

THE TENSION BETWEEN TEACHER BELIEFS AND TEACHER PRACTICE: THE IMPACT OF THE WORK SETTING

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This paper presents part of an ongoing project on teachers' beliefs and practices in state schools and in privately owned exam preparation schools in Turkey. Extracts from an interview with a teacher who uses a technique that he disapproves of will be reported and discussed. The paper considers how the teacher reconciles his practices with his beliefs, drawing on both social psychology and socio-cultural perspectives.

INTRODUCTION

Research on teacher beliefs and goals is common in educational research, as is research on teacher practice, but pursuing the relationship between them has only recently been considered as an important issue of mathematics education. It has been established that teachers' beliefs about mathematics, teaching and learning have a significant influence on their instructional practices (Calderhead, 1996). In some cases, research has found that teachers' beliefs about mathematics, teaching and learning are consistent with classroom practice (Thompson, 1985). However, Thompson (1984) and Raymond (1997) have documented inconsistencies between professed beliefs and observed practices, with an implication that the teachers were unaware of a conflict between them. The assumption is usually that awareness of a difference between beliefs and practice would result in some attempt to change (Lerman, 2002). This paper reports a situation in which there is a tension between a teacher's beliefs¹ about how mathematics should be taught and his own classroom practice, and yet, despite showing an awareness of the conflict, the teacher is not trying to change.

THE RESEARCH

In this paper, we present a part of an ongoing project to investigate some teachers' beliefs about teaching and learning and their actual practices, in two different contexts in the Turkish education system for 17-18 year olds. Students of this age in Turkey are taught mathematics in two places. They attend state schools (SS), but at

¹ Beliefs have been regarded as a "messy construct" (Pajares, 1992) - difficult to define as well as to elicit. We will therefore make use of Schoenfeld's (1998) concept of "professed beliefs" throughout the paper, so that whenever we refer to 'beliefs' this should be understood to mean professed beliefs, with no guarantee that they reflect genuine beliefs.

weekends or in the evenings most of them also attend courses in privately owned schools (PC). The main objective of such private school courses is to prepare students for the university entrance examination (UEE), which is made up of multiple-choice questions. Private courses, rather than state schools, are the institutions where teaching for the multiple-choice tests is practiced. As one teacher put it [translated from the Turkish]:

“The aim of mathematics teaching [in PC] is not to teach mathematics basically, but to prepare students for the examination they will take – to make them able to answer the questions that they will face in the examination in the most practical and easiest way. Our aim is not teaching mathematics deeply and with its theory. As an educator in private courses, our aim is to prepare them for the examination in a practical manner.”

Teachers from each kind of institution (SS and PC) were interviewed using the hierarchical focusing technique (Tomlinson, 1989) and their lessons video recorded. The research reveals a widespread contrast in PC teachers between their beliefs about mathematics teaching, as expressed in interview, and their observed practices.

In this paper we will draw on the data obtained from a single PC teacher, a mathematics teacher with eleven years of experience of teaching in different PC. He has been chosen as the case study for this paper, because not only is he aware of the discrepancy between his beliefs and his practice, he is able to reconcile the two.

FINDINGS AND DISCUSSION

Extracts from the interview with the teacher are presented below. In the first, the teacher talks about a special problem solving method for multiple-choice questions, called ‘numerical value technique’ (NVT). Prior to the presentation of the actual transcript, we will clarify what is meant by NVT. Here is a typical UEE question:

For given $x < 3$ and $f(x) = x^2 - 6x - 2$ what is $f^{-1}(x)$?

$$a) 3 - \sqrt{x+11} \quad b) 3 + \sqrt{x+14} \quad a) 2 - \sqrt{x+14} \quad a) 2 - \sqrt{x+11}$$

The essence of NVT lies in assigning a simple numerical value [like 0, 1 or 2] to each of the variables given in the root problem [lets say $x = 2$] and calculating the result with these values [$f(2) = -10$]. Then, the output values are assigned to the variables in each of the options and calculated. Since the options represent the inverse function, then for $x = -10$ we must get the result of 2. Only option (a) gives 2, so the correct choice is (a). If more than one option gives the required value, different numbers are given to the variables in the root expression, and the options are re-tested.

NVT enables students to solve problems in a very short time and usually without any recourse to the theoretical knowledge supposedly required by the question. The classroom observations as well as researcher’s interactions with several PC teachers suggest that this method is commonly practised in PC as a method to reach the

correct answer in a relatively easy way. As far as we are aware it is not used in SS. In the following excerpt the teacher describes his attitude to the use of this technique.

- 1 **I:** What do you think about using numerical values to solve problems?
- 2 **T:** Yes, this is a part our system. In terms of university preparation, preparation for
3 university entrance examinations, this is part of our system...Using numerical
4 values is of interest to them and they like it very much. 'Let's assign 1 to the
5 value of 'a', and after that, lets give the options, lets put 1 for wherever you see
6 'a', what a simple thing, isn't it!' This is a part of our system, I mean, as a
7 private course it is a part of us, we make use of it.
- 8 **I:** Do you mean it is one of the indispensables of private courses?
- 9 **T:** To me², look, sometimes you may not be able to remember the solution of a
10 problem. Because the student may become nervous during the examination s/he
11 may not be able to do things s/he can do normally. But if you approach them
12 like 'you can solve it using numerical values' s/he can make use of a second
13 method and s/he can possibly solve the problem in a practical manner with ease
- 14 **I:** Do you think it is a healthy method in terms of mathematics?
- 15 **T:** In terms of mathematics teaching it is not a healthy method. Because it keeps
16 students away from formulas, it keeps them away from definitions. I mean
17 without understanding the definition, without understanding the formulas, they
18 want to solve problems. That's not healthy in terms of mathematics education.

Although NVT is taught efficiently and effectively, at the same time the teacher states that he regards NVT as not a healthy way to teach mathematics (lines 15-18). From his point of view, it keeps students "away from" a theoretical understanding of mathematics, a clear indication of disapproval of the technique that he teaches. It could be argued that the teacher's disapproval is not particularly deep-seated, and was perhaps a product of the question and the interview context rather than his true belief. This has to be acknowledged as a possibility, which the reader can consider by examining the excerpts given. However, the totality of the interaction with the teacher strongly suggests that the teacher did care about the issue. In the following excerpt, the teacher shows his disapproval in terms of the consequences of the context in which the teaching and learning takes place.

- 19 **I:** I came across situations where a student brings a problem to the teacher and
20 asks questions like 'What should we do for this type of problem?' Do you
21 think this mechanises mathematics? I mean, does what is taught in private
22 courses mechanise mathematics?
- 23 **T:** Of course. I mean, whether we like it or not, we do it. There are some
24 [question] forms and these forms should be learned. The aim here is to bring
25 the students to such a level that they can solve these forms. Whether we like it
26 or not, we have to mechanise a bit.

²Considering the original interview recording, there is an unuttered but definite 'yes' at this point.

There is, it seems to us, a clear tension between beliefs and practice within his words, as well as the influence of the work setting, as shown by the expressions ‘whether we like it or not’ (lines 23; 25-26) and ‘we have to’ (line 26).

One of the crucial points in understanding this teacher, from our perspective, is that he is aware of the tension. If the teacher was unaware of the tension, as in the case reported by Raymond (1997), then one would not expect him to attempt to address it. Yet despite his awareness, he did not seem to be uneasy about the conflict.

27 **I:** Is it [NVT] characteristic of mathematics in private courses?

28 **T:** Whether one likes it or not because the characteristic of the University entrance
29 examination is to deal with the practical side of mathematics³. In the exam it is
30 not important the way you solve the problem, it is not important how the
31 student solves the problem.

32 **I:** Let’s ignore state school mathematics or private course mathematics.
33 Considering using numerical value to solve the problem, do you think it is an
34 ideal way to teach mathematics?

35 **T:** It is not healthy. In my opinion, solving a problem using numerical value is
36 only going for an easy⁴ ride. But it perfectly fits with the private course
37 approach. It attracts students’ attention. Students like it because students’ aim
38 is solving the problem in any possible way, but it is not an ideal way to teach
39 mathematics. From my perspective, it is going for the easy way, a kind of
40 escape to an easy way.

Again the tension is prominent in lines 28, 35-36, and 38-40. The teacher does not feel comfortable with NVT. He claims that it is ‘going for an easy ride’ and it is not an ideal way to teach mathematics. However, he says ‘But it perfectly fits with the private course approach’, bringing his work setting into perspective.

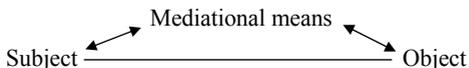
A description of this situation in socio-cultural terms can help to explain how this is possible. In the last few decades there has been a considerable shift in educational research from purely cognitive approaches to socio-cultural or cultural-historical studies in which the setting is considered as an important parameter to take into account. This change can be seen not only in educational research but also in the research of other social sciences (e.g. Chaiklin and Lave, 1993). Derived from writings of Vygotsky and his followers, the socio-cultural approach is based on the claim that “human action typically employs ‘mediational means’ such as tools and

³ Here the term ‘practical’ refers to solving problems in a shortest time and quickest way without dealing with any theoretical aspect of the problem at all.

⁴ The Turkish word ‘kolay’ is translated as ‘easy’ but this does not exactly correspond to the its meaning. The reader should take into account that ‘kolay’ clearly connotes disapproval in this context.

language, and that these mediational means shape the action in essential ways” (Wertsch, 1991, page 12). A “mediational means” stands between a subject (a person) and an object (a goal or purpose) as the practical way through which the object is achieved (see Figure 1).

Figure 1: an action triad

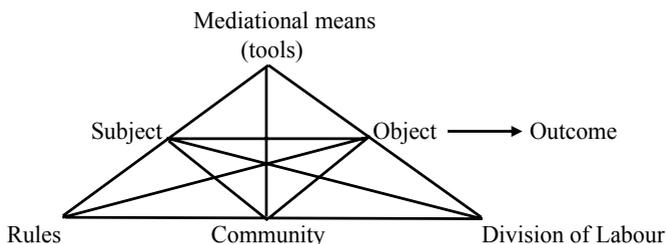


When a tool or other mediational means has been used frequently in a particular setting, the subject’s actions are mediated by it, and the subject begins to “appropriate” the tool – that is to make it his / her own (Wertsch, 1998). Appropriation refers to the process through which a person becomes sufficiently familiar with a mediational means / tool that he or she is able to use it purposefully and flexibly in particular social environments (Grossman et al., 1999). The tools a person adopts and uses fundamentally affect his or her practice.

In the PC context the teacher’s goal (object) is to make the students, as he puts it, “able to answer the questions that they will face in the examination”. NVT is a ‘mediational mean’, or tool, towards the object of examination success. Furthermore, for this teacher (the subject), the technique has been ‘appropriated’, as suggested by lines 2-7, and this has been observed to have affected his practice fundamentally.

The importance of the work setting in a socio-cultural analysis is in putting the goal or purpose into a broader context. If the teacher did not work in a private school, it is likely he would have a different ‘object’, and would probably use different mediational means to attain it, since as Nikiforov (1990) observes, the goal constrains the options for action. The work setting is crucial to the conflict between the teacher’s beliefs and his actions. In the activity theory of Engeström (1993, 1999), the ‘triad’ above is extended to include elements of the social context (see Figure 2).

Figure 2: an activity system



In the activity system of the PC work setting, NVT is regarded as a ‘mediational mean’ towards the goal of the activity partly because, as classroom observations suggest, it is a common technique used by PC teachers towards a shared goal (the

outcome) of the PC community. The activity of the preparation of students for the examination in PC is therefore mediated by NVT. The expression ‘as a private course it is a part of us’ (lines 6,7) gives a clear signal of this. The teacher considered NVT to be indispensable for teaching in PC. One way of thinking of the teacher’s use of a technique that he disapproves of is that his goal-in-context has such an influence on him that he feels an obligation to use the generally deployed means to achieve it.

Socio-cultural theorists commonly refer to the ‘tensions’ or ‘contradictions’ in and between the components of an activity system as triggers for change (Engeström, 1993, 1999). Yet the tension between the beliefs and practice of this teacher do not seem to be bringing any pressure for change – any attempt, for example, to give up NVT or to make it more educative. In that respect, the socio-cultural perspective does not seem to have “action” to analyse. So, despite the invocations of Wertsch (1998) to “live in the middle” between the ‘reducing’ perspectives of psychology (when it considers the social context only in relation to its impact on the individual) and sociology (when it considers individuals only in relation to their impact on the social) it seems necessary to look to social psychology for an explanation of why the teacher’s inner cognitive conflict is not a motivation to change.

According to Eagly and Chaiken (1993), the dissonance theory of Festinger (1957) is the most widely accepted account of cognitive sources of motivation for change. This approach is based on the principle that disharmony among cognitive “elements” (people’s mental representations of their beliefs, attitudes, and attitudinally significant behaviours, decisions and commitments) motivates cognitive changes designed to restore harmony. Festinger (1957) suggests four such changes, which are presented here in a form pertinent to the present case:

1. The teacher avoids thinking about the elements that conflict (specifically his belief that NVT is harmful), and so experiences disharmony only transiently;
2. The teacher tries to change his practice (e.g. stops using NVT);
3. The teacher changes his beliefs (e.g. comes to consider NVT less harmful);
4. The teacher incorporates into his thinking additional “consonant elements” which effectively ‘water down’ the tension between his beliefs and his practice, and thereby reduce the motivation to change.

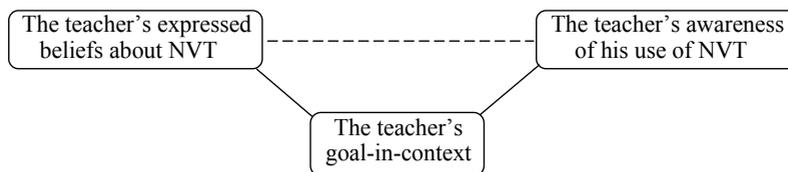
The fourth of these seems to fit the current case. In Festinger’s (1957) analysis the use of NVT by a principled teacher might be seen as an example of “forced compliance”, which as his practical studies show, can be lived with on the basis of financial reward. The teacher has chosen to work for the private school, where the pay is good and the status is high, and accepts the consequences of doing so. However, this may be an example of focusing too much on the subject in isolation (Wertsch, 1998) and it does not adequately explain the teacher’s ‘appropriation’ of NVT, which is beyond mere compliance. A socio-cultural perspective would suggest that the additional “consonant elements” pertinent to the motivation of the teacher are

provided by his participation in the “activity” of PC. The shared goals and collective action seem to be sufficient to dissipate the motivational effects of tension between beliefs and practice. This is evidenced by the mode of speaking of the teacher when referring to his disapproval of the action he takes, in that he makes statements of facts (how it is) rather than expressing values (how it should be). In Wagner’s (1987) terms, he uses the indicative mode, rather than the imperative mode.

CONCLUSION

The research presented in this paper highlights the significance and fundamental effects of ‘mediational means’. As observed throughout the teacher’s classroom activities and in the interview, his practice has been ‘mediated’ by the numerical value technique. Yet the teacher’s beliefs about NVT were negative. This had the potential to create a tension that might have motivated change, but did not. Careful consideration of the excerpts from interview has suggested that the teacher reduced the possible conflict by referring to the work context and, in particular, his goal as a teacher in that setting. Using Festinger’s (1957) vocabulary, he added a new “consonant element” to his thinking to avoid the conflict. Figure 3 schematises this situation, where the dotted line indicates the potential tension / conflict.

Figure 3: A representation of the teacher’s inner conflict.



The study also documented that teachers’ goals, in particular when they are ‘imposed’ upon teachers (from the teachers’ participation in an activity system) are of such importance that it can lead to classroom practices that conflict with their beliefs. Although it is generally felt that “Beliefs have a strong shaping effect on behavior” (Schoenfeld, 1998, page 19), teachers’ beliefs about how mathematics should be taught can be overwhelmed by the goals in particular settings. In other words, goals can drive actions more than beliefs do.

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