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Colloquium

Time of day, exam performance and new technology

James Hartley and Lisa Nicholls

Address for correspondence: James Hartley, Research Professor, School of Psychology, Keele University, Staffordshire, ST5 5BG, UK. Email: j.hartley@psy.keele.ac.uk. Lisa Nicholls, School of Psychology, Keele University, Staffordshire, ST5 5BG, UK.

Introduction

What time did you go to bed last night? What time did you get up this morning? Do you always leave things to the last minute? And how do you compare with your friends and others in your family?

Different people function more efficiently at different times of day, and this can affect their performance on any task (Smith *et al*, 2002). In terms of teaching and learning, this means that some teachers, and some learners, will perform better in the morning, some in the afternoon, and some in the evening. It also means that some students will do better in their examinations at different times of day from others.

Considerable research supports this proposition in primary and secondary education. Useful reviews and representative studies are provided by Callan (1999), Dunn, Beaudry and Klavas (1989), Folkard, Monk, Bradbury and Rosenthal (1977) and Smith *et al* (2002). Most of these authors report significant effects—learners do better if they learn and take their exams at their preferred times.

However, we have located only one study with university students on the topic. Here Smith *et al* (2002) developed and used a questionnaire to measure university students' time-of-day preferences in six countries. However, this enquiry was more concerned with developing an appropriate scale, and the authors did not report on students' differences in academic performance according to their diurnal preferences. They did report, however, that people in more temperate climates perceived themselves to be more morning-oriented than did their peers in less temperate climates.

In this paper we report our findings when we used a version of this scale to assess how time of day preferences might impact on university students' academic performance in the UK.

Method

An opportunity sample of 80 3rd-year Psychology students completed a revised version of the scale produced by Smith *et al* (see Appendix) and reported the mark that they had obtained in a recent 2-hour essay examination that had taken place in the morning (from 9:30 to 11:30 a.m.). Usable data were obtained from 78 students (31 men and 47 women, average age 21 years).

We divided the students into three groups, based upon their scores on the questionnaire. We labelled students scoring 41–50 'morning learners', 26–40 'intermediate', and 11–24 'evening learners'. We then compared the examination scores of these three groups.

Results

Our analysis of the responses showed that the revised scale had good internal consistency, with a Cronbach's alpha of 0.96. Table 1 shows the mean scores (and standard deviations) for the exam scores grouped in terms of the students' time-of-day preferences. Analysis of variance showed that the differences reported in Table 1 were statistically significant. The scores of the students with morning and intermediate preferences were not significantly different from each other, but both scored significantly better than did the students with evening preferences ($p < 0.01$ in each case). There were no significant sex differences in the distributions of the numbers of men and women in each of the three groups, nor in the exam scores that they achieved.

Discussion

These results are clear, although limited in scope. It would have been nicer to have had a larger group of 'morning' students, and to see if the findings could be replicated in other contexts. But if the current findings are valid, then what are their implications? Are large numbers of our students disadvantaged by taking examinations in their less preferred times? And, if this is the case, what can we do about it?

It has been held for years that no one can take such preferences into account in this context because it is not possible to set examinations for students at different times of day. But this is only partly true. It is now no longer beyond the bounds of possibility to set up tailored computer-based exams—especially if multiple-choice type tests are used and individuals can receive a random selection of test items from a large database. In

*Table 1: Mean scores and standard deviations (*SD*) on the exam taken in the morning by students with different time of day preferences*

Time of day preference	*Exam score mean*	SD
Morning ($n = 13$)	61.3	5.8
Intermediate ($n = 38$)	59.3	7.3
Evening ($n = 13$)	54.1	8.2

any event, as noted elsewhere, we need to move on from handwritten to computer-based examinations (eg, see Fiddes, Korabinski, McGuire, Youngson & McMillan, 2002; MacCann, Eastment & Pickering, 2002; Russell & Plati, 2002).

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Appendix: The questionnaire used in the present study (adapted from Smith *et al* (2002)

Please answer the following questions according to your own preferences and not what you may be forced to do by your work/study schedule. For each question circle the alternative that best indicates your preference relative to that of most people. When answering questions about sleep, please refer to your main sleep time, not a nap or short sleep.

Please circle the appropriate number on the given rating scale

Compared to most people, assuming you were free to choose:	*Much later than most people*	*A little later than most people*	*About the same time as most people*	*A little earlier than most people*	*Much earlier than most people*
1. When would you prefer to get up?	1	2	3	4	5
2. When would you prefer to go to bed?	1	2	3	4	5
3. When would you prefer to take an important 3 hour examination?	1	2	3	4	5
4. When would you prefer to get up if you had a day off and nothing to do?	1	2	3	4	5

Compared to most people, assuming you were free to choose:	*Much later than most people*	*A little later than most people*	*About the same time as most people*	*A little earlier than most people*	*Much earlier than most people*
5. When would you prefer to start writing an essay?	1	2	3	4	5
6. When would you prefer to meet with friends (or attend social activities) on a day off?	1	2	3	4	5
7. When would you prefer to eat breakfast?	1	2	3	4	5
8. When would you prefer to start lectures?	1	2	3	4	5
9. When would you prefer to do hard physical work or exercise?	1	2	3	4	5
10. When would you prefer to have an important interview at which you needed to be your best?	1	2	3	4	5
11. When would you prefer to revise for an important examination?	1	2	3	4	5
12. At what time of day do you feel most alert? (Please state a.m. or p.m.)					
13. At what time of day do you feel most sluggish? (Please state a.m. or p.m.)					

Please could you report your recent mark on Module 30026. Your honesty is appreciated.

Thank you.