

# **Academic Engagement, Motivation, and Buoyancy During a Month at School: Using Mobile Technology to Capture Intensive Intra-individual Real-time Data**

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## **Abstract**

The present study collects intensive real-time longitudinal data, with three data collections per day, every school day, across four school weeks. Using mobile technology (e.g., PDAs, smart phones, laptops, tablets) to capture intensive intra-individual real-time data, a four-level model was explored, consisting of within-day ratings at the first level (3 ratings per day), between-day ratings at the second level (5 days per week), between-week ratings at the third level (4 weeks), and between-student ratings at the fourth level (60 possible time points per student). Multilevel modeling showed substantial within-day (intra-individual) variability in engagement, motivation and buoyancy ( $M = 23\%$ ) and substantial between-student variability ( $M = 67\%$ ). There was not so much variability between days ( $M = 3\%$ ) – and not so much between weeks ( $M = 6\%$ ). We propose the study offers insights for engagement, motivation and buoyancy theorizing (particularly around stability and developmental issues) and technological and logistic guidance for collecting real-time data.

## **Introduction**

What is the pattern of students' academic engagement, motivation and buoyancy over the course of a day, a week or a month at school? Is there more or less variation within a day than between days and weeks? Are there particular points in a day, week or month where educational practice is best directed to enhance student engagement, motivation and buoyancy? What conceptual, operational and methodological lessons can be learnt from 'real-time' intensive longitudinal engagement, motivation and buoyancy research? In this study, we address these questions using mobile technology to collect intensive real-time multidimensional engagement, motivation and buoyancy data, with three data collections per day, every school day, across four school weeks.

While studies in personality and psychiatry have for some time focused on intra-individual variability such as in mood (e.g., Eid & Diener, 1999) and emotions (e.g., Trull, Solhan, Tragesser, Jahng, Wood, Piasecki & Watson, 2008), psycho-educational researchers tend to know less about intra-individual ebbs and flows of engagement and motivation. Empirical attention to intra-individual variability follows Cattell's (1952) early calls for focus on occasions within persons and Molenaar's (2004) more recent calls to return the focus to the individual in psychology. Similar to the approach of investigating (in)stability of personality traits from day to day (Hamaker, Nesselrode, & Molenaar, 2007), we investigated the within daily and between daily patterns of engagement, motivation and buoyancy factors.

## Summary of Methods

To build on the typical large-sample cross-sectional engagement, motivation and buoyancy research conducted to date, the present study collects intensive intra-individual real-time longitudinal data using mobile electronic devices through the day (up to three times), week (on 5 weekdays), and month (across 4 weeks). At each measurement point, students were asked to rate themselves on a variety of engagement (e.g., self-regulation, persistence), motivation (e.g., self-efficacy, mastery orientation) and buoyancy factors. The dataset comprised a maximum of 60 observations on each of 15 variables for each of 20 high school students in Year 7 ( $N = 8$ ) and Year 11 ( $N = 12$ ) from one non-government school in a major city on the east coast of Australia.

Using a mobile device (e.g., PDA; iPod; iPhone; iPad) to record responses into SurveyMonkey, each student was asked to rate themselves up to three times each day of the school week for four weeks. The study was conducted in Term 1 of the school year and the rating periods were the school morning (before lunch), the school afternoon (before the last lesson), and in the evening (during homework/study). Thus, a possible total of 60 responses per student were possible. Most students rated themselves two to three times each day, yielding a total of  $N = 759$  responses. This represented a response rate of approximately two-thirds and an average of 38 responses per student for each dependent variable. At the start of each week all students received reminders and further encouragement to participate. Students' response rates were monitored and students were sent individualized reminders if their response rate was declining. The ordering of items was randomized at the start of each week to guard against any systematic non-response effects at particular points of the week.

The data were conceptualized as a four-level model, consisting of within-day ratings at the first level (Level 1, L1), between-day ratings at the second level (Level 2, L2), between-week ratings at the third level (Level 3, L3), and between-student ratings at the fourth level (Level 4, L4). The multilevel analyses (for details see Goldstein, 2003; Raudenbush & Bryk, 2002) were conducted using MLwiN version 2.25 (Rasbash et al., 2012). In the first set of analyses, a baseline variance components model (Rasbash et al., 2012) was used to evaluate how much variation in each of the measures could be attributed to students (L4), weeks (L3), days (L2), and time within days (L1). Following variance components models, the same random elements and set of measures were analyzed but with (a) the fixed linear and non-linear quadratic effects of time within day, time within week, and week of the month included and (b) socio-demographic (e.g., grade, ethnicity, parental education, and prior achievement) and prior achievement fixed effects also included. A third set of analyses tested for variability in linear and non-linear effects as a function of student.

## Summary of Findings

After controlling for socio-demographics and prior achievement, findings showed that the bulk of variance resides within the day and between students. Interestingly, there was not so much variability between days – and not so much between weeks. Specifically, modeling showed substantial within-day (intra-individual) variability in engagement, motivation and buoyancy ( $M = 23\%$ ) and substantial between-student variability ( $M = 67\%$ ), but not so much variability between days ( $M = 3\%$ ) – and not so much between weeks ( $M = 6\%$ ). Linear (testing a rise or a fall) and non-linear (testing a rise and fall/fall and rise) effects through the day, week and month were predominantly non-significant. It therefore appears that it is not so much the time of day, week or month that is related to engagement, motivation and buoyancy, but what is happening at any point in the day that appears to be salient. Notwithstanding this, there is variability between students in engagement, motivation and buoyancy slopes across the month. Thus, although the overall linear effects are not significant, the linear pattern of engagement, motivation and buoyancy from student to student can change significantly.

## Summary Conclusion

With developments in mobile technology as well as widespread and cost-effective accessibility, there are opportunities for educational researchers to employ complex research

designs and collect real-time intra-individual data with relative ease. The present study collected intensive real-time longitudinal engagement, motivation and buoyancy data at multiple points in the day, each day, for four school weeks. Consistent with major developmental and psycho-educational theorizing, findings demonstrate intra-day and inter-student variability in engagement, motivation and buoyancy, suggesting activity- and person-centered approaches to enhance students' academic development.