TEACHER ACTION THEORIES AND THE USE OF GROUP WORK IN UPPER PRIMARY MATHEMATICS CLASSROOMS

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Although group work is widely used by primary teachers in most Key Learning Areas, this is not always the case in mathematics. Why do teachers behave in this way? Argyris and Schon (1974) claimed that behaviour was driven by individual action theories. This study used the Theory of Planned Behaviour (Ajzen, 1988) to uncover teacher action theories with a sample of NSW upper primary teachers (N = 115). It will discuss these theories in order to assist teachers in their critical reflection of current practice.

In America there had been considerable interest in small-group instruction (Good, Grouws, & Mason, 1990; Good, Mulryan, & McCaslin, 1992). Although group work was widely used by primary teachers in most Key Learning Areas, this was not always the case in mathematics. For example, researchers reported that "for reading, the teacher will work with three (or more) groups, but in mathematics the mode is one group - all children are given the same instruction despite individual differences in ability, achievement, needs and interests" (Reys, Suydam, and Lindquist, 1984).

Why do teachers behave differently when teaching mathematics? The beliefs held by teachers concerning the use of groupwork might provide the answers. Good, Grouws, and Mason (1990) surveyed 1509 elementary school teachers and used six categories to describe grouping strategies used in teaching mathematics. Small-groups were regarded as consisting of 1 to 12 members. When asked the organisational structure used throughout the year 55% indicated whole class instruction and only "5% of the teachers indicated that they primarily used a grouping plan in which students worked cooperatively with their peers" (p. 6).

In 1994, a pilot study was conducted with a sample of 89 randomly selected NSW upper primary teachers. A phenomenographical approach (Marton, 1986) was used to analyse the results and to produce a set of descriptive categories which encapsulated the variety of conceptions held by the teachers and to indicate the differences in understanding. Group work was defined as students being divided into small groups of approx 3-6 students, to work independently and together on a task set by the teacher. The results of the study identified and described a range of teacher beliefs for using and for not using group work in an upper primary classroom. However this study was unable to indicate which of these beliefs provided the basis for teacher intentions or behaviour.

While some research efforts had described consistencies between beliefs and classroom actions (Peterson, Fennema, Carpenter, & Loef, 1989), others had described inconsistencies between the two (Thompson, 1992). It was claimed that the link between beliefs and behaviour was a complex mix of intentions, attitudes, social influences, evaluations and motivations (Ajzen & Fishbein, 1980). Argyris and Schon (1974) claimed that behaviour was driven by individual action theories. They identified and described espoused theories and theories-in-use and expected that individuals would not design and implement a theory-in-use which was significantly different from their espoused theory. What they discovered was quite the opposite. Not only were there significant differences between the two types of theories but "individuals develop designs to keep them unaware of the mismatch" (Argyris, 1993, p. 51). Thus, change could not occur until these theories were uncovered and made available for examination and reflection. This current study sought to uncover

the microtheories behind teacher classroom behaviour by applying the constructs and instruments of the model titled the Theory of Planned Behaviour (TPB) to the specific teaching behaviour of group work. The results were called teacher action theories to distinguish them from Argyris and Schon's work.

THEORETICAL ISSUES

The Theory of Planned Behaviour (TPB; Ajzen, 1985, 1987, 1988) is an extension of the Theory of Reasoned Action (TRA; Ajzen & Fishbein, 1980). Both have been very successful in using a small number of beliefs to predict behaviour across a wide range of contexts and both come from an objectivist (positivist) stance. This stance has been the target of a great deal of criticism (see for example Lather, 1991) and it is beyond the scope of this paper to address this criticism.

According to TRA the immediate determinant of behaviour is intention and two major factors determine a teacher's behavioural intention: a personal or attitudinal component; and a social or normative component. The attitudinal component measures the teacher's attitude towards performing the behaviour and "is simply a person's general feeling of favorableness or unfavorableness for that concept" (Ajzen & Fishbein, 1980, p. 54). The second or normative component of the theory deals with the influence of the social environment upon intention and behaviour. This is a measure of the teacher's perception of whether most important people support or don't support the performance of the behaviour. This implies that a teacher will usually intend to perform a behaviour that is positively evaluated and has the support of significant others. If TRA was to stop at this point we would have very little information to assist our understanding of behaviour. However, both components can be investigated further. Attitude towards a behaviour is determined by the product of the teacher's beliefs about performing the action and the evaluation of the outcomes of the action. Subjective norm is determined by the product of the teacher's beliefs of social expectations to perform the behaviour and the motivation to comply with these expectations. In the final analysis then, TRA attempts to explain a teacher's behaviour in terms of beliefs which represent the information (be it correct or incorrect) that the teacher has about their situation. Successful predictions of behaviour using TRA have been done of such diverse areas as voting behaviour (Fishbein, Ajzen & Hinkle, 1980), family planning (Fishbein, Jaccard, Davidson, Ajzen & Loken, 1980), consumer behaviour (Ajzen & Fishbein, 1980), and seatbelt use (Budd, North, & Spencer, 1984).

TPB expanded TRA in order to include the construct of perceived behavioural control (PBC). Ajzen (1988) proposed that it would be important as a determinant of intention when the individual had previous knowledge or experience of the behaviour in question. In this study it is probable that teachers would have had knowledge or experience of the behaviour included in the questionnaire. Other researchers have had similiar views such as Budd, North, and Spencer (1984) and Wittenbraker, Gibbs, and Kahle (1983) who included past behaviour as a determinant of behavioural intention when using TRA. Fewer studies have been published using TPB, however Schifter and Ajzen (1985) studied perceived control and weight loss and Ajzen and Madden (1986) used the theory to predict undergraduates' course performance. Parker, Manstead, Stadling, Reason and Baxter (1992) made an assessment of the ability of TPB to account for the intentions of drivers to commit driving violations and concluded that "the addition of perceived behavioral control led to significant increments in the amount of explained variance of intentions, thereby supporting the theory" (p. 94). For the purposes of this paper, only the salient beliefs used in regard to the constructs of attitude, subjective norm and perceived behavioural control which form the teacher action theory will be examined and reported.

METHOD

TPB requires behaviour to be carefully defined. This was done by means of the scenario below which was taken from the phenomenographical pilot study as it produced a high level of agreement among teachers.

> *Scenario*: You are teaching mathematics to your class at the usual time and place. You consider a range of options before using group work. (In this study, group work refers to students being divided into small groups of approx 3-6 students, to work individually and together on a task set by the teacher).

A questionnaire was constructed according to TPB and consists of 28 semantic differential scales and was applied to a sample chosen randomly from across the population of primary teachers who worked at a NSW Department of School Education primary school and who taught mathematics to years 5 and/or 6. A total of 119 teachers returned the questionnaire and the data were entered into a spreadsheet and the software program Statview 4.0 was used to analyse the data. A decision was made not to include four returns because of the amount of missing data.

The questionnaire asked teachers to imagine behaving in the manner described by the scenario and to rate their response on each of the 28 scales. There was one scale for the direct measure of intention to perform the behaviour (endpoints likely/unlikely) and three for a direct measure of attitude (endpoints good/bad, beneficial/harmful, wise/foolish) which were later combined into a single index (Direct attitude index - DAI). A belief-based attitudinal index (BBAI) was also calculated. The behavioural beliefs were selected from across the continuum developed in the pilot study and are listed below.

Table 1

Teacher Beliefs about Using Group Work

My decision to use group work:

1. would place too great a demand upon resources, space and equipment.
2. would increase the efficient organisation of resources and space.
3. wouldn't cater for all individual needs.
4. would allow more capable children to help the less able children.
5. would result in pupils not working well together as they lacked the necessary social skills.
6. would allow students to work together, bouncing ideas off each other and being exposed to each others' view.

According to the model TPB, the strength of the belief was measured on a bipolar 7 point scale (endpoints likely/unlikely) with a score of 3 signifying a strong positive belief strength and -3 signifying the opposite. The evaluation outcome was also measured on a similar scale (endpoints good/bad) giving a product score range of 9 to -9. The BBAI was constructed using the summed products of the six beliefs and the resultant scores ranged from 54 which indicated a very positive attitude towards the behaviour in question to a score of -54 which indicated the opposite (refer to Table 2).

There was one scale to measure teacher perceptions of the overall influence of important others and a corresponding scale to measure teacher willingness to comply with this influence. According to the model TPB, the product of these two scales produced one direct measure of subjective norm (SND). A belief-based index of subjective norm (SNB) was similarly obtained by summing the products of each of four normative beliefs about salient referents (Principal/supervisor, Parents, Students, Other Teachers) with their corresponding motivations to comply. To complete the TPB model there were two scales (endpoints of full-control/no-control, easy/difficult) to measure perceived behavioural control and these were combined to give one index (PBC). Finally there were four questions

which gathered information on the teacher's sex, teaching experience in years, approximate age, and year level now taught.

RESULTS

The demographic results of the sample if summarised using modal characteristics indicated that the teacher was likely to be female; aged between 36 and 45; with 11 to 15 years teaching experience; and with a class of only year 6 students. The descriptive statistics of the constructs of TPB listed in Table 2 show that the majority of teachers intended to use group work within the clasroom.

Table 2
Constructs of the Theory of Planned Behaviour: Mean Values and Standard Deviations

	Mean	Standard deviation
Attitude toward behaviour		
Direct. DAI	5.95	2.34
Belief product. BBAI	10.19	9.2
Subjective norm.		
Direct. SND	0.63	2.98
Belief product. SNB	3.91	7.01
Control belief. PBC	3.66	1.74
Behavioural intention	1.78	1.18

Note: The table contains both the direct measures and the summed product measures of attitude and subjective norm. For attitudes the direct measure range is -9 to 9 and the product measure is -54 to 54. The subjective norm direct measure range is -3 to 3 and the product measure range is -36 to 36. The behavioural intention range is -3 to 3. The control belief range is -6 to 6.

The teacher action theory for group work is illustrated pictorially in Figure 1 which shows the correlations between the components of the TPB model. These correlations were mostly positive with a moderate linear association between intention and DAI ($r = 0.52$). There was a very weak association with SND ($r = 0.01$) and a slightly moderate one with PBCI ($r = 0.45$). The correlation results involving the belief based measures show a moderately strong linear relationship between SNB and SND ($r = 0.61$) and a very weak one between BBAI and DAI ($r = 0.27$). Of interest, but not included in the diagram is the moderate linear relationship between the control belief ($r = 0.48$) and PBCI and the very strong one between the self-efficacy belief and PBCI ($r = 0.95$).

Multiple regression analysis of the full sample ($N=115$) revealed that taken together, attitudes, subjective norm and PBCI accounted for 35.1% (adj R^2) of the variance in intention to use group work in the classroom. The partial standardised regression coefficients show a moderate influence between intention and DAI ($\beta = 0.43, p < 0.0001$), a slightly moderate influence by PBCI ($\beta = 0.33, p < 0.0001$) and a very weak non-significant influence by SND ($\beta = 0.03, p = 0.6938$).

Attitude was the strongest contributor to intentions for the teacher action theories. In an examination of both components of attitude the high intent group revealed that they believed that it was:

(a) unlikely that group work would place too great a demand upon resources, space and equipment, and if it did then it was a very bad outcome;

(b) quite likely that group work would increase the efficient organisation of resources and space and this was a slightly good outcome;

(c) slightly unlikely that group work wouldn't cater for all individual needs, and if it didn't cater for these needs then this was a very good outcome;

(d)   likely that group work would allow more capable children to help the less able children and this was a very good outcome;

(e)   slightly unlikely that groupwork would result in the pupils not working well together because they lacked the necessary social skills and if it did produce discord then it was neither a good nor bad outcome;

(f)   very likely that group work would allow students to work together, bouncing ideas off each other and being exposed to each others views and this was an extremely good outcome.

The influence of subjective norm upon intentions wasn't strong. However, the high intent group believed they received support from all four significant referents and felt encouraged to use group work. They believed that they had full control over the behaviour and that it was a very easy behaviour to perform.

Not surprisingly the teacher action theory of those not intending to use group work was quite different. The components of attitude for the low intent group revealed they believed that it was:

(a)   likely that group work would place too great a demand upon resources, space and equipment and this was an very bad outcome;

(b)   slightly unlikely that group work would increase the efficient organisation of resources and space and this was a bad outcome;

(c)   likely that group work wouldn't cater for all individual needs and this was a very good outcome;

(d)   likely that group work would allow more capable children to help the less able children and this was a good outcome;

(e)   likely that groupwork would result in the pupils not working well together as they lacked the necessary social skills and this was a bad outcome;

(f)   likely that group workwould allow students to work together, bouncing ideas off each other and being exposed to each others views and this was a very good outcome.

Figure 1

Basic Model for Teacher Action Theory: Relations among beliefs, attitude, subjective norm, control and intention
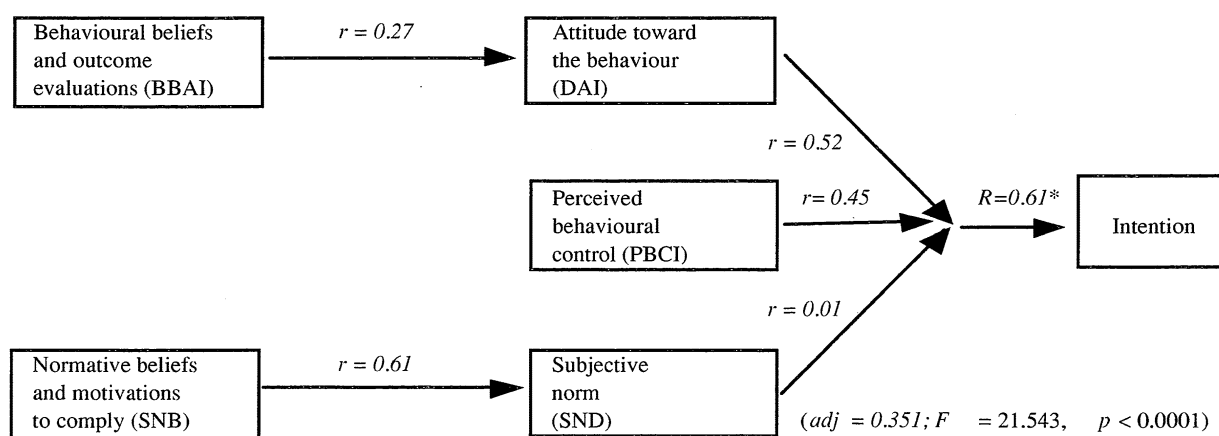
(Note: N = 115; *= p<0.0001)

The social environmental influence revealed that the low intent group believed they received a slight discouragement from the Principal, Students and Parents, and only very slight encouragement from the Other Teachers. While they believed that they had full control over the behaviour they indicated they felt that it was very difficult to carry out. Thus this group of teachers believed that group work although providing opportunities for collaborative learning and peer tutoring, wasn't worth the effort. It was too demanding of time and resources, didn't cater for all students, and was difficult when the students lacked the necessary social skills. This teacher action theory lends itself to speculation concerning its formation. One possibility is that the teachers lack the necessary skills to organise and conduct group work lessons. Either through poor preparation or by not developing the necessary social skills within their students, attempts at group work had failed. Failures in classroom teaching quickly attract attention which may reinforce the perception of the social environment discouraging the use of group work. Only other teachers would fully understand the pressures and be supportive of further attempts.

DISCUSSION

How can this information be used to inform current teaching practice? When considering the various teacher action theories it becomes apparent that some teachers have beliefs that are contrary to the spirit of the mandatory syllabus documents. The task of encouraging teachers to alter their beliefs to mesh with the goals of the K-6 Mathematics Syllabus (NSW Department of Education, 1989) and more recent documents is a challenge for all teacher educators as well as educational leaders and administrators. The stated aim of this paper was to contribute to the understanding of teacher classroom behaviour via teacher action theories and not behaviour change. Yet the results of such reflection may well involve behaviour change.

Stephens, Lovitt, Clarke and Romberg (1989, pp. 223-4) examined recent reform movements in the teaching of mathematics and extracted four principles they claimed were the basis of successful change. The four principles for introducing a new program were:

(i)   Any new program must convey to teachers, in practical terms, a clear image of what the changes might mean in the classroom;

(ii)   Impediments to change must be addressed;

(iii)   Exemplary curriculum materials must be provided; and

(iv)   Access to a well-structured environment must be provided for professional growth.

However, Siemon (1989, p.252) disagreed and questioned whether the four point plan would be enough. She claimed that it was predicated on the belief that if the majority of teachers expanded their repertoire of how to teach mathematics more effectively, then a much better state of affairs would come to exist. However there was no guarantee of change. Instead she argued change should follow the 'constructivist view' of learning. It must make sense to those who have to implement it and so must recognise the implementers as learners in their own right. This means that the implementers' theories need to be recognised, understood and challenged in order to facilitate effective and meaningful change. "Until these underlying beliefs, attitudes and knowledge bases are meaningfully challenged, the change effort is in real danger of becoming yet another 'bandwagon'" (p. 254). This study agrees with Siemon claiming that teacher action theories can provide a vehicle for assisting a process of reflection and change. Others such as Thompson (1992) also agree with Siemon.

The authors of TRA and TPB felt that by understanding why teachers perform as they do it would contribute to identifying possible aids and obstructions to change (Ajzen &

Fishbein, 1980). Content was regarded as the most important factor influencing the effectiveness of any communication intended to result in change. However, this content was special because it had to address the primary beliefs that determined the target variable to be changed. Studies that ignored content when examining other presentation variables such as credibility, self esteem, distraction, and others were regarded as being flawed. Thus any manipulations of source, message, or receiver factors may influence the effectiveness of a persuasive communication only to the extent that they affect the message's direct or indirect effects upon the primary beliefs. Thus the limits to the amount of change in the primary beliefs of the target variable were dependent upon the content of the message, and the other variables work within the limits. Teacher action theories clearly identify the beliefs associated with a particular behaviour. The success of both TRA and TPB in predicting behaviour across a wide range of contexts is dependant upon the models ability at tracing the influence of a small selection of salient beliefs upon intention and behaviour.

Argyris and Schön (1974) were also interested in research aimed at putting theory into practice. When applying their research to how people learn, they used the terms 'single loop' and 'double loop' learning to make a crucial distinction. They provide a simple analogy to explain the distinction: "a thermostat that automatically turns on the heat whenever the temperature in a room drops below 68 degrees is a good example of single loop learning. A thermostat that could ask, 'Why am I set at 68 degrees?' and then explore whether or not some other temperature might more economically achieve the goal of heating the room would be engaging in double-loop learning" (Argyris, 1991, p. 100).

Argyris and Schön claimed that a single learning loop was commonly used by professional practitioners, which would also include teachers. However single loop learning was found to have problems concerning the effectiveness of those who used it and its influence upon the individual's ability to learn about their own behaviour. In fact, they claimed that single loop learning worked against effective and productive change because associated with single loop learning were a number of strategies to overcome or hide feelings of embarrassment and threat. This was true for both individuals and groups. Thus "whenever undiscussibles exist, their existence is also undiscussible... These cover-ups, and their cover-up, are indications of organisational *defensive routines* , which may be defined as any policy or practice that prevents organizations (and their agents) from experiencing embarrassment or threat *and* at the same time prevent them from identifying and reducing the causes of embarrassment or threat" (Argyris,1993, p.621).

Single loop learning helps to explain how professionals avoid learning. It also indicates how defensive reasoning blocks learning despite a high individual commitment to learn. Argyris and Schön proposed that effective change needed a double learning loop and they offered a method to assist the transition from a single loop to a double learning loop model. They claimed their method presents a theory of action to enhance human activity, responsibility, learning, effectiveness and self actualization. They argued that people can be taught to recognise the reasoning they use in designing and implementing certain behaviour. They proposed to help subjects identify the inconsistencies between their espoused and actual theories of action. Their method has been successfully adapted to helping successful people learn more effectively (Argyris,1991), and promoting effective organisational change (Argyris,1993). This current study differs from their approach in that it uses the TPB to model the teacher action theories. Whereas, their approach relied upon the researcher to uncover the theory-in-use through the use of observation.

CONCLUSION

In helping current and future teachers work towards practices that are consistent with the wider goals of the educational system, teacher action theories could play an important

part. Teachers are exposed to many factors that influence their classroom practice. Teachers would benefit from a self-examination of the relationships between their beliefs, attitudes, intentions and behaviours. Teacher action theories provide a framework for understanding and discussing teacher behaviour. Early and continued reflection of teacher action theories and practice in both preservice and inservice programs may provide a further strategy in the process of improving the quality of teacher classroom practice in the teaching of mathematics.

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