Change Trajectories in Teacher Professional Growth

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Professional growth is a form of learning. As such, it is not surprising that the response of a teacher to a professional development program is a very individual one. This paper reports the professional growth of two teachers involved in the same professional development activity, and with many common elements in their personal histories and work situations. However, the teachers' responses to the professional development program were significantly different with respect to: the level of classroom experimentation (both reported and observed); the degree to which each reflected on their teaching and the consequences of the program; the changes they reported in their practices and beliefs; and their engagement in collaborative activity with their colleagues. The challenge for the researcher investigating teacher professional growth is to find a suitable mechanism to describe the growth process. This paper employs "change trajectories" as a suitable descriptive device. The metaphor of a trajectory offers an image of movement over time, and draws attention to issues like: the dimension along which change occurred; the rapidity of the change; and the factors facilitating and inhibiting the change. In the case of the two teachers reported here, the change trajectories are sufficiently different to provide a useful insight into the individuality of a teacher's response to a professional development experience.

Historically, academics and policy-makers have sought strategies by which to effectively reform the curriculum. Such strategies include: the development of innovative curriculum materials; new assessment initiatives; and, new professional development activities and programs for teachers. The calls for reform of the teaching and learning of mathematics over the past ten years have led to professional development activities assuming an increasingly important part of mathematics teachers' lives.

Whilst much research has led to common agreement about the complexity of the change process, and growing agreement about features of effective professional development, there is more that needs to be known about teachers, professional development and change (Sparks & Loucks-Horsley, 1990). The intricacies of the change process are not clear, and so recommendations for improving professional development to assist teacher change in mathematics are difficult to make (Brown, Cooney & Jones, 1990). As Clarke (1993) reports, "A question of interest now is the order in which the change process occurs, and the nature of the interactions between the variables involved. A greater understanding of these aspects is essential if staff development programs are to make a major contribution to teacher professional growth" (p.46).

With these considerations in mind the study reported in this paper sought to unfold more about the process of change for teacher participants of a mathematics professional development program. In particular, the study was designed to examine teacher growth through the investigation of changed practice, both observed by the researcher and reported by the teachers, and the identification of factors that influenced the process of change for the teachers.

In establishing a descriptive framework for the study, the researcher made use of the Interconnected Model of Teacher Professional Growth (Teacher Professional Growth Consortium (TPGC), 1994) as a model for examining the process of change for the teachers involved in the professional development program. The Interconnected Model, presented in Figure 1, is a model of Professional Growth. This may be influenced by Personal Activity or Beliefs or it may, in turn, be an influence on Personal Activity or Beliefs. In this study the Interconnected Model is used as a means for describing change in the teacher's Curricular Activity. Personal Activity and Personal Beliefs are both facilitating and inhibiting factors which influence change in the teacher's Curricular Activity, and may also be changed in turn as a consequence of teacher growth in such aspects as an increased valuing of reflective activity and an

increased professional self-esteem. Curricular Activity in this study is described in terms of three components of teaching: Teaching Strategies, Use of Resources, and Assessment Strategies.

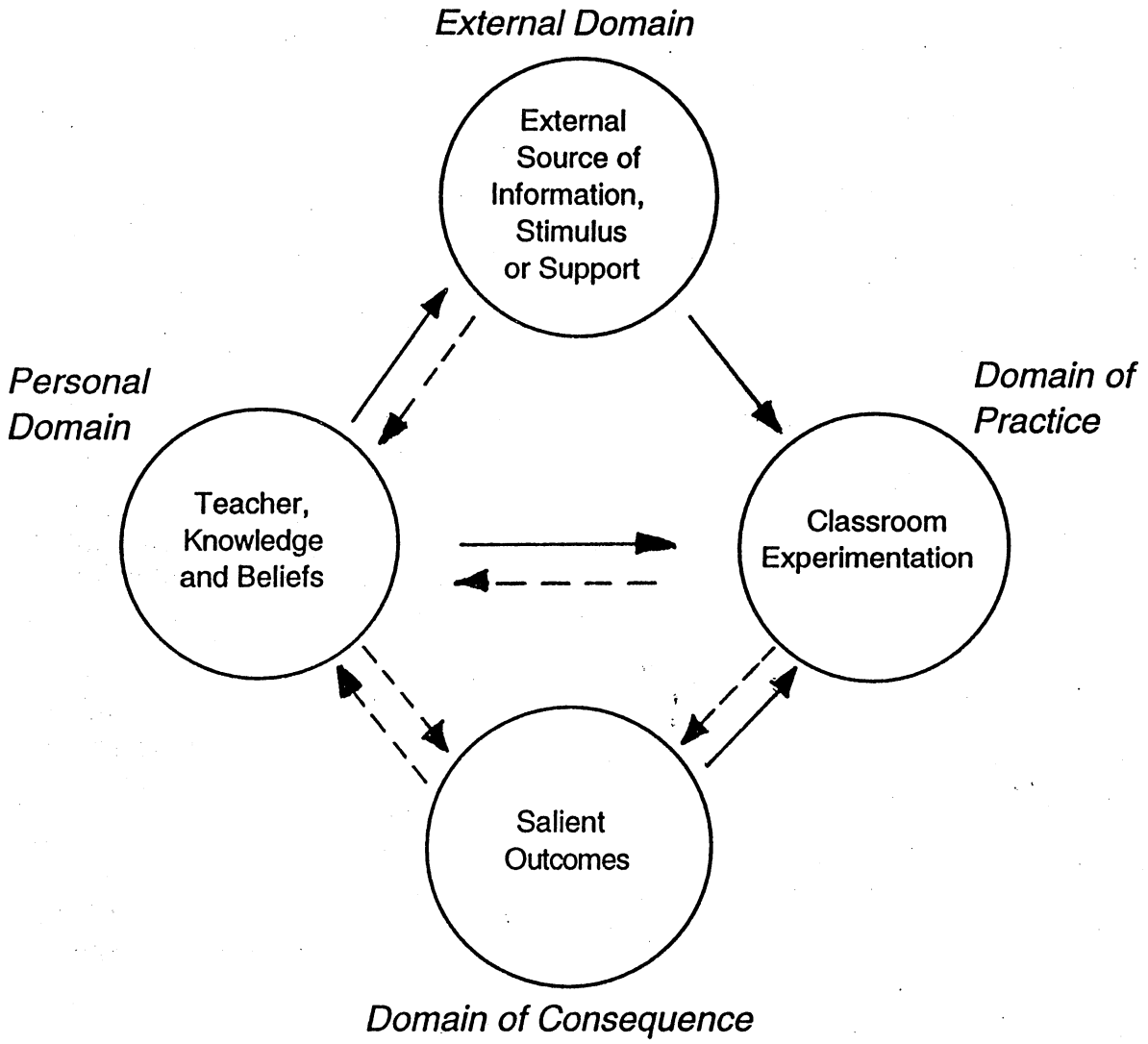


Figure 1. An interconnected model of teacher professional growth (solid line = *enactive* mediating process; broken line = *reflective* mediating process). (TPGC, 1994)

This paper reports some aspects of the professional growth of two teachers involved in the study and introduces the use of "change trajectories" as a suitable mechanism for describing the growth process.

Methodology

The study involved a detailed investigation of the process of change for teacher participants of the Victorian mathematics professional development program, Exploring Mathematics In Classrooms (EMIC). The EMIC program was designed to affect the practice of teachers by encouraging them to reflect on their current practice, read appropriate professional literature, and trial effective teaching strategies in their classrooms. It was the aim of the EMIC program not only to inform teachers of current trends in mathematics education, but also to encourage them to develop and expand their repertoires of effective strategies and practices (Ministry of Education, 1990).

Data was collected from six teacher participants of a ten week EMIC program. The teachers were interviewed and observed, both during their EMIC participation and in their classrooms, over a period of 18 months, beginning at the commencement of their involvement in the program. Documents and teaching records of each participant were also examined. The study traced the perceptions and practice of the teachers in relation to their Curricular Activity from their initial involvement in the program through to a period of consolidation and refinement 12 months after completing the program.

Classroom observation record charts were completed for each observed lesson. Interviews were transcribed and teacher statements were categorised using a coding system developed to classify components of the teachers' Curricular Activity. Field notes were also generated in relation to a selection of the EMIC workshops, but this data is not reported in this paper. In addition, field notes were maintained relating to informal conversations with the teacher-subjects. Teaching documents, such as work programs and assessment records, were also collected.

The data were rigorously analysed from a variety of perspectives derived from the key components of Curricular Activity. The intention was to identify structure and relationships within the data. It was in this fashion that the potential significance of certain scales, such as Range of Resources or Diversity of Teaching Strategies, was recognised. The notion of change across a variety of dimensions suggested the use of "trajectories" as a suitable metaphor for describing the process of change, and as a powerful method of communicating the data arising from this study.

Results

Consistent with the descriptive framework employed in this study, Curricular Activity data were collected with specific respect to Teaching Strategies, Resources, and Assessment Strategies. The results reported in this paper focus on the professional growth of two teachers, Geoff and Paula. While both teachers experienced the same professional development activity, and had common elements in their personal histories and work situations, their responses to the professional development program were significantly different with respect to: the level of classroom experimentation (both reported and observed); the degree to which each reflected on their teaching and the consequences of the program; the changes they reported in their practices and beliefs; and, their engagement in collaborative activity with their colleagues. Some of the key differences between the responses of the two teachers with respect to each of these are summarised below. Two forms of activity are distinguished and different representational forms are employed to report the analysis of each activity type. Practical Curricular Activity is the outward evidence of professional growth, and, as such can be expected to change incrementally. Classroom experimentation, teacher reflection, changing teacher practices and beliefs, and teacher collaborative activity can be identified with particular elements in the Interconnected Model. Whereas Curricular Activity is clearly an outcome of professional growth, these other elements can be seen as characteristics of the growth process. it is these characteristics that are discussed first.

Level of classroom experimentation

Both teachers engaged in some classroom experimentation throughout the study. In interviews, Geoff was much more likely to discuss his experimentation than was Paula. It was certainly true that Paula had a more extensive repertoire of teaching strategies at the commencement of the EMIC program, than did Geoff. Analysis of classroom observations and teaching records suggest that over the period of the study, Paula and Geoff engaged in a similar range of teaching strategies and with a similar level of frequency. This is an important point for researchers investigating professional growth. Whose professional practice is more praiseworthy: the teacher who continues to maintain a reasonably varied teaching repertoire, or the teacher who moves from a

comparatively impoverished range to one that is more extensive? It may be that the limited nature of Geoff's initial teaching repertoire made him more inclined to discuss this aspect of his classroom experimentation. Certainly the researcher gained the impression of a greater willingness to experiment from Geoff, than from Paula. Both teachers explored the use of a similar range of teaching resources. With regard to the range of assessment strategies employed, Geoff was observed (and reported) using a wider variety of assessment techniques than did Paula. The visibility of Geoff's experimentation was, in part, due to his willingness to discuss, in interviews and informal conversations, his use of new techniques.

Level of reflection

From the commencement of data collection, it appeared that Geoff was much more likely than Paula to reflect on his teaching practice or on his experience of the professional development program. Paula did not make statements that suggested she was reflecting on either the program's content or her classroom practice. These topics were only addressed in response to questions from the researcher, whereas Geoff would volunteer observations about his teaching and his use of ideas encountered through the program. An example of this occurred during Classroom Observation 2 as Geoff's students worked with concrete materials on a number of tasks related to fractions. He commented about the "great things" that they did the day before, and how he felt that they were really "looking at the sizes and comparing them" (Field Notes - Observation 2). He noted that one student who usually had difficulty staying on task when more rigid guidelines were set [as he inferred was the case with his previous mode of teaching], could actually "work on this activity all day". It appeared that these positive salient outcomes were impacting on Geoff's view of his mathematics teaching as he was involved in experimentation with strategies recommended in the EMIC program.

Changing practices and beliefs

Geoff reported change in practices and beliefs with regard to all three areas of Curricular Activity: Teaching Strategies, Resources and Assessment.

> I use groups and pairs and things like that rather than just this is how you do it, putting 30 problems up on the board and saying open your books and go for it. So a lot of it's different... just a whole lot of things to make maths more interesting. (Interview 3)

> The kids are using more concrete materials in maths now as a result of me doing that [EMIC]. Things like fraction kits and cuisenaire, and just anything that's going to be of benefit for what we're doing rather than having everything in the abstract... my starting point is different. Before I was the type of person that if I had a maths course or a couple of maths books, I'd tend to start at page one and work through. Now if I'm doing like that fractions unit, I'm more likely to go in search of maths books and text books and look through to see is there anything in these books that's relevant to what I'm doing? So now I'm looking for anything I can find that might be of help to what I'm actually doing. So I'm working in the opposite direction I think, coming from a different place. (Interview 2)

> I always thought that the way to assess children's performance in mathematics was to give them a test and whatever they got, like if it was worth 20 and they got 19 they had done really well, and if they got 10 they had done rotten, which is a very old style. Now I've realised that important things are observation, and there are so many more things to evaluation than just a score on a test. So when my kids are working in pairs or groups I spend as much time watching the children, the way they interact with one another and I tend to have a list and make comments about things that they do just for a personal record. I think that's as important as anything else that they can do. (Interview 3)

He reported that his whole approach to teaching mathematics had changed considerably since his involvement in the EMIC program.

> Well when I first spoke to you about this I was always extremely formal. My maths teaching was always really formal. Obviously I've learnt that there are better ways and more interesting ways to teach maths.
> (Interview 3)

These reports appeared to be consistent with observations made in Geoff's classroom over the period of the study. He demonstrated changes in his practice in each of the three areas of Curricular Activity.

Paula, on the other hand, whilst demonstrating some experimentation in each of the three areas of Curricular Activity in classes observed, reported change only with regard to her use of Resources.

> Using things around the room, and things around the school, more of that...
> I think I'm more aware of what's around me, and I make use of those. (Interview 3)

She also, however, reported an increase in confidence in relation to Assessment.

> I'm certainly more confident in that area [Assessment]. (Interview 3)

Level of collaborative activity

It was noteworthy that Geoff would make repeated reference in interviews and in informal conversation to his increased level of collaborative involvement with other staff.

> Well, Patricia and I, we do all our planning together, if not at school, then out of school. We're doing a totally integrated program now with whatever we're doing. We go through each particular unit of work that we're going to do and then we select the maths that's relevant to that unit. Then by discussing it and also using Cathy [EMIC Tutor] as well, then we come up with different ideas that we can use. (Interview 3)

> There's a lot of sharing here. It happens all the time. (Interview 3)

This change in Geoff's behaviour was significantly obvious for it to be reported by the Program Tutor.

> I worked very closely with Geoff... I look at him now and he's right in teaching with Patricia... and he's really holding his own... he now makes a very sound contribution school wise... (Tutor Interview)

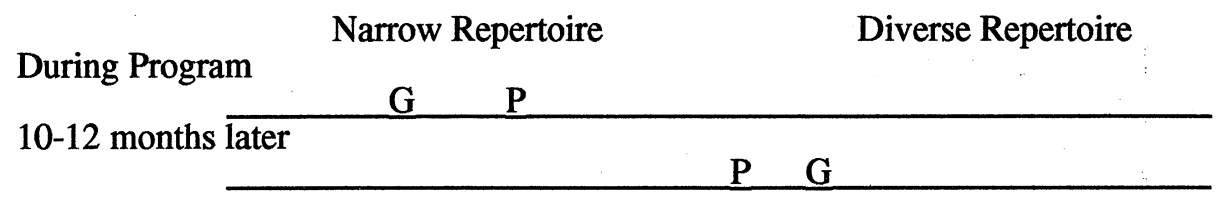
Paula mentioned the availability of assistance and support from other staff, however there are no data to suggest that she took advantage of this directly, during the course of the study.

Change Trajectories

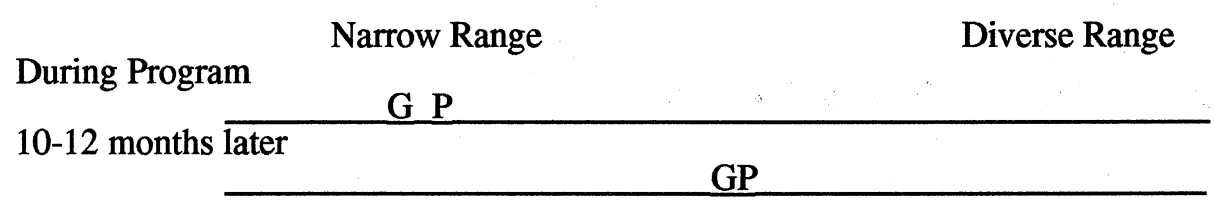
The challenge for the researcher investigating teacher professional growth is to find a suitable mechanism to describe the growth process. If we consider Curricular Activity with respect to each of the three identified components of teaching practice, we can locate a teacher's Curricular Activity on a notional scale with respect to each of Teaching Strategies, Resources and Assessment. One attempt to do this is set out

below. The Curricular Activity of both Geoff (G) and Paula (P) are located on each of the scales shown. Pairs of scales are employed in order to make clear the extent of change over the course of this study.

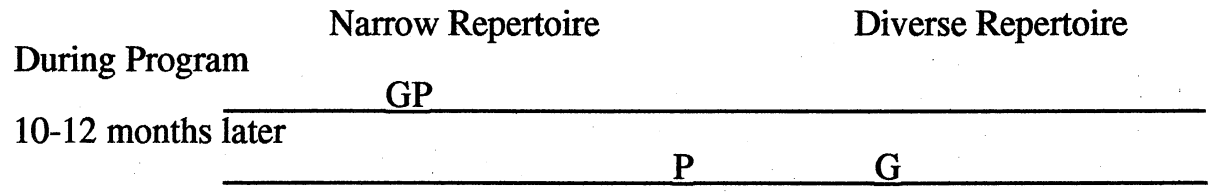
Teaching Strategies



Use of Resources



Assessment Strategies



While the scales above give some idea of the nature of professional growth for each of the teachers, the approach is one of snapshots in time, rather than conveying a sense of a change process. Since data were collected at four points over the period of the study, it is actually possible to give a more continuous picture of this process of professional growth. The metaphor of a trajectory offers an image of movement over time, and draws attention to issues like: the dimension along which change occurred; the rapidity of the change; and, the factors facilitating and inhibiting the change.

Figures 2, 3 and 4 extrapolate from the scales employed above to show graphically how each component of the teacher's Curricular Activity changed with time during the course of the study. In each Figure the solid line represents changes to Paula's Curricular Activity and the broken line represents changes to Geoff's Curricular Activity.

Discussion

As can be seen in the change trajectories presented in Figures 2, 3 and 4, Geoff appeared to experience the most significant change in each area of Curricular Activity investigated. His professional growth with regards to Teaching Strategies and Assessment was particularly rapid, whilst Paula's most significant area of change was in her Use of Resources.

A range of supporting and inhibiting factors may have impacted on the process of change for Geoff and Paula. Whilst as noted earlier they had many similarities with regards to their personal histories and work situations, each one brought to the professional development program their own needs and interests, and as would be expected each responded to the program ideas in their own way.

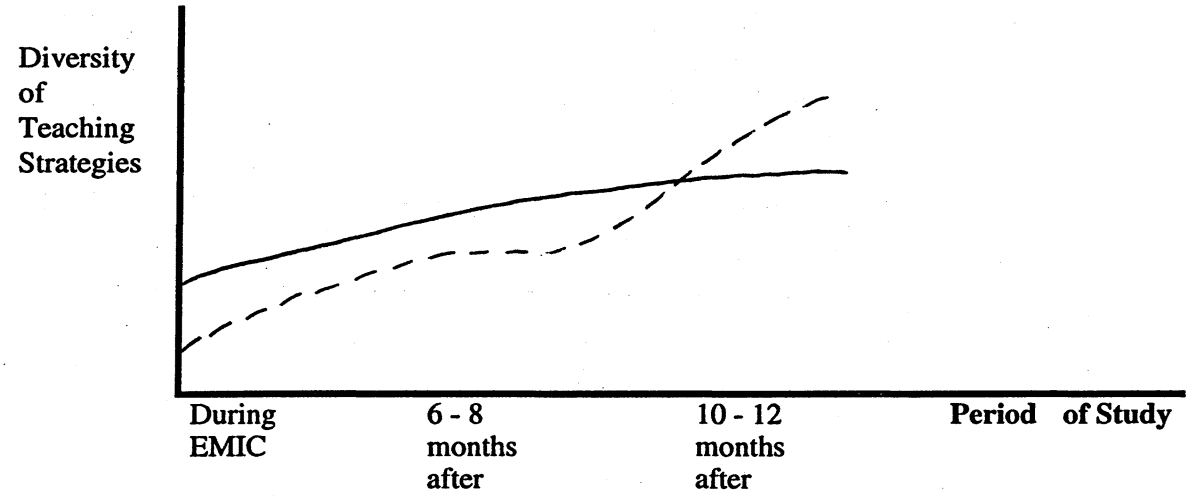


Figure 2. Changing Teaching Strategies

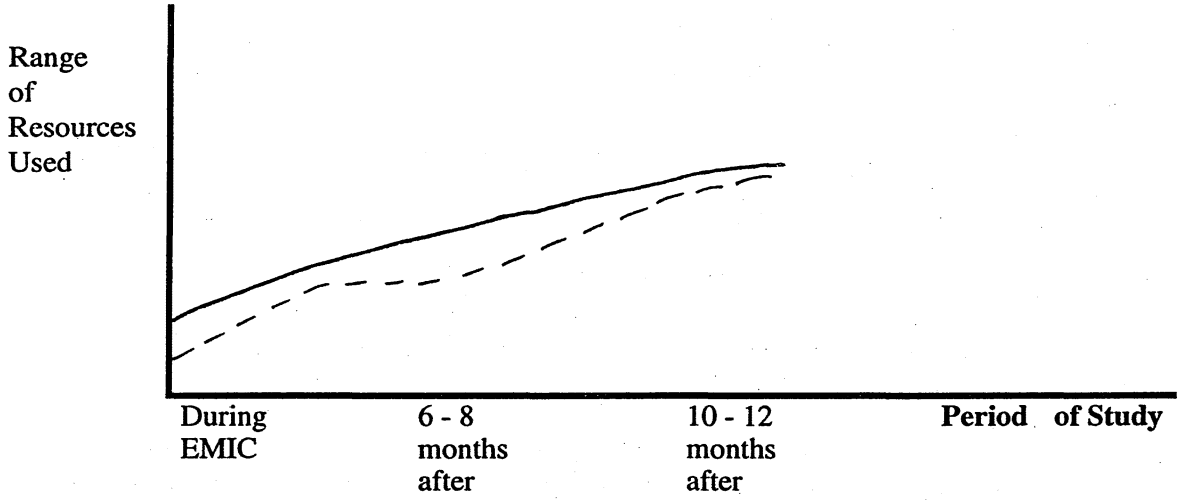


Figure 3. Changing Use of Resources

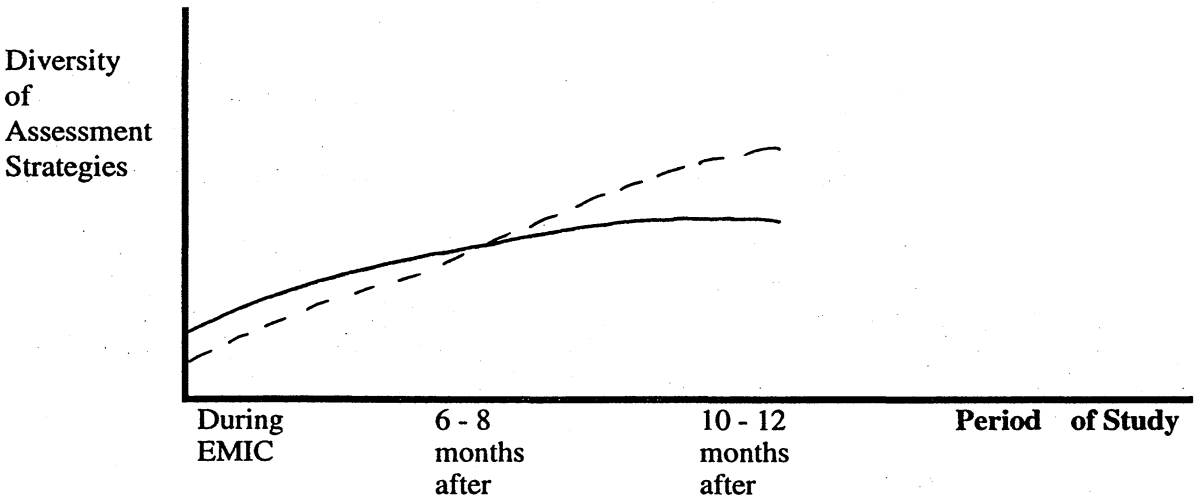


Figure 4. Changing Assessment Strategies

Factors associated with the teaching context and the professional development program context were very similar for each teacher, so it could be assumed that differences with regards to the changes in their Curricular Activity were the result of each teacher's own Personal Activity and Beliefs as they responded to the EMIC program.

For Geoff, two associated factors appeared particularly significant in supporting his professional growth throughout the study. The first was related to his motivation for involvement in the professional development activity. Whilst he was initially reluctant to participate in the program due to personal constraints such as the need to commit time to attend the program sessions, he regarded his mathematics teaching as problematic, and the EMIC program provided him with a stimulus to reconsider his mathematics teaching methods and beliefs. A further associated factor that appeared to support his professional growth in each area was his "inclination to reflect" on both the outcomes of his classroom experimentation and the content of the professional development program. As he explored new territory in his mathematics teaching, and reflected on the impact of that exploration, he became excited about the outcomes for both his students and himself, and he sought further ideas, strategies and resources to explore.

Whilst Paula was also coerced into participating in the EMIC program, she did not regard her mathematics teaching to be as problematic as Geoff did his. Paula explored many of the ideas presented in the program and reported that she considered the program useful and beneficial. However, she did not appear to reflect on her classroom explorations with the same level of detail as Geoff, or report the outcomes of her explorations with the same level of satisfaction or enthusiasm as he did. Paula appeared to regard the ideas presented in EMIC to be a useful addition to her usual mathematics teaching and learning program.

Conclusions

The teachers described here differed in key aspects of the growth process and in the specific outcomes arising from that process. Those of us who are interested in promoting teacher professional growth, need new ways to think about the process of growth, new models, and new metaphors. In this paper, I have explored the potential of the metaphor of a "change trajectory" as a tool for helping me to understand and compare the changes I observed in the Curricular Activity of two teachers. I feel that, in the case of the two teachers reported here, the change trajectories are sufficiently different to provide a useful insight into the individuality of a teacher's response to a professional development experience. Certainly I will continue to apply this method in seeking to understand differences between individual teachers' approaches to professional development. It will be interesting to see whether other researchers find value in this approach.

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