

Mathematics Teachers: A Study of Life Inside School and Beyond

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The shortage of skilled teachers has once again intensified investigations into the nature and scope of teachers' work. In this paper, findings are reported from a recently conducted pilot study in which the daily lives – in and out of working hours – of secondary school mathematics teachers were tracked. Data collection focused on the activities undertaken, their contexts, and the participants' associated affective reactions to them. The efficacy of a key instrument used for data collection, the Experience Sampling Method, and its feasibility for use in a larger scale project, are also examined.

Articles drawing attention to the shortage of skilled teachers and to the stress and exhaustion experienced by teachers regularly appear in the popular print media (e.g., Cleveland, 2003; Dowling, 2004; Stewart, 2003). Typically highlighted are: the vast range of teaching and non-teaching tasks that comprise teachers' daily work, and the many complex educational, psychosocial and cultural, as well as emotional issues with which teachers have to contend on a daily basis. More formal investigations covering job satisfaction, professional standards for teaching practice – generally and with respect to mathematics teaching – and to conditions of employment (e.g., Committee for the Review of Teaching and Teacher Education, 2003; Goodrum, Hackling & Rennie, 2001; Sinscalco, 2002), testify to widespread concerns about teachers and teaching.

Interest in defining and understanding teachers' work has sparked considerable research activity (Australian College of Education; 2001; Campbell & Neill, 1994; Drago et al., 1999; Goodrum et al., 2001; Harvey & Spinney, 2000; Smaller, Hart, Clark & Livingstone, 2001). Issues examined have ranged from the most general question of the number of weekly hours teachers work, to more detailed analyses of time spent each day or week on various broadly defined types of activities (e.g., face-to-face teaching, administration, professional development), to very detailed investigations of teachers' use of time, sometimes including an analysis of their attitudes towards these activities (often focussing on stress levels).

Different instruments have been used to describe teachers' lives. Whether the diversity of approaches yielded consistent findings was examined by Drago et al. (1999) who used six different measures of work to analyse data:

Contractual working time – measured by analysis of collective bargaining agreements for teachers; this was compared with actual working time discovered through the time-diary study;

Standard diary approach – work carried out for the employer at the workplace and at home, excluding leisure time at work, but including commuting to work;

Face time – the amount of time the respondent is physically present in the workplace;

Work invasiveness – the amount of personal and family time invaded by work activities; can occur at any time for professionals such as teachers – may include a discussion of problems at work at the dinner table, a phone call or emails at home etc; may capture aspects of work time which, for various reasons, are understated or not detected by the standard diary approach;

Housework time – household chores. (This category is often ignored by those insensitive to gender linked roles.)

Total working time – includes both housework and work for an employer.

The analysis of data using these different measures revealed that “the choice of method [chosen to measure working time] exerts an important influence over measured working time” (Drago et al., 1999, p.38). For example, contractual working time severely underestimates actual working time of teachers (yet these are often the basis of public perceptions of teachers’ work). Face time measures show work hours are longer than those contractually required, standard diary methodology shows even longer hours, while the work invasiveness measure shows longer hours yet.

In this study the scope and demands of the lives of mathematics teachers are explored, within the limits imposed by our modest sample size, through the *Experience Sampling Method* [ESM]. This approach uniquely “bridges the precision of paper-and-pencil measurement and the ecological validity of on-site observational techniques” (Csikszentmihalyi, Rathunde & Whalen, 1993, p. 49) and captures many of the time measure nuances examined by Drago et al. (1999).

Of particular interest in this study were (1) the effectiveness of, and participants’ reactions to, the ESM as a data gathering tool; (2) the pattern of activities in which mathematics teachers were engaged; (3) comparisons of activities in and out of formal working hours – defined as 8.30 am to 4 pm (Monday-Friday); and (4) feelings associated with the teaching of mathematics and administration. Other aspects – a comparison of the work patterns of experienced and novice mathematics teachers and of situations likely to produce teacher stress - were reported in Leder and Forgasz (2005).

The Study

The Sample

The sample comprised 14 secondary school mathematics teachers, six males and eight females, from six non-government schools in Victoria, Australia. The group’s teaching experience ranged from one to 32 years. Both coeducational and single sex schools participated; all but one was located in the Melbourne metropolitan area. The formal qualifications of participants varied, though all were well qualified and had a minimum of four years of tertiary education. Four indicated that they had taught in primary grades at some stage. Thirteen of the group were in permanent positions; one was on contract. Twelve of the teachers were full time; two held part time positions (0.95 and 0.75).

Collectively, the group taught the full range of mathematics subjects: from grade 7 to grade 12. Subjects other than mathematics taught by participants included: personal development, sport, outdoor education, science, VET, psychology, industry and enterprise, health, and religious education. Most participants indicated that they had additional responsibilities. For some of these they received an allowance; others were considered part of their normal responsibilities.

Method and Instruments

Data gathering took place in 2004, early in the second half of semester two. One week of intensive data collection was followed by interviews with four teachers conducted over the subsequent two weeks.

Biographical information sheet. Prior to the week of monitoring, participants were asked to complete a background information sheet listing biographical data (e.g., gender, age group) and work details (e.g., subjects and grade levels taught, years of mathematics teaching experience).

The Experience Sampling Method [ESM]. Data gathering relied heavily on the *Experience Sampling Method*. The ESM was developed about 30 years ago and since then has been used in various settings (e.g., Csikszentmihalyi et al., 1993) and with different samples, including teachers (Bishay, 1996) university students (Leder & Forgasz, 2004), and academics (Forgasz & Leder, 2003). In response to a signal, sent five to seven times daily over a period of one week, participants chart the course of their daily lives and experiences by completing a specially designed *Experience Sampling Form [ESF]* in which they report their current activities, companions, thoughts, and feelings. Thus, over a sustained time period, information is gathered about the activities in which participants are engaged as well as their reactions to, and beliefs about, those activities. ESF response rates are typically high. Minor, Glomb and Hulin (2001) commented that “participants respond to and complete the ... administered questionnaire about 75-85% of the time they are signaled” (p. 6).

In the present study, the SMS text messaging facility of contemporary mobile telephones was used to signal participants to complete ESFs. The 14 participants were sent SMS messages six times a day for one week between the hours of 7.30am and 9.30pm on weekdays, and between 10am and 9.30pm on weekend days. A typical SMS message read as follows: “DLMT [*Daily Lives of Mathematics Teachers*] study. 2.50pm Tuesday. Message 4. Complete ESF now, please” i.e., the SMS message included the time it was sent, the day of the week and the message number for the day. The technology we relied on allowed the same SMS message to be sent simultaneously to the 14 participants’ phones via a single email message. On receipt of a message, participants were asked to complete the appropriate ESF on, or as soon as possible after, receiving it – preferably within half an hour. Excerpts from the ESF used are shown in Figure 1.

Interviews. Interviews were conducted with selected participants to supplement the ESF data. The interview protocol used was semi-structured. Some items were tailored to expand on participants’ ESF entries; others to probe participants’ reactions to the ESM. Examples of questions asked included: “Tell me about your typical working day”, “Do you have to work at home (i.e., out of hours)?”, and “Please describe your reactions to the ESFs... Did you find any of the questions intrusive?”.

Analyses. Information collected via the ESFs was transferred to *Excel* spreadsheets and into SPSS for analysis. The data on the types of activities participants were engaged in were coded into categories, initially based largely on the work of Campbell and Neill (1994) and subsequently compared with those used by Harvey and Spinney (2000). Other coding categories were defined as they emerged during the analyses. Category details are shown in the results section. The audiotaped interviews were transcribed.

EXPERIENCE SAMPLING FORM [ESF] (excerpts)

Name: _____

Date: _____ Time received/read: _____ Time filled out: _____

As you were contacted:

You may have been engaged in a work-related pursuit (teaching, professional development, administration, preparation), household chore, leisure activity, driving to or from school, etc. Any of these are relevant for the purposes of this study. Please provide specific details in response to each item – use examples provided to guide the form of your responses.

Where were you? (e.g., teaching Gr. 12 mathematics class; in staff room)	
Who were you with? (e.g., Gr. 9 mathematics class; the principal)	
What were you doing? (e.g., photocopying for Gr. 10 mathematics class)	
Was what you were doing directly work-related? Circle response	YES NO
What were you thinking about? (e.g., how boring this meeting is)	

Tick the column which best describes how you rate:

	Very low	Low	Average	High	Very high
The challenge of the activity					

Tick the column to indicate your response to each of the following:

	Not at all	A bit	Average	Quite a lot	Very much
Was this activity important to you?					
Were you satisfied with how you were doing?					

In the table below you are asked to describe your mood when you were contacted. Two words, emphasising the extremes of a continuum are given for each line. Tick the appropriate column which best describes your mood along that continuum. (The full list had 11 adjective sets)

	Very	Quite	NEITHER	Quite	Very	
Interested						<i>bored</i>
Stressed						<i>relaxed</i>
Distracted						<i>focused</i>
Satisfied						<i>dissatisfied</i>

If you had the choice when you were contacted, what would you prefer to have been doing?

Figure 1. Excerpts from Experience Sampling Form [ESF].

Results and discussion

ESF Response Rate

The ESF response rate was very high. Eleven of the 14 respondents completed 42 or 41 ESFs. Twelve of the 14 completed at least 93% of the ESFs. The lowest response rate was 74% (one respondent), with the next lowest at 85%. In total 564 (95.9%) out of the possible maximum of 588 (14 respondents x 7 days x 6 ESFs per day) ESFs were completed and returned. This was considerably higher than the 75-85% cited by Minor,

Glomb and Hulin (2001), suggesting that the participating teachers were committed to the study and were serious about their involvement in it.

Teachers' Reactions to the ESM

In comparison to journal keeping, the ESM may appear an “intrusive” research approach. As this was a pilot study, we were interested to know how the participants’ felt about the methodology and whether they believed it was able to capture what their working lives were like. At interview these questions were asked. The responses of two of the four teachers are presented below. The other two teachers spoke similarly.

Andrea [pseudonyms have been used]

I: Can you describe your reactions to the ESFs? Was it easy to work with?

A: *Yeah it was pretty easy. I have to say when I read it, um coz Mark said do you want to go ahead with this, that's the Head, and I read it and I thought Oh my God, getting six SMSs a day would be very intrusive, so that was my initial reaction but it wasn't like that at all. I didn't find it intrusive at all, and I know that when the other people that did it, I spoke to a couple of them, and they found it fine.*

Susan

I: Do you feel any questions were intrusive?

S: *No. I was – no not really. I don't think – I was honest. I wrote down what I felt – it was no big deal. But no, not intrusive at all.*

I: Do you believe that we were able to capture what your working life is like through the approach we used?

S: *Sometimes it was difficult ..., if for example there was no space if you were spending a lot of time looking through emails or things like that. I would write that down but I guess that was one of the last questions if there was anything else you wanted to know. So I guess when it didn't[fit in the space] I just put it in that section, but most of the time there was always a spot to put something.*

I: Is there anything you feel that we missed?

S: *No. Not that I can think of.*

The ESM was seen as having successfully provided a portrayal of the working lives of these four teachers. The structure of the ESF used was considered appropriate and the questions included were not seen as intrusive.

So, what did the working lives of these teachers look like?

Activities in which the Teachers were Engaged

Drawing on previous research in which teachers’ work activities had been categorized, and using a grounded approach (Strauss & Corbin, 1998) with data that did not seem to fit any pre-determined groupings, the activities the participating teachers reported when signalled were sorted into nine main categories. These, and their respective response frequencies were: teaching (17.9%), preparation (15.1%), professional development (0.2%), administration (12.8%), other school-related activities (9.9%), domestic activities (23.4%), social activities (5.2%), travelling (7.6%), and other (7.8%). The main categories

were divided into sub-categories. It should be noted that teachers were in mathematics classes 80% of the time that they were “teaching”.

Working hours were defined as from 8.30 am to 4 pm on weekdays and 266 of the 588 signals (45.2%) were sent during working hours. When the data were split by in or out of working hours, an interesting pattern emerged. The data are illustrated in Figure 2 and reveal that teachers were more likely to undertake preparation (preparing lessons and marking) out of school hours (18% of responses) than during the school day (12% of responses). A large slice of the school day appears to have been spent on administrative activities (22% of responses). From the graph it can be seen that various school and teaching related activities also took place out of working hours.

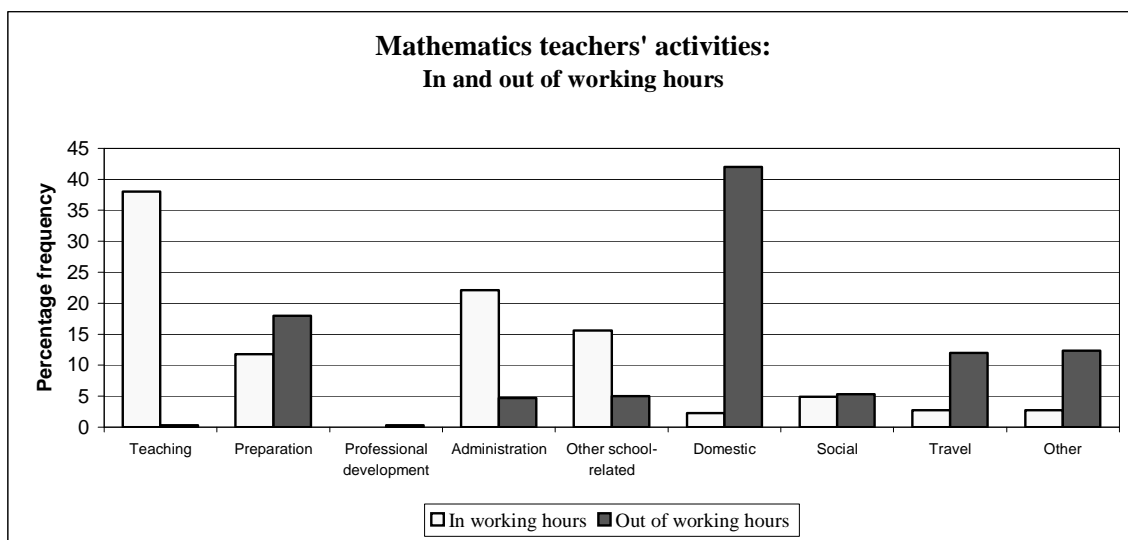


Figure 2. Teachers' activities in and out of working hours.

The subcategories of “preparation” were: lesson preparation, marking, and other. Their in/out of working hours break-up are shown in Figure 3. Lessons, it can be seen, were more likely to be prepared in working hours, marking out of hours. These data refer to all teaching preparation, but most are likely to be mathematics-related (see above).

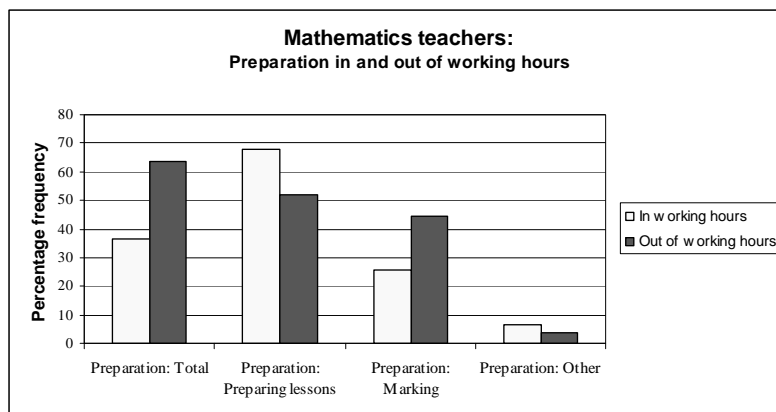


Figure 3. Preparation activities in and out of working hours.

Teachers' Feelings and Mathematics Teaching

Teachers' feelings when they were contacted could be inferred from their responses to the adjective pairs (see "mood" item in Figure 1) and from other affective data gathered via the ESFs and interview. Space constraints restrict our discussion to the adjective data for two categories: "teaching mathematics" and "administration". The data are summarised in Table 1. The five response categories shown on Figure 1 were collapsed into three: the positive and negative percentages shown in Table 1 were derived by combining the "quite" and "very" categories for each adjective pole.

Table 1.

Response Frequencies to Adjective Pairs when Teaching Mathematics and Attending to Administrative Tasks

Adjective pair	Positive (%)		Neutral (%)		Negative (%)	
	Teaching	Admin	Teaching	Admin	Teaching	Admin
Satisfied/dissatisfied	61.8	49.3	23.7	26.1	14.5	24.6
Alert/drowsy	90.8	69.6	3.9	10.1	5.3	20.3
Happy/sad	61.3	37.1	28	54.3	10.7	8.6
Cheerful/irritable*	61.8	38.6	15.8	35.7	22.4	25.7
Active/passive	86.8	47.1	6.6	18.6	6.5	34.3
Interested/bored	71.1	54.3	13.2	17.1	15.8	28.6
Clear/confused	90.8	77.1	6.6	20.0	2.6	2.9
Relaxed/Stressed*	35.5	27.1	32.9	28.6	31.6	44.3
Focused/distracted*	73.7	73.5	15.8	11.8	10.5	14.7

* *The adjective pair was presented in the opposite order on the ESF*

When teaching mathematics, the bulk of the teachers' responses to each adjective, apart from relaxed/stressed, was overwhelmingly in the positive direction indicating that they were generally satisfied, alert, happy, cheerful, active, interested, clear and focussed. High engagement and pleasure in the task of teaching mathematics can be inferred from the teachers' choices of the positive poles of the adjective pairs provided. The much lower positive response rates, apart from focussed/distracted, when attending to administrative tasks are noteworthy. The outlying responses to relaxed/stressed suggest that teacher stress is worthy of further investigation.

Conclusions

The teachers' comments in the interviews indicated that the ESM was perceived as an effective, non intrusive data gathering tool. Participants felt that the range of activities in which they engaged, inside and outside the classroom, was captured comprehensively. The instrument enabled participants to describe the contexts (physical and interpersonal) of their activities and their feelings about them. The multiple snapshots gathered over a sustained period of time present a systematic and detailed overview of the scope of teachers' work and other responsibilities.

The findings confirmed that teachers' work extends well beyond formal school hours. Preparation, in particular marking/correcting students' work, was more likely to be done out of hours. Administration, which took up a large slice of the working day, also intruded into out of work hours. A more fine grained description, based on all coded subcategories of the teachers' activities, is outside the scope of this paper.

It is noteworthy that when teaching mathematics, the participants' feelings and moods were generally positive, and high levels of engagement could be inferred – far more than

for administration. How the administrative burdens placed on teachers can be reduced warrants thoughtful consideration.

Based on the findings from the pilot study a more intensive examination, with a larger and more diverse sample, is warranted. Such a study will yield rich, detailed, and contextualised information about the realities confronting teachers in their daily lives and the factors which impede or facilitate their core task of teaching.

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