Dashboard literacy: understanding students' response to learning analytic dashboards

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Abstract

Dashboards are the graphical interface that manipulate and present data about students' learning behaviours (attendance, visits to the library, attainment etc.). Although only a few UK HEIs have developed a dashboard for students, most other UK HEIs have an aspiration to develop their use (Sclater 2014). Hence it is timely and significant to understand the ways that students respond to seeing data presented to them in the form of a dashboard.

This paper discusses and conceptualises the findings from a small scale study, funded by Society for Research in Higher Education. The study involved twenty-four final year undergraduate students in a single faculty in a UK University. The study focussed on the ways that students interpret and respond to seeing data about their learning presented via a dashboard. Sutton's (2012) three pillars of feedback literacy: knowing, becoming and acting, were employed to understand the potential of dashboards for supporting students' motivation towards their learning.

The paper suggests that, similar to feedback literacy, there is a type of literacy associated with dashboards that has components of knowing, becoming and acting and that employing these concepts helps us to understand how students' respond to dashboards. By identifying students' engagement with dashboards as a literacy practice rather than a technical skill or understanding, the paper argues that we need to focus on students' growing identity that is embedded into a sense of being and is individually experienced and constructed. Hence the notion of dashboard literacy suggests that institutions need to work with students to develop their personal and reflective processes to enhance the way that dashboards are interpreted.

The paper provides evidence that students may be motivated by seeing their data presented in a dashboard format and this can lead to changes in behaviour which are likely to lead to improved student outcomes and attainment. It also illustrates how students' engagement with dashboards is highly individual and dependent on their personal disposition and orientation to learning. Hence their use needs to be treated cautiously recognising the power that these tools have to shape impact on students' well-being alongside their potential.

Keywords

Dashboard, students' response, learning behaviours, literacies, literacy.

Context and rationale

Dashboards are the graphical interface that manipulate and present data about students' learning behaviours (attendance, visits to the library, which books they take out, their attainment etc). Although only a few UK HEIs have developed a dashboard for students, most other UK HEIs have an aspiration to develop their use (Sclater 2014).

Learning analytics take students' behaviours as "proxies for learning" and in doing so they simplify and codify learning in terms of what they are able to measure. There have been critical views of other uses of such top down technologies including Land and Bayne's (2002) analysis of the VLEs that applied Foucault's (1977) metaphor of the panoptican, a prison designed for easy surveillance which brings about compliant behaviours even when prisoners are not being watched. Similarly, MaFarlane has critiqued the way that the UK higher education audit culture uses measures of student performance as proxies for their development (cognition) (2017, p.47). Gourlay (2015) has problematised the notion of student engagement which is complex and often

not visible and notes that the term student engagement as defined by Trowler (2010) and Coates (2007 in Trowler 2010), misses out on the invisible, the intangible and the process aspects of learning (interlocution). She argues (2017) that the notion of time on task is problematic and leads to a 'tyranny of participation' (2015, p.402). These critiques of top down approaches to defining and measuring learning provide a critical lens to understand the limitations of dashboards.

Research into use of dashboards is in its early stages with some evidence of their positive impact on student engagement leading to improvements in student motivation, retention, satisfaction and attainment (Duval, Verbert, Klerkx, Govaerts, & Santos 2013; HEA 2014; Sclater 2014; UCISA 2015). However, much of the focus of the research is on the technical aspects of collecting and analysing data (Papamitsiou & Economides 2014; Jivet, Scheffel, Drachsler, & Specht 2017) with little understood about how students respond to seeing data presented in this form (Duval et al. 2013). Jivet et al. (2017) have carried out a literature review of 26 papers to identify which educational concepts are integrated into the design of student facing dashboards. They found that the majority of papers employ self-regulated learning. However, they argue that the use of self-regulation principles needs to be expanded to incorporate changes that are cognitive, emotional and behavioural rather than being limited to the metacognitive processes associated with self-regulated learning. In addition, they comment that even when a dashboard design has been informed by principles of self-regulation, they tend to focus on reflection and evaluation but the dashboards need to support other parts of the self-regulation process such as goal setting. Their paper concludes by arguing for more research into how learner dashboards are experienced and used by learners and this is the gap that this small scale study set out to address.

Research Aims

- To identify which elements of dashboards design were most valued by students;
- To identify students' emotional and learning responses to seeing data presented about themselves via a dashboard;
- To identify the potential and limitations of using dashboards with undergraduate students;
- To identify questions raised by their use for future research in the area.

Methods

The study was small scale, using two methods of data gathering: focus groups and semi-structured interviews. A focus group was used first to generate an understanding of how to design the dashboards, and in particular to understand which types of the dashboard elements e.g. pie chart, comparative data, progress, word cloud, students liked. Following the focus group, individual interviews were held with twenty-four students who were given their own data in dashboard format and then their response was explored. The interview was semi-structured around three open interview questions:

- What were your response to seeing the dashboard elements containing your actual data?
- What action would you take as a result of seeing your data?
- Whose responsibility do you think it is to act on the results of your data?

Sample

The sample was final year undergraduate students within the School of Education at a single case study UK higher education institution. The sample for the focus group and first round of interviews was a self-selecting group of 10 students. The second round of interviews involved a whole cohort consisting of 14 final year students.

The academic range of the sample was varied, with students in the first round of interviews ranging from 1st to 168th in their cohort. Their on-track score (showing what class of degree the students were on track to get ranged from 51% (low 2:2) to 74% (1st) which is a range of 23%. The dashboard presented each student with their performance in a recent assignment: for half of the group this assignment mark was better than their overall average, and half of the group did worse in this assignment than their overall average. This suggests that we had the potential to uncover a range of emotional responses to the assignment data, not just being pleased that this assignment was bringing their average mark up or just disappointment that it was lowering their mark. Overall the sample had significant variation in the academic range of the students and in where this mark sat on their overall profile.

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Ethics

The study was sensitive in nature, given its focus on students' academic performance. Ethical concerns related to providing data about progress to students which might negatively impact on their well-being. These students were all in final year, a time of increased anxiety and pressure as they come towards their final pieces of assessed work that will determine their degree classification.

BERA principles informed the study (2011). Participation was voluntary, so students made informed choice about what they would get out of participation. The value to the students was that they would get some first-hand experience of data gathering which might benefit them in terms of being able to apply this understanding to their own research. In addition, providing students with data about their progress has been found to support positive student engagement and retention (see the rationale for the study). We were aware of the responsibility that we had for supporting students' positive experience of receiving data about their progress. We did this by preparing carefully to ensure that all the data presented was valid, and by helping students to interpret their data in a way that would encourage positive outcomes. For instance, explaining how the on-track score was calculated and how it will change as future results are entered (we explained how the details of the final degree classification is arrived at by explaining that the lowest mark is dropped from the calculation of the final degree classification and talked in particular how the student's current on-track score could be improved). Students all appeared to value this discussion and find it motivating. Students' identity has been anonymised through the use of pseudonyms.

Analysis

Our analysis uses Sutton's (2012) feedback literacy notions to understand the data. Sutton (2012) draws on understandings of academic literacies to make the case for the notion of feedback literacy. The work of Lea and Street to understand the nature of students' academic practices identified the notion of Academic Literacies, which are embedded practices that exist within discipline values and norms, and have epistemological roots (1998). They suggest that academic literacy is not simply a set of discrete technical and instrumental skills which learners must master, rather academic literacies is entwined with "issues of identity and the institutional relationships of power and authority that surround, and are embedded within, diverse student writing practices across the university" (Lea and Street 1998, p.157).

Drawing on this understanding of Academic Literacies, Sutton (2012) has developed a model of feedback literacy around three interrelated dimensions: knowing, being and doing, and suggests that acquiring feedback literacy is mediated by the students' perceptions of their university teachers' identities.

In the analysis of the data we provide a description of each of Sutton's (2012) dimensions, knowing, being and acting, followed by quotes from our data which exemplify each dimension. We then conclude by arguing that there is a particular type of literacy associated with understanding dashboards.

Knowing

Sutton (2012) describes the knowing dimension of feedback literacy as engaging with the epistemological dimension of feedback in which academics comment upon the quality and quantity of knowledge learners have presented, and also feedback for learning which offers guidance on how academic performance can be improved. In relation to dashboards, the knowing dimension has a number of features including checking its accuracy (especially the attendance data), understanding their individual marks and their significance to their personals goals (ipsative feedback). It also involved understanding where their performance sits in the cohort (norm referenced performance) and understanding their performance relative to criteria for good students (criteria referenced performance).

The ipsative dimension is illustrated in the following examples where students are making sense of the dashboard and the way that it presents their data. Their understanding of the data is as something personal, that is about their own academic development or their interaction with the university:

> There is no point in seeing an average of everybody's marks, only because it doesn't really matter what other people get because it's only your marks that matter…I like the pie chart for the presence and absence, only because it makes you feel a little bit better when you see that it's not as bad as you thought. (Ingrid)

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One of the more challenging aspects of the dashboard is seeing how one's performance compares to the rest of the cohort - norm referenced data. The responses to norm referenced data were highly personal depending on the student's disposition: some students liked knowing this information as it helped them to better understand their position in the cohort. It was surprising that it was not only those who were doing well who felt this way: Claire who scored 71% and was 25th in the cohort of 178 (towards the top of the class) was happy to see her results compared to others:

> It was quite useful for me because I know my position in the class…Knowing your position in a class is always a nice thing because you know where you are, what you need to do, do you need to move up … are you on the right track? Are you following other classmates? (Claire)

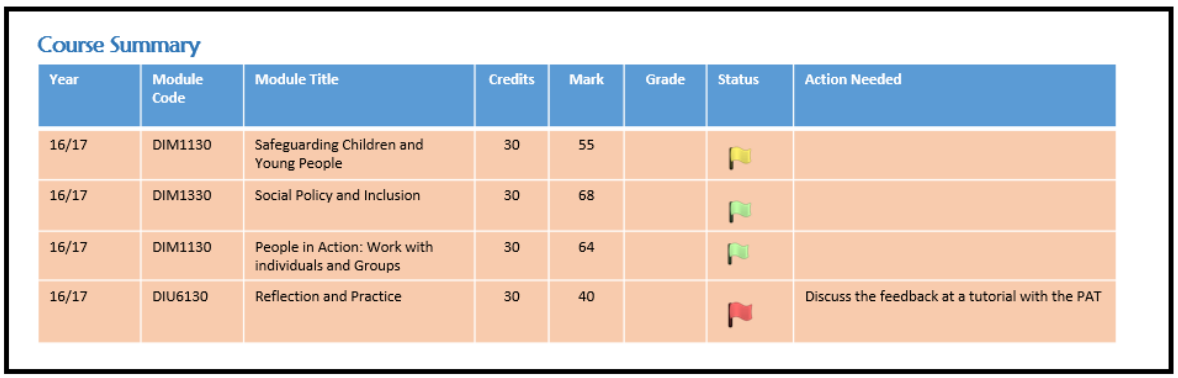
However, Justine who had a higher mark than Claire, was really uncomfortable seeing her mark being compared to others because it took away some of the satisfaction that she felt with achieving a good mark:

> I'm happy with that [mark of 75%] but I don't think I still need to know what position I'm in. Because I know that I've done better than the majority, so that's fine… I was happy with the grade and I've done better than the majority I still think that [positional data] kind of makes me feel I still could've done better. (Justine)

Other students were more ambivalent about seeing their mark being compared to the rest of the cohort. For instance, Jasmin who was around the middle of the group and Ingrid who was in the bottom 10% both expressed a less emotional response to this comparative data:

> I mean I would like it to be higher but, because I know it's not one of my best, yeah. I do like it because you can see kind of where you are, but then it kind of makes me think, oh well eighty-two people are better than me. (Jasmin)

The final aspect of 'knowing' (understanding) dashboard feedback relates to ways that students responded to data presented in criteria referenced form. On the dashboard students were able to see their score relative to thresholds which we determined: red, amber and green flags were used to RAG rate the score that each student received see Figure 1.



Course Summary

Year	Module Code	Module Title	Credits	Mark	Grade	Status	Action Needed
16/17	DIM1130	Safeguarding Children and Young People	30	55			
16/17	DIM1330	Social Policy and Inclusion	30	68			
16/17	DIM1130	People in Action: Work with individuals and Groups	30	64			
16/17	DIU6130	Reflection and Practice	30	40			Discuss the feedback at a tutorial with the PAT

Figure 1 A student's profile with RAG rating flags

> I like the flags because it's another visual aid to see, okay well if I'm green I'm good (Rebecca)

> if you're going through it in your first year you don't really know what you're doing and if you see [the flag saying] "need to make an appointment" you are more likely to make an appointment because you know you haven't done that well. (Ingrid)

RAG rating is a technique used to benchmark in that it indicates where a student's performance is acceptable (good), at risk (amber) and below the desired performance (red). RAG rating, makes criteria referenced judgements about what is considered to be 'good' (green) and bad (red). It encodes a set of values and determines what is judged as success (green) and what is judged as failure (red). In our dashboards we coding

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these firsts and 2:1 scores as green (i.e. 60% and above), scores in the 2:2 range amber (i.e. 50 to 59%), and scores below this red (ie. below 50%). This is, of course, problematic as it imposes a set of values on the student and does not allow them agency to determine their own personal goals. Many of our participants wanted to change the way that we had RAG rated their profile to reflect their personal aspirations, see the quote from Jasmin, whilst others were happy for the institution to set the flags, see the quote from Marcia:

> The thing about the green flag is some people will be getting a 2:2 and actually that will be an incredible grade for them. For me, I obviously want a first, and it is possibly still doable as long as I work my socks off. (Jasmin)

> I'm happy for it [the flag colour] to be decided for me because I think it motivates me more to work harder, whereas if I set it myself I'd just [set it] too low. (Marcia)

Becoming

Sutton's (2012) second pillar of feedback literacy is about becoming which he explains as the student's investment of their identity in their academic work. Sutton (2012) illustrates the power that feedback has to shape a student's identity which involves feelings of being worthy. For instance, that they have the ability to achieve the degree. Feedback affects students by helping to develop their self-confidence or alternatively it can have a negative impact on individuals. Sutton (2012) argues that students need to recognise that accepting feedback is a process of self-development and for some learners developing their mode of educational being constitutes a challenging and anxiety-provoking experience.

When exploring our data, it was clear that similar processes occurred as students interpreted the data in their dashboard. Marcia talks about seeing herself as a 2:1 student and feeling concerned at the way the dashboard appears to show her as doing less well:

> oh am I really going to graduate with a 2:2? […] Because I've always seen it as hoping to aim for a 2:1 or a first (Marcia)

The criteria referenced data presented a significant emotional challenge for many learners both those at the top and the bottom of the group. Jasmin, who was on track for a first, but who scored around the middle of the cohort in the particular assignment presented on the dashboard, conveys her disappointment: she needs to process this emotion to make sense of it and looking at the dashboard display that shows where stands in the cohort is a way to do that:

> Because I was really disappointed with it [seeing her position in the group], but then seeing that maybe that is average, it's not as bad I suppose (Jasmin)

Seeing her score of 75% compared to the cohort, Justine expresses how this has a negative impact on her:

> 14 other people have still done better than me...I had thought I'd really, really topped it, I've maxed out here. And it's taken away a bit from that feeling of elation. (Justine)

For some students seeing their data in this way will boost their self-confidence as a learner:

> So that's a bit of an ego boost isn't it? It tells you how well you're doing (Rebecca)

> it's quite nice to see that I'm using it [VLE] enough but I'm definitely using it more than the others and it seems to be reflecting in my grades…. I've done better as the years have gone on and it's really shown how much university has helped me progress with my academic writing skills (Rebecca)

Acting

The final dimension of feedback literacy is that of acting on feedback. It involves reading, thinking about and taking action as a result of feedback (Sutton 2012). Similarly, students needed to read and interpret their dashboard data and in doing so it invoked a range of ways that they would act in response. The following quotes illustrate these action-orientated responses to seeing their data. For many of our students their response was to feel more motivated, determined to do better and to prioritise their academic study:

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> I think when I first, as soon as I saw it I decided I'm taking a month off [paid] work to just get on with my dissertation (Marcia)

> I'd work even harder to get my last module to be like, so hopefully I would get a first type of thing…. even if I were on track for a third I think that this probably would motivate me if it had some pointers as to what I could be doing to get a higher grade. (Sarah)

However, alongside the positive impact on motivation there was also evidence that providing data could be unsettling and destabilising. Ingrid's response to seeing marks from previous years that she can't change is feeling of sadness:

> The saddest one that will make me feel is like the core summary overall because looking back on grades that you've previously had is, like you can't really change them any more so you can't really do anything. (Ingrid)

Thus in relation to the 'acting' dimension of dashboard literacy, for most students, dashboards appeared to help them reflect on learning and to motivate learning. Much of the literature on use of dashboards has focussed on their potential to support self-regulation learning behaviours (Jivet, Scheffel, Drachsler & Specht 2017) and our data supports this potential of dashboards, however we have also highlighted a range of ways that students engage with their dashboard data including deeper questions of learner identity, discussed above.

Whilst there were examples of positive learning behaviours in our data, there were ways that the dashboards encouraged action that might be of questionable value. Many of the students focussed on the accuracy of their attendance data and this provided a distraction from academic aspects of the dashboard. They wanted to question its accuracy and wished to correct any inaccuracies in their recorded attendance pattern. This investment in time and effort to correct attendance data could be seen as effort that is wasted or that could be better spent on other learning related activities. Hence the potential of dashboards to raise anxiety levels was evident. Further it illustrates MacFarlane's (2017) notions of student presentism, whereby students feel compelled to attend lectures because they are being monitored rather than because they believe that they will be a valuable learning opportunity and demonstrates how an institution's policies and practices shape students' behaviours in ways that may not be the best use of their time and effort.

Dispositions to learning and response to dashboard

Sutton talks about grades being polysemic, in that they signify different meanings to different students (2012, p.34). Similarly, to understand the impact of dashboards leads to seeing student's responses as very personal with a strong ontological dimension: there is no 'one size fits all' approach to the way that dashboards are interpreted by students. Justine and Ingrid's response to the dashboard was completely different. Justine was on track for a first and had the 15th highest mark yet she found it challenging to receive this information via the dashboard. Whereas Ingrid, who was doing significantly worse, coming 168th out of 178, is phlegmatic about her position and finds a way to talking to herself that is kind on her self-image:

> I was happy with everything apart from the position. I still don't think that part's relevant. Although I know that I've got, I got 75% and this next section, the distribution of marks, shows that I got higher than the average, I'm happy with that but I don't think I still need to know what position I'm in. Because I know that I've done better than the majority, so that's fine. [I don't like it because] I know that fourteen other people have done better than me… I still think that kind of makes me feel I still could've done better. (Justine)

> [How do you feel seeing the positional data?] I'm not really that bothered because if you already know your grade and you know that you didn't do that well you know, you've kind of already guessed that you're not going to be at the highest point with everybody else. It reminded me of when I was like younger and I would come back home with like a bad grade and show it to my mum…and I would turn around and say 'oh well Helen got worse than me', and she said 'well it doesn't matter because you're not Helen'. (Ingrid)

The notion of the variation in student dispositions (Barnett 2012) helps to understand students' response to dashboards and to avoid simplistic over generalisations about how dashboards impact on students as if they are a

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homogenous body. Understanding this personal (ideographic) response is important because institutions need to avoid losing sight of the individual when scaling up use of data.

Conclusion

In this paper we have analysed some of the complexity in the ways that dashboards are understood by individual students using Sutton's (2012) dimensions of feedback literacy: knowing, becoming and acting. The paper has illustrated how these dimensions apply to students' understanding of dashboards and suggested the term 'dashboard literacy' to explain the ways that students make sense of them. By identifying students' engagement with dashboards as a literacy practice, we suggest that it involves a growing student identity and is embedded into their identity work in that it is individually experienced and constructed and not simply a technical skill or simply a matter of a cognitive understanding. Thus we suggest that institutions should find mechanisms to ensure that students engage with all three dimensions of dashboard literacy (knowing, becoming and acting).

We have illustrated how institutions need to be cautious in relation to their implementation of dashboards because of their power to valorise the sorts of behaviours and the levels of attainment that are seen to be important, valid and worthy of measurement or recognition. This is particularly evident in relation to use of criteria referenced presentations of the data. Techniques such as RAG (red, amber and green) ratings can impose values onto students and thus reduce student agency as they embed institutional goals. This is part of an ethical dimension of the use of dashboards which needs to be consciously considered by institutions to ensure that dashboards are tools that foster and develop students as active agents in their own learning. In addition, we suggest that institutions should make explicit the principles that underpin their use (see for example the Open University's 2014 Policy on Ethical Use of Student Data for Learning Analytics).

Dashboards are often associated with interventions offering extra support which are targeted at particular, usually low-attaining students (Sclater & Mullan 2017). Our findings have suggested that the impact of seeing interventions presented via a dashboard is likely to be emotionally charged for some students, and has the potential to have a negative impact on student's well-being and to reinforce feelings of negativity and 'otherness' (Thomas 2017). Thus within a context of increased incidence of students' mental health, illustrated in the recent Higher Education Policy report (Brown 2017) institutions have a duty to take care how they implement dashboards.

There is a growing expectation that data gathered about students' learning behaviours and attainment will be shared with students in the form of a dashboard (Sclater 2014). The paper has illustrated the ways that students respond to seeing their data and, we suggest, these understandings have significance to the sector as these tools become more widely adopted. In addition, we propose some practical recommendations for the design and implementation of dashboards that flow from this paper:

- Ensure a focus on ipsative ways of presenting data;
- Consider ways to make norm-referenced data optional and/or allow students control over how norm-referenced data is presented (e.g. allowing students to choose who their scores are compared against (average mark for the module or cohort or to the highest performers on the module or cohort);
- Enable students to set their own goals so that any criteria referenced display is tailored to an individual student's targets;
- Embedded the use of dashboards into personal development planning and or personal academic tutorial processes to ensure that each student is individually and collectively supported to interpret and plan how to act based on their data;
- Focus on the way that interventions are signposted with an awareness of the emotional component of feedback;
- Develop institutional principles to underpin adoption of dashboards.

The study was based on final year students and the extent to which the findings apply to other less experienced learners needs further research. However, bearing in mind the caveats discussed in the paper, it provides evidence to support the use of dashboards as tool to support student engagement and motivation.

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