructed in the course of interaction between people (Blumer, 1969).

IF I AM EXCLUDED WHERE DO I BELONG?

A number of themes emerged from the students' lived experiences of learning mathematics. Of significance, yet not surprising, was that the traditional approach to teaching mathematics through one-way communication (from the teacher to the student) (cf column 1 of Table 2) dominated the experiences of many students. Learning rules and formulas without understanding why they work and where they fit in their daily lives has not provided these students with opportunities to identity themselves as mathematics learners. Instead, as noted earlier (see Table 2), this approach requires them to accumulate isolated bits of information mainly by listening, memorising and drill and practice. In this frame, the learner is constructed as the passive recipient of someone else's knowledge.

While it may indeed be the case that, as in Cell 2 of Table One, some students are comfortable with this process, for the subjects of this study the result was a community of failures which holds learners as hostages to their experience. For example, Peter[1] explained

that he found learning mathematics difficult because the teacher only showed the students how to arrive at an answer rather than explaining "what it does and how to do it". Peter further explained that his mathematics experiences were boring and largely involved completing worksheets or working from a textbook: the teachers "just give you a maths book and you just work through it".

What was surprising in this study was how these students described the effects of teacher communication on their learning and how they identified themselves as belonging (or not belonging) in such a community. The following excerpts with Jasmine and Robert illustrate the effects of teacher communication on learners.

22	Jasmine:	She would tell us (.) what to do. Like (.2) she'd tell us to turn to a page in the textbook. Then she would not really explain it. Just basically she done it on the board and said oh you do this and this. It wasn't really explaining it; it was just the same as the textbook.
23	Researcher:	As a learner what did you do?
24	Jasmine:	I'd have to go back into the textbook (.) and try to read over it and read over it again until I sought of understood it.
25	Researcher:	Did you go to anybody else for help at all?
26	Jasmine:	Just the person that was sitting next to me, but they didn't really know much more than me.
27	Researcher:	In what ways did you feel like you belonged or in what did you feel you didn't belong?
28	Jasmine:	I belonged in a way that no one else really understood anything that we were learning anyway.

10	Robert:	[Teachers ( ) help the students, just write it up on the board yeah do this. When you ask what has to be done they tell you and they tell you hardest form possible for us to understand and um, like (.) they don't just explain it enough. It's a set thing you do it this way. Mostly not enough time to do the things because you're lagging behind it's probably because you are spending time on it and learning it and um (.2) YEAH when you do lag behind the teachers just go off. I've just walked out of class ( ) I've just walked up to the detention room RTC, one of the teachers there I used to get along with him really well. He used to get my work I used to do it up there 'cause I could learn easier there.

The issue of teacher communication in relation to experiences of not belonging and not identifying and participating in such a community is very real for these students. This is particularly evident in the response of the second student, who decides to leave the classroom and work with another teacher in a different area of the school. Clearly for these students for whom there is little sense of belonging and a lack of identification with the community of school mathematics, there is the risk of exclusion from that community of practice (Cotton, 2002) and the potential for another community of practice, antithetical to curricular and pedagogical aims, that of failure. The young people who found the communication with and from teachers difficult to understand, who perceived mathematics

as complex and unattainable, were more likely to be represented in such a community, displaying subversive behaviours whereby they identity and participate on the boundaries of inclusion and exclusion (Wenger, 1998) from mathematics classes or school itself (Cotton, 2002).

After the initial set of interviews, the focus shifted to establish particular characteristics of teacher communication that had an effect on learners. This is elaborated upon in the following two transcripts:

10	Angelique:	Okay yeh we would just walk in sit down with our textbooks. He would write up all this stuff on the board to go to. You would have to go to the page that he has written. It's like page 236 blah, blah, blah. You'd just go to that and he says work from your book and then he gives you, writes all the answers on the board. That's all you do in high school, work from your textbook. And it was pretty difficult stuff, not easy.
11	Researcher:	As a learner of mathematics what effect did that have on you?
12	Angelique:	It was hard, because I did not know the basics, as I said. I did not know the basics so coming to do all this was hard, so I just blocked off. Like I would just sit there and that is how I got bad grades and stuff 'cause I would just sit there and would not pay attention.

1	Michael:	(0.1) Oh pretty shocking I suppose. He just, he had a textbook with all the things and that and he'd just write it up on the board, give you like minutes and show you working hhh. Then like 'cause there's the whole class, doesn't give you much time to show everyone, some people don't learn as quick as the others and that. And then you just lose track, can't keep up, you're just up to your neck in homework and that.
2	Researcher:	So (0.1) when you say you were up to your neck in [homework
3	Michael:	[Oh yeah, like 'cause like say you're trying to get something but then by the time you think you've got it sought of sussed he's already putting something else on there and that. He doesn't (care), doesn't (really teach you), doesn't really show it.

These students' experiences bring to light several characteristics inherent in one-way teacher communication in many secondary classrooms; for example, the use of textbooks, the pace and sequence of content delivery, chalk and talk, and mounting homework. An inference from the transcript above is that incomplete class work meant this student was required to complete it for homework, a difficult challenge for those students who did not understand what was taught in the first place.

What was particularly evident in the students' reflections was the effect teacher communications had on their particular identification as learners and on what they were supposed to be learning. When content is communicated explicitly and the teacher's criteria are visible (Bernstein, 1990) students are more likely to recognise what the teacher wants. However, when it is implicit and invisible as is the case for the students in this study failure is the most likely consequence. They are more likely to feel excluded from

classroom learning because they were unable to identify the "rules of the game". They were reduced to experiencing feelings of not belonging, not coping and not being empowered in the community of which they were supposedly members. The following transcript addresses this issue:

5 Kate: (.4) I don't know. We just go in the class, sit down and then he would start writing out on the board what we had to do. We'd do it, but then if we got it wrong he would put us down ( ), like cause we were in Grade 9. That was about it, we did work and then (.) went out basically.

6 Researcher: When you say that he put you down [because

7 Kate: [Well, he reckoned that the work was easy, but then sometimes when you got it wrong it wasn't that easy because you didn't get taught it (.) Like I knew nothing about area until I came here.

In this excerpt Kate gives an account of her experiences of learning mathematics. She highlights the difficulty of understanding the form of teacher communication she and her class experienced during lessons. Further questioning revealed several aspects of Kate's learning which were significant to her. She focused on aspects of teacher communication in her classroom, that is, chalk and talk and the teacher yelling at students and putting them down if they got their work wrong.

Issues to do with teacher communication and students' feelings of exclusion and not identifying and participating in mathematics classrooms are evident throughout the interviews. It is also clearly evident that an identity of non-participation is shaped through marginal membership in the classroom community. Here, Cotton (2002) suggests it is not a case of classroom contexts predicting and producing the practices that occur. Rather, "the identities and practices constitute the very context within which they become practices and identities" (p. 285).

Through the course of the interviews, students began to compare the similarities and differences of learning mathematics at school and at TAFE (cf Table 3). They explained the significance of teacher communication and its effect as they attempted to identify and participate in a TAFE community. (Two students however, acknowledged that they did not have a problem with the way teachers communicated to them in mathematics, and that other factors hindered on their learning in school.)

26 Michael: (.) yeah it's alright (.1) it's good here too because you can talk sense and say anything to the bloke next to you (.1) and say look at this I'm stuck here, teachers are busy, do you know anything about this? It works like that or visa versa.

46 Robert: This fraction thing I could not understand (.) and I asked the teacher and she came and helped me. And at that time there was no one sitting near me and I am glad of that. I felt a bit laughed at but um (.1) yeah, she explained it to me

		maybe six or seven times and I still could not get it and then I just looked at it. And stared at it, and then it sought of came to me, but um yeah (.2) they don't (.) teachers don't have problems with sitting down and explaining it how ever many times it takes for me to understand it.
20	Carla:	That is because we would come in and they would communicate better, they offer to walk around and help (.) there are more teachers teaching the students, so they can help you individually and not all together and um (.2)
21	Researcher:	That support [
22	Carla:	[It is a lot easier and better here because they start with you even if yeah (.1) they start from counting. If you cannot count, they come here and expect you not really to count and then they help you from that.
23	Researcher:	What sort of an impact do you think that has on you as a learner? Or how motivating do you think it is?
24	Carla:	I think because um (.1) it gives me (.) it makes me want to learn when I know (.1) when I know what I am talking about and what they're talking about it kind of gives me the confidence to do it as well with them in the class (.) to join in so it's a lot better.
25	Researcher:	So you can actually communicate? And are there enough opportunities for you to be able to do that feel comfortable about it?
26	Carla:	YEAH definitely.

In these transcripts, it is evident that students are aware of the effect that teacher communication has on their learning of mathematics, their sense of belonging and how they identify and participate in a mathematics learning community. This was a strong theme evident with most of the students interviewed. Their strong support for the TAFE program suggests that good work and good outcomes are achievable in mathematics.

DISCUSSION: THE COMMUNITY THAT TRANSFORMS STUDENTS' IDENTITIES

Shaping an identity of participation in mathematics learning communities is not about the reproduction of the conditions that create the marginalising of some students in the first instance. It is not about holding students as hostages to their experiences. Rather, it is about learning and the transformation of students, and what they can do in mathematics. Teachers have the potential to support students in inclusive learning communities. They can bring about transformations. If learning is supported, and the process of the acquisition of knowledge is sustained, new ways of knowing can be realised in the form of an identity of participation (Wenger, 1998).

In the case of these students' mathematical learning experiences at school and TAFE, it is evident that teacher communication has a significant effect on how they shape their identity of participation (cf Table 3). If a student fails to learn as expected, it may be

Learning mathematics at school	Learning mathematics at TAFE
• Alone/worked individually • No "real" interaction with teacher and peers since primary school • Minimal explanation and discussion about mathematics • Did not participate in discussion/s for fear of getting "it" wrong • Put down in class if got an answer wrong • Treated as a lesser person because student was not an "A" grade person • Little opportunity to excel • Just another student • Teachers yelled at students • Learned mathematics from a textbook • Felt like an "outcast" • Teachers lost interest in supporting students who were not good at mathematics • Despondent – gave up and just sat there • Not inspirational learning – not bothered to learn – not noticed anyway	• Peer supported learning/ interaction • Communicate with teacher/s, tutors and peers in and about mathematics • Responsible for own learning • Teachers don't raise their voice • More supportive communication/ more personal • Treated like an adult not like a "dropkick" • Work booklets • Extra teachers and volunteer tutors who are encouraging and show interest • Friendly and "more civilised" makes for a better environment to learn • Acceptance • Flexible learning structure – more regular breaks • Teacher/s start from "where you're at" • Seeing the same teachers • More challenging but teacher/s willing to assist • Positive learning atmosphere • Teacher/s respect students - students respect teacher/s • Willing to participate and learn

Table 3: Mathematics learning experiences at school and TAFE

necessary to consider not only possible problems with communication, but also what is lacking in the context where they should be supported and the competition from other places to which they are drawn. As Wenger (1998) suggests, "to redirect learning, it may be necessary to offer learners alternative forms of participation that are as much a source of identity as they are finding elsewhere" (p. 215). Thus, learning is a process of becoming a particular person or avoiding becoming a particular person; it entails a process of transforming knowledge and defining an identity of participation. In this setting, teachers can scaffold learning and learners by supporting the acquisition of knowledge and new ways of knowing by communicating with students in a community of practice which supports change as a part of shaping an identity of participation.

FINAL REMARKS

This paper has shown how particular teaching practices such as teacher communication influence the shaping of an identity of participation in learning communities such as classroom mathematics. Using aspects from the theoretical framework offered by Wenger

(1998) this paper has shown how teacher communication in mathematics lessons influences young people and their identity as learners. For the focus group of this study, the form of teacher communication is critical for their success or failure in learning mathematics.

This paper proposes that educators offer new forms of identity and membership and empowering forms of ownership of meaning where young people can shape what they do, who they are, and how they understand what they do, as this will better support them in their mathematics learning. If they do not, Wenger (1998) argues, they risk reproducing the same communities outside of mathematics classrooms, that is, communities of young people on the boundaries of society because of their lack of mathematics knowledge and understanding of the connections in their daily lives. There is a real danger that teachers may support only those students who already identify with the material in other contexts. In this frame, what is needed to be known are the characteristics of the TAFE program that support young people in shaping an identity of participation in mathematics, particularly when they are already "victims" of ineffective teacher communication in school mathematics classrooms. If such programs do support these students, how can schools, teachers and program providers ensure "successful outcomes" for them?

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The author wishes to thank Dr. Merrilyn Goos for her comments on a previous draft of this paper.

[1] To protect the identity of students all names are pseudonyms.