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**Biographical Notes**

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Annelie Harvey is a Senior Lecturer in Social Psychology at Anglia Ruskin University. Annelie is particularly interested in the psychology of Social Justice and her research considers how people react to victims and instances of misfortune. Annelie is a Senior Fellow of the Higher Education Academy, UK.

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**How do I compare thee? An evidence-based approach to the presentation of class comparison information to students using Dashboard**

**Abstract**

Learning Dashboards display analytics pertaining to student performance and attainment, often alongside scores for the class cohort average. Little research has considered the effects of this social comparison information on students’ well-being, motivation, and engagement. The current study presented participants with hypothetical data that simulated a student performing above, below, or at the class average before measuring self-esteem, persistence on an impossible anagram task, and willingness to engage with study support services. Our results showed that where upward social comparisons were induced (exposure to Dashboard data displaying engagement and attainment below the class average), students reported lower self-esteem than participants presented with above average vignette data. Interestingly, this effect was not moderated by the grade profile of students and no effects on persistence or willingness to engage with study support were observed. We conclude that upward social comparisons in Dashboard data can have negative consequences for students’ self-esteem.

Keywords:Social comparison, self-esteem, dashboard, higher education, students, motivation

Word count: 4999

**Introduction**

In his seminal paper, Festinger (1954) posited that individuals have a drive to evaluate their own abilities and opinions, and do so by comparing themselves against others. For example, someone may compare their running times with a peer to see if they are faster or slower in comparison, and thus gain information on their own running ability. Festinger (1954) proposed that people seek comparative information in the absence of any objective standards. Even when objective information is available, participants do not generally understand it, and instead show a preference for comparative feedback (Harris, Sparks, & Raats, 2002). In support, Schmiege, Klein, and Bryan (2010) found that dental flossing behaviour increased when participants were given inflated estimates of peer flossing behaviour, regardless of whether objective expert recommendations were provided or not. As such, social comparison information is a dominant predictor of a number of outcomes over and above objective information.

Whom an individual utilises as a comparison target can lead to very different evaluations and outcomes. Musseiler, Rüter, and Epstude (2004) demonstrated that participants lowered predictions of their own athletic ability when they had previously been exposed to former professional basketball player Michael Jordan, but increased their predictions when exposed to 84-year-old Pope John Paul II. In addition, Medvec, Madey, and Gilovich (1995) presented participants with video clips of silver and bronze medallists from the 1992 Olympic Games. Participants rated the bronze medallists as happier than they rated the silver medallists, despite the silver medallists objectively receiving the more prestigious award. The researchers concluded that the silver medallists were comparing themselves to the gold medal winners and consequently feeling downtrodden, whereas the bronze medallists compared their performance with the competitors who did not win a medal and were feeling elated.

Therefore, people’s self-worth and evaluations of their own abilities can be greatly influenced by social comparison and particularly by whom the comparison target is. Comparing oneself to someone relatively better off (e.g. a silver medallist comparing themselves with a gold medallist) is considered an upward social comparison (see Collins, 1996). Comparing oneself to someone relatively worse-off is considered a downward social comparison (see Wills, 1981). In a recent meta-analysis of the social comparison literature, Gerber (2018) found that overall, downward comparisons produce positive effects and upward comparisons produce negative effects. Specifically, Gerber (2018) evidenced that upward comparisons led to negative estimates of ability (e.g. “How smart are you?”) and lowered performance satisfaction (e.g. “How satisfied are you with how you did on that test?”) compared to downward comparisons.

 Additionally, research within psychology has demonstrated the harmful effects upward comparisons can have on individuals’ well-being. Personal Relative Deprivation (PRD) is a term used to describe the unpleasant belief that one is deprived of a deserved outcome compared to another (see Smith, Pettigrew, Pippin, & Bialosiewicz, 2012). Callan, Kim, and Matthews (2015) evidenced that high PRD is associated with poorer levels of physical and mental health (e.g. stress, self-rated health). As such, comparing oneself to someone better than you, and feeling negative and resentful about said comparison, can have detrimental effects to one’s health and wellbeing. The present study is particularly interested in the impact and effects of social comparison – provided via Learning Analytics Dashboards – on students within Higher Education.

***Social Comparisons in Education***

Research suggests that children as young as kindergarten age (approximately 5.5 years old) already express direct social comparison, with statements such as “Mine is better than yours” and “He’s on page 10, and I’m only on page 8” (Altermatt, Pomerantz, Ruble, Frey, & Greulich, 2002). As students progress through the education system, comparing oneself with peers is arguably unavoidable as one is not educated in isolation, but as part of a class and a cohort (Pulford, Woodward, & Taylor, 2018). Therefore, we can confidently assume that students in higher education compare their academic success against that of their peers. Of interest to the current paper is the impact that such social comparisons have on students in relation to their self-esteem, academic persistence, and academic help-seeking behaviour.

A wealth of research considering students across the educational lifespan demonstrates the positive effects of making downward comparisons (Altermatt & Pomerantz, 2005; Wehrens, Kuyper, Dijkstra, Buunk, & Van Der Werf, 2010). In their large-scale longitudinal study, Wehrens et al. (2010) found evidence of the positive effects of downward social comparison on student academic performance. The larger the extent of a downward comparison, the higher a participant’s reading comprehension score and mathematical test score was two years later.

Interestingly, Pulford and colleagues (2018) found that for higher education students, making downward academic social comparisons was not common and had no effect on academic confidence. Engaging in upward social comparisons, in contrast, led to university students demonstrating less confidence in numeracy, speaking, and hard IT. In addition, students who were less likely to compare themselves socially were ultimately more confident in reading, writing, and time management. This research highlights the negative effects social comparisons can have on students’ academic performance and academic confidence.

It is important to note that the effects of upward and downward comparisons detailed above may not be generalizable for all students. In fact, research suggests that the impact of social comparison on a student depends on the academic ability of said student. In a longitudinal study of students in grades 3, 4 and 5, Molloy, Guest, and Rulison (2010) found evidence for academic achievement moderating the effects of social comparison. Students making upward comparisons showed a boost in their academic self-concept if they were high-achieving students. For low achieving students however, upward comparisons resulted in a decreased academic self-concept. In addition, Altermatt and Pomerantz (2005) found that low-achieving students demonstrated a trade off when they had high-achieving friends. Low-achieving students with high-achieving friends evaluated themselves less positively, but performed better academically than low-achievers with low-achieving friends. As such, in the present study we measured students’ academic performance and included this as an independent variable in our analyses.

***The Present Study***

Learning Analytic Dashboards are graphical interfaces that capture and visualise data regarding a learner’s activities in order to support awareness, self-reflection and, sense-making (Verbert et al., 2014), and are widely used across Higher Education institutions (Bennett, 2018). Higher education has seen development in learning Dashboards in recent years, justifying research enquiry into the effects of this emerging technology on students. With a growing body of literature considering the use of Learning Dashboards, little research has considered the use of Dashboards in a student-facing capacity or the impact of Dashboard information on students (see Schwendimann et al., 2016; Verbert, Duval, Klerkx, Govaerts & Santos, 2013).

Bennett (2018) utilised interviews to consider the effects of Dashboard data on students and found that most students, even those who are low-achieving, are motivated following viewing their Dashboard display, and such motivation can lead to positive changes in student behaviour. In addition, Bennett observed that even high-scoring students felt deflated after comparing themselves to others. Akin to Medvec et al.’s (1995) Olympic findings, even though these students had done objectively very well, the upward comparison against those who had performed slightly better produced detrimental effects. Dashboards display learning analytics, often alongside comparison information (e.g. the level of the student’s engagement/attainment compared with the course average), and as such, may impact students’ self-esteem or academic performance. However, such effects appear to be dependent on (1) the direction of the comparison (Pulford et al., 2018, Wehrens et al., 2010) and (2) the student’s academic achievement (Altermatt & Pomerantz, 2005; Molloy et al., 2010).

The current study sought to present students with hypothetical Dashboard displays that simulated a student performing at and engaging below the course average, above the course average or at the course average. Hypothetical vignettes and scenarios are used widely in a range of areas of research and can provide researchers with an interpretation of the real world in a particular situated context (Hughes, 1998; Shippen et al., 2005; Hofer et al., 2007). In addition, we wanted to limit variability and control the extent of social comparison that participants were exposed to, as previous research suggests positive effects of downward comparisons increase with the extent of the comparison (Wehrens et al., 2010). To control for academic ability acting as a potential moderator (Molloy et al., 2010), we also accounted for the average grade profile of students (below a 2:1, at a 2:1 or above a 2:1 grade) as an independent variable. As upward and downward comparisons have been shown to impact on well-being (Callan et al., 2015), academic performance, confidence (Pulford et al., 2018), and motivation (Bennett, 2018), we measured participants self-esteem, persistence with an impossible task, and willingness to engage with academic support services after viewing the Dashboard display. We hypothesised that students making an upward comparison (i.e. those in the below average condition) would report lower self-esteem, spend less time persevering on the impossible task, and be less willing to engage with academic support compared with students making a downward comparison (i.e. those in the above average condition), with students in the average condition serving as a control. However, Bennett (2018) states that a “one size fits all” approach is not appropriate when considering how students react to Dashboard comparisons. As such, academic ability is predicted to moderate the effect of upward comparisons, such that high achieving students (above a 2:1), are more likely to be persist with the impossible tasks and show willingness to engage with academic support following an upward social comparison than low performing students (below a 2:1).

**Method**

***Participants***

Students from Anglia Ruskin University in the UK were recruited via electronic communications on campus. The study received ethical approval from the Psychology Departmental Research Ethics Panel, which was ratified by the Faculty Research Ethics Panel under the terms of Anglia Ruskin University’s Policy and Code of Practice for the Conduct of Research with Human Participants. Participants were awarded a £5 Amazon gift voucher for their time.

A total of 260 participants took part in the study, although 22 of these participants were later excluded due to incomplete data. Of the remaining 238 participants, 71% were female, 27.7% male and 1.3% selected “prefer not to say”. The mean age of participants was 24.71 years (*SDage* = 8.01) and the large majority of participants were white (66.2%), followed by Asian or Asian British (8.5%), Black or Black British (8.1%), Mixed (5.4%) and other (3.5%). The majority of participants were not mature students (61.2%) and there was a good distribution of participants across levels of study; foundation year = 3.5%, 1st year undergraduate (UG) = 21.9%, 2nd year UG = 21.5%, 3rd year UG = 28.1%, taught postgraduate (PG) = 12.3%, and research PG = 3.8%. The majority of students were not international students (78.8%).[[1]](#footnote-1)

***Design***

The study operated a 3 (Grade profile: below a 2:1, at a 2:1, or above a 2:1) X 3 (Dashboard condition: above average, below average, or average performance) between subjects ANOVA. The dependent variables of the study included self-esteem, measured via Rosenberg’s (1965) self-report scale, persistence (by measuring the time participants spent on impossible anagrams; see Ventura, Shute, & Zhao, 2013), and the self-reported willingness to engage with study skills support.

***Materials***

*Dashboard Manipulation.* The student view of Dashboard for Anglia Ruskin University (ARU) students was edited so that participants saw a display that indicated engagement either below average, above average or the same as the course average. The displays used the same colouring and font as the ARU student display. Students were shown two dials for engagement, one titled “Your Engagement Indicator” coloured in blue and the other titled “Course Average” coloured in gold. A percentage score was displayed in the middle of each dial. Below the engagement data, a bar chart showing attainment for four nondescript modules showed students “Your Mark” in blue and the “Course Average” mark in gold. The percentage of each grade was shown within each bar.

 Participants exposed to the below average condition saw their hypothetical engagement score as 25% and the course average as 50%. Participants in this condition consistently scored 10% below the course average on the four modules for attainment. At the bottom of the display, one line of text informed participants “You are performing below the class average”. Participants in the average condition viewed an engagement score that matched the course average (50%) and showed the same grades of attainment for the four modules as the course average. The final line of text for participants in this condition read, “You are performing the same as the class average”. Finally, participants in the above average condition viewed their engagement as 25% higher than the course average of 50% (i.e. 75%) and achieved grades 10% higher in each of the module presented. The summary line of text for participants in this condition read, “You are performing above the class average”. See Figure 1 for an example of the above average Dashboard display.[[2]](#footnote-2)

*Self-Esteem.* Rosenberg’s (1965) 10 item self-report scale for self-esteem was utilised. The scale includes questions such as “I take a positive attitude towards myself” and “On the whole, I am satisfied with myself”. Agreement to the items are scored on a 4-point Likert scale and this scale achieved good internal consistency in this study (*α* = .88). As a result, all 10 items were summed and averaged to create a composite measure of self-esteem. Higher scores indicate greater self-esteem.

*Willingness to Engage with Study Support Services.*To measure the willingness for students to engage with study resources, we created four items referring to the institutional academic support service called “Study Skills Plus”. On a 5-point Likert scale from “extremely likely” to “extremely unlikely” we asked students “How likely are you to visit the study skills plus website?”, “How likely are you to attend a study skills plus workshop?”, “How likely are you to visit a study skills plus drop-in session?”, and “How likely are you to book a one-on-one session with a study skills plus coach?”. These items achieved good internal consistency (*α* = .90), so were summed and averaged to create a composite measure of willingness to engage. Higher scores indicate a greater willingness to engage with study support services in the university.

*Persistence Task.* Previous research has measured participants’ willingness to preserve in impossible anagrams tasks before giving up as a measure of persistence (Ventura, Shute & Zhao, 2013). Participants were presented with five impossible anagrams (e.g. KDNITE) and asked to reorder the letters of each anagram to make a word. Participants were not told the anagrams were impossible, but were instructed not to cheat or find the answers online. Participants were told that if the anagram was too difficult, they should move on to the next one and once all anagrams have been attempted, participants needed to continue the survey by clicking on the “continue” button. The survey platform Qualtrics recorded the time spent on the anagram task.[[3]](#footnote-3)

*Demographics.*Participants were asked to think about the last three assessments they received grades for and to answer under what grade boundary these assessments (mostly) aligned with. Participants were also asked to report if they were an international student or a mature student. Participants reported their ethnicity and gender, and stated their current level of study.

*Uplifting task.*Borrowing from Callan, Kay and Dawtry (2014), in order to pre-empt a reduction in participants’ self-esteem, we asked participants to list three of their best qualities at the end of the study.

(Insert Figure 1 here)

***Procedure***

Participants were students from Anglia Ruskin University and were assumed to be familiar with Dashboard. Dashboard is a university-wide metric for student engagement, which is available to students directly, as well as via personal tutors in one-to-one meetings. Following consent, participants were first exposed to one of the three hypothetical Dashboard displays. Participants were asked to imagine the displayed scores reflected their own levels of engagement and were reminded that the data showed both their levels of engagement and attainment (in blue) and that of the course average (in gold).

 All participants then completed Rosenberg’s (1965) self-esteem scale, the willingness to engage questionnaire, and the anagram task. Participants completed demographic questions before engaging with the uplifting task (see Callan et al., 2014). Finally, participants were debriefed and reimbursed for their time.

**Results**

Data from 22 participants were excluded due to missing values. For the remaining 238 participants, there was an even split between Dashboard Condition vignette groups (Below Average *N* = 79, Average *N* = 79, Above Average *N* = 80), and a comparable number of participants fell into each of the three Grade Profile groups (Below 2:1 *N* = 75, 2:1 *N* = 92, Above 2:1 *N* = 71). Three separate 3 X 3 between-subjects ANOVAs were carried out, with DVs of self-esteem, perseverance on an impossible anagram task and willingness to engage with study support services.

***Self-esteem***

There was a significant effect of Dashboard Condition on participants’ self-esteem, *F*(2, 229) = 4.93, *p* < .05, ƞp2 = .041. One-tailed follow-up tests show that participants who were exposed to Dashboard analytics describing their performance as above the class average had significantly increased self-esteem compared to those who were exposed to the below average Dashboard analytics, *t*(157) = 3.04, *p* < .005. Those in the below average condition had lowered self-esteem compared to those in the average condition at a level that approached significance following Bonferroni correction, *t*(156) = 1.83, *p* = .03*.* No difference in self-esteem outcome was observed between participants in the average condition and the above average condition, *t*(157) = 1.10, *p* = .14.The alpha for follow up tests was Bonferroni-adjusted to .017 for three comparisons. See Figure 2 for an illustration of these effects.

 No effect of Grade Profile was observed on self-esteem, *F*(2, 229) = 1.42, *p* = .24, and a participant’s Grade Profile did not significantly interact with their Vignette Condition group, *F*(4, 229) = 0.24, *p* = .91.

***Persistence***

Persistence, as measured by time spent attempting to solve the impossible anagram task, was not affected by Dashboard Condition, *F*(2, 229) = 1.24, *p* = .29, nor was it affected by a participant’s Grade Profile, *F*(2, 229) = 0.66, *p* = .52. These two variables did not significantly interact in their effect on perseverance, *F*(4, 229) = 0.76, *p* = .55.

***Willingness to Engage with Study Support Services***

A student’s Grade Profile did not impact on their willingness to engage with support services, *F*(2, 229) = 0.18, p= .84 There was also no effect of Dashboard Condition, *F*(2, 229) = 0.07, *p* = .93,nor any interaction between Grade Profile and Dashboard Condition, *F*(4, 229) = 0.68, *p* = .61 on a student’s willingness to engage.

(Insert Figure 2 here)

**Discussion**

Using an experimental design, we report social comparison effects on students’ self-esteem. Specifically, making upward comparisons (i.e. students comparing themselves to a cohort that is generally performing better than them and who are more academically engaged) has a detrimental effect on self-esteem. Interestingly, this negative effect on self-esteem did not translate into decreased levels of motivation as assessed on a perseverance task or by willingness to engage with study support services. Finally, self-esteem effects affected students across all grade profiles equally.

The self-esteem results reported here suggest that the effects of class cohort comparison are negative in their drive. That is, we report significantly lowered self-esteem for students in the below average vignette condition in comparison with both the average (control), and above average condition. In contrast, students in the above average vignette condition did not report a significant bump in self-esteem in comparison with students in the average vignette (control) condition. This suggests that particular caution must be used when implementing this tool at a university-wide level: the positive effects of downward social comparison reported here are small and non-significant, whereas the negative effects of upward social comparison are substantial.

In line with Molloy and colleagues (2010) and Altermatt and Pomerantz (2005), we predicted that making upward social comparisons would affect students of different grade profiles differentially. In particular, we predicted that any effects of upward comparison would be moderated by academic achievement, with students attaining grades at a higher level less affected by this comparison than less academically successful students. Instead, we report a universal negative effect of upward social comparison on students’ self-esteem. In both of the studies cited above, the students were of a young cohort (3rd-7th Grade students). Our results suggest that for a Higher Education population, academic achievement may not offer the same protective benefits. That is, across the board of academic achievement, making upward social comparisons with one’s class cohort had a similar debilitating effect on self-esteem.

***Limitations and Future Research***

We were interested to note that the negative effects of upward social comparison observed for self-esteem did not translate into decreased motivation to engage – either with the perseverance task or on willingness to engage with student support services. Here we have demonstrated an *immediate* negative effect on self-esteem from reading an imaginary vignette, which placed students in a position of upward comparison with their class cohort. It is possible that more long-term negative social comparison information (e.g. frequent reminders that performance is below the cohort average) may be required before effects on motivation to engage are evident. Indeed, while it is relatively easy to manipulate state self-esteem with immediate effect (as demonstrated here), academic self-concept – which has direct links with academic motivation (e.g. Awan, Noureen & Naz, 2011) – is more temporally stable (Bong & Skaalvik, 2003) and would therefore take greater social comparison input over a longer period of time to affect. It would be difficult to ethically design such a study, and simply looking at motivation in poorer performing students makes it difficult to disentangle social comparison effects from other factors, such as ability. Instead, we recommend that Higher Education institutions implementing student-facing class comparison tools (such as Dashboards) closely monitor effects and compare engagement of student cohorts prior to and following the introduction of such systems. In light of ongoing retention issues in Higher Education (HESA, 2018), it will be important to assess whether the lowering of poorly-performing students’ self-esteem might result in an increased drop-out rate.

The current study utilised hypothetical Dashboard data from one institution to consider the effects of social comparison. Although hypothetical vignettes are widely used and offer many benefits (Hughes, 1998), the hypothetical data may not have been as impactful as students’ own data and, as such, not produced authentic student responses. In addition, the current study only considered the impact of social comparisons on one Dashboard model (see Figure 1). To generalise and increase the reliability of the findings, future research should also consider different models of Dashboard data (i.e. display different analytics or vary visual representations) and replicate this study utilising authentic student Dashboard data.

***Conclusion***

The use of Dashboard systems online – whereby a student can access comparison information in relation to their cohort – should be regarded with caution in the Higher Education setting. Using a realistic Dashboard interface, designed to mimic the student view of class cohort comparison information, we report that viewing information leading to upward social comparison has a detrimental effect on student self-esteem. This effect is not dependent on the grade profile of the student: upward social comparison in a Higher Education setting affects students of different academic abilities equally.

**References**

Altermatt, E.R., Pomerantz, E.M., Ruble, K.S., & Greulich, F.K. (2002). Predicting changes in children’s self-perceptions of academic competence: A naturalistic examination of evaluative discourse among classmates. *Developmental Psychology,38*, 903-917.

Altermatt, E.R., & Pomerantz, E.M. (2005). The implications of having high-achieving versus low-achieving friends: A longitudinal analysis. *Social Development,14,* 61-81.

Awan, R.-U.-N., Noureen, G., & Naz, A. (2011). A study of relationship between achievement motivation, self-concept and achievement in English and Mathematics at Secondary level. *International Education Studies,4*(3), 72-79.

Bennett, L. (2018). Students’ learning responses to receiving dashboard data. *Society for Research into Higher Education.*

Bong, M., & Skaalvik, E.M. (2003). Academic self-concept and self-efficacy: How different are they really? *Educational Psychology review,15*(1), 1-40.

Callan, M.J., Kay, A.C., & Dawtry, R.J. (2014). Making sense of misfortune: Deservingness, self-esteem, and patterns of self-defeat. *Journal of Personality and Social Psychology,107,* 142–162.

Callan, M.J., Kim, H., & Matthews, W.J. (2015). Predicting self-rated mental and physical health: The contributions of subjective socioeconomic status and personal relative deprivation. *Frontiers in Psychology,6,* 1415.

Collins, R.L. (1996). For better or worse: The impact of upward social comparison on self-evaluations. *Psychological Bulletin,119,* 51-69.

Festinger, L. (1954). A theory of social comparison processes. *Human Relations,7,* 117-140.

Gerber, J.P. (2018). A social comparison theory meta-analysis 60+ years on. *Psychological Bulletin,144(2),* 177-197. Doi: 10.1037/bul0000127

Harris, P., Sparks, P., & Raats, M. (2002). Theoretical and applied issues in the provision of absolute and comparative risk information. *Risk Decision and Policy*,7, 153–163.

Higher Education Statistics Agency (2018, March 8). Non-continuation summary: UK PPerformance Indicators 2016/17. Retrieved from <https://www.hesa.ac.uk/news/08-03-2018/non-continuation-summary>.

Hughes, R. (1998). Considering the vignette technique and its application to a study of drug injecting and HIV risk and safer behavior. *Sociology of Health and Illness,20*, 381-400*.*

Hofer, M. Schmid, S., Fries, S., Dietz, F., Clausen, M., & Reinders, H. (2007). Individual values, motivational conflicts, and learning for school. *Learning and Instruction, 17,* 17-28.

Medvec, V.H., Madey,S.F., & Gilovich, T. (1995). When less is more: Counterfactual thinking and satisfaction among Olympic medallists. *JPSP,69,* 603-610.

Molloy, L.E., Gest, S.D., & Rulison, K.L. (2010). Peer influences on academic motivation: Exploring multiple methods for assessing youths’ most “influential” peer relationships. *The Journal of Early Adolescence,31,* 13-40.

Mussweiler, T., Rüter, K., & Epstude, K. (2004). The man who wasn’t there: Subliminal social comparison standards influence self-evaluation. *Journal of Experimental Social Psychology,40(5),* 689-696.

Pulford, B.D., Woodward, B., & Taylor, E. (2018). Do social comparisons in academic settings relate to gender and academic self-confidence? *Social Psychology of Education,21*(3), 677-690.

Rosenberg, M. (1965). *Society and the adolescent self-image.* Princeton, NJ: Princeton University Press.

Schmiege, S.J., Klein, W.M., & Bryan, A.D. (2010). The effect of peer comparison information in the context of expert recommendations on risk perceptions and subsequent behavior. *European Journal of Social Psychology,20*(5), 746-759.

Schwendimann, B.A., Rodriguez-Triana, M.J., Vozniuk, A., Prieto, L.P., Boroujeni, M.S., Holzer, A., Gillet, D., & Dillenbourg, P. (2016). Perceiving learning at a glance: A systematic literature review of learning dashboard research. *IEEE Transactions on Learning Technologies,10,* 30-41.

Shippen, M.E., Crites, S.A., Houchins, D.E., Ramsey, M.L.,& Simon, M. (2005). Preservice teachers’ perceptions of including students with disabilities. *Teacher Education and Special Education, 2,* 92-99.

Smith, H.J., Pettigrew, T.F., Pippin, G.M., & Bialosiewicz, S. (2012). Relative deprivation a theoretical and meta-analytic review. *Personality and Social Psychology Review,*16, 203–232.

Ventura, W., Shute, V., & Zhao, W. (2013). The relationship between video game use and a performance-based measure of persistence. *Computers & Education,60,* 52-58.

Verbert, K., Duval, E., Klerkx, J., Govaerts, S., & Santos, J.L. (2013). Learning analytics dashboard applications. *American Behavioural Scientist,57,* 1500-1509.

Verbert, K., Govaerts, S., Duval, E. et al. (2014). Learning dashboards: An overview and future research opportunities. *Personal and Ubiquitous Computing,18*, 1499-1514.

Wehrens, M.J.P. W., Kuyper, H., Dijkstra, P., Buunk, A.P., & Van Der Werf, M.P.C. (2010). The long-term effect of social comparison on academic performance. *European Journal of Social Psychology,40*, 1158-1171.

Wills, T.A. (1981). Downward comparison principles in social psychology. *Psychological Bulletin,90(2),* 245-271.

**Figure Captions:**

**Figure 1.** Above average Dashboard display.

**Figure 2.** Average self-esteem scores after reading a vignette describing a student’s performance as below the class average (dots), at the class average (diagonal lines) or above the class average (checker). Error bars represent standard error.

1. The authors documented detailed demographic information to provide insight into the makeup of the population sample. This demographic information may be of use to future researchers looking to replicate or generalise this work. [↑](#footnote-ref-1)
2. Timing data indicated that participants spent an average of 26.22 seconds (*SD* = 36.65 seconds) considering the Dashboard display (with a range of 5.96 to 465.03 seconds). [↑](#footnote-ref-2)
3. Excluding an outlier of 4910.18 seconds, participants spent on average 226.10 seconds (*SD* = 243.12) on the anagram task (with a range of 1.36 to 1426.15 seconds). [↑](#footnote-ref-3)