



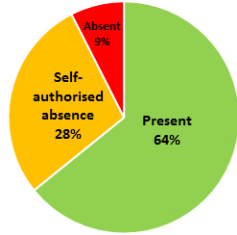
Four design principles for Learner Dashboards that support student agency and empowerment.

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Attendance Monitoring Data:



Module Assignment Details:

Module: Abrahamic Religion in Contemporary Contexts
 Assignment: Essay
 Overall Percentage: 63%
 Grade: B
 Average percent for the whole cohort: 64.5%
 Position in Cohort: 9th out of 17

You are currently on track for:



Distribution of Grades

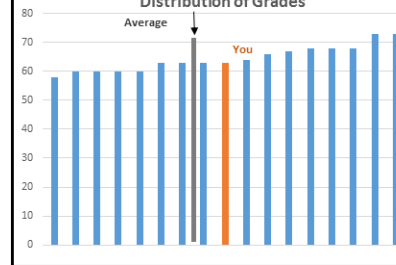
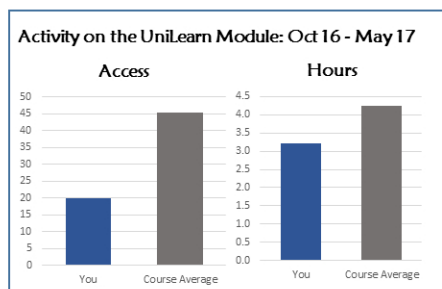


Figure 1: Descriptive Learner Dashboard elements



Personal Tutor Meeting Log

6/5/16 – Discussed poor draft assignment result, reasons and possible course of action.

5/3/16 – Progressing reasonably well [AS!]

10/1/16 – Referred to Academic Support Tutor for help with correct referencing

12/9/15 – Initial meeting – all fine.

Course Summary –

Year	Module Code	Module Title	Credits	Mark	Grade	Status	Action Needed
15/16	DFR6130	An introduction to Dharmic Religions	30	57	C	🚩	
15/16	DFM1230	Self Society and Welfare	30	56	C	🚩	
15/16	DFR6230	Introduction to Abrahamic Religions	30	54	C	🚩	
15/16	DFM1030	Theories and Strategies for Learning	30	46	D	🚩	
16/17	DIM1130	Safeguarding Children and Young People	30	56	C	🚩	
16/17	DIR1230	Dharmic Religion in Contemporary Contexts	30	61	B	🟢	
16/17	DIM1330	Social Policy and Inclusion	30	59	C	🚩	

Figure 2: Three elements of the student dashboard

Four design principles for Learner Dashboards that support student agency and empowerment

Abstract

Purpose: The paper takes a student-centred perspective to understanding the range of ways that students respond to receiving information about their learning behaviours presented on a dashboard. It identifies four principles to inform the design of dashboards which support learner agency and empowerment, features which Prinsloo and Slade (2016) suggest are central to ethical adoption of learning analytics.

Design/methodology/approach: The study involved semi-structured interviews with 24 final year undergraduates to explore the students' response to receiving dashboards that showed the students' achievement and other learning behaviours.

Findings: The paper identifies four principles that should be used when designing and adopting learner dashboards to support student agency and empowerment.

Practical implications: The paper suggests that these four principles are guiding tenets for the design and implementation of learner dashboards in higher education. The four principles are: 1) designs that are customisable by students; 2) foregrounds students sense making; 3) enables students to identify actionable insights; 4) dashboards are embedded into educational processes.

Practical limitations: The study was based on a small sample of undergraduate students from the final year from one academic school. The data is based on students' self-reporting.

Originality/value: The paper's originality is that it illuminates student-centred principles of learner dashboard design and adoption.

Keywords: Learning Analytics; dashboards; student agency; student empowerment; design.

Article Classification: Research Paper

Introduction

Learning Analytics is a rapidly growing area in Higher Education (Howell et al., 2018). It is defined, by Slade and Prinsloo (2013, p.1512) as the “collection, analysis, use, and appropriate dissemination of student-generated, actionable data with the purpose of creating appropriate cognitive, administrative, and effective support for learners”. Dashboards display the outputs from learning analytics in a range of visual formats for instance through graphs, bar charts and other visualisations (Khan and Pardo, 2016). The dominant use of learning analytics dashboards has been to provide data for use by academics or managers to identify students at risk of dropping out, or to identify where interventions are needed, rather than being used by students (Schwendimann et al., 2017; Willis III et al., 2016). However, there is a growing interest in developing and adopting student-facing learner dashboards (Ferguson et al., 2014; Newland and Trueman 2017).

Learning analytics involves gathering data about student behaviours that the student may not be aware of, and this leads to ethical issues related to the challenge that institutions are surveilling their students without their explicit consent (Prinsloo and Slade, 2017). In addition, the types of data gathered, and the significance that is attached to these data makes assumptions about what is valued and is shaped by those who design the algorithms (Wilson et al., 2017). Indeed, dashboard development is typically owned by computer service departments (Ferguson et al., 2014) and driven by a focus on the possibilities of large datasets to reveal information (Dyckhoff et al., 2013). Frequently, students are not consulted in the design of the dashboard (Roberts et al., 2017). Thus providing students with access to dashboards that present them with visualisations of their data is a move that redresses the hitherto institutional focus of learning analytics.

Adoption of learning analytics and dashboards is often accompanied by a technological deterministic assumption that their introduction will inevitably lead to positive results (Howell et al., 2018). Yet Khan and Pardo (2016) found no correlation between students’ engagement with their dashboard and academic performance. Similarly, Viberg et al. (2018) based on an analysis of 252 papers on learning analytics in higher education, found little evidence of improvement in student learning outcomes from the use of the analytics. Even when research has identified a positive impact on students’ motivation from use of learner dashboards the impact is not uniform with a few students having a negative impact on their motivation (Bennett 2017). Indeed, Bodily and Verbert who reviewed 93 papers on students’ use of learner dashboards, have noted that uptake of learner dashboards by students was low.

This means that the field needs to better understand the ways that student dashboards can be designed and implemented in order to engender positive student behaviours. This paper, therefore,

sets out to establish principles for design and adoption of learner dashboards, which will help to ensure that they are effective in terms of their impact on students' behaviours.

Design of learner dashboards as 'tools in use'

Learner dashboards provide students with visualisations about their learning behaviour with the aim to develop "student autonomy, giving students more control over their learning and helping them feel more intrinsically motivated to succeed" (Bodily and Verbert, 2017, p.405). There are, broadly, three types of learner dashboards: predictive, modelling and descriptive. Predictive types use machine learning based on computer algorithms which draw on a range of trace data to predict a student's likely outcome. Frequently the algorithms are used to produce an 'at risk' rating for individual students (Arnold et al., 2014; Prince 2018). Modelling dashboards provide students with a visual representation that models their learning behaviours. For instance, aspects of a students' online behaviours such as communication, initiative, presence that have been derived from the number of posts, the number of comments in reply to others' posts, the time spent online etc. the third type of dashboard is descriptive and displays past learning behaviours. Figure 1 is an example of a descriptive dashboard and depicts four dashboard elements displaying a particular student's attendance in pie chart form, the score that they are currently on track for, and their attainment in a particular assignment represented as a bar chart and in a narrative form. All three types aim to provide a student with representations of their learning data, presented in graphically rich ways.

Figure 1: Descriptive Learner Dashboard elements

There is a growing body of literature about the design of learner dashboards and several literature review papers which scope the field. A comprehensive literature review by Bodily and Verbert (2017) involved identifying and analysing 93 papers in relation to their functionality, data sources, design analysis, student perceptions, and measured effects. They found that the clear majority of papers focussed on technical features such as the data sources, the functional aspects (e.g. data visualisations, what the dashboard aimed to do) whereas only 2 papers reported on how students' behaviours were changed through the use of learner dashboards and only a third (34 out of 93) focussed on students' perceptions of the design (Bodily and Verbert 2017). Indeed, Bodily and Verbert conclude that the field needs more studies that aim to understand the students' perspective and which go beyond the technical features to examine the dashboards as 'tools in use'.

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3 Another comprehensive meta-analysis examined the impact of learning analytics on student
4 outcomes based on 254 papers and found that there was limited evidence of improvement in
5 learning outcomes (Viberg et al. 2018). Viberg et al's (2018) study was broader than Bodily and
6 Verbert's (2017) in that they included not just student facing dashboards but all types of learning
7 analytics tools (i.e. included those aimed at tutors and administrators) but similarly they argue that
8 the field needs to employ more mixed method and qualitative studies to understand how students
9 interact with learning analytics and in order to better understand and optimise learning and the
10 environments in which it occurs.
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17 Both these meta studies undertaken by Bodily and Verbert (2017) and Viberg et al. (2018) point to
18 the need to understand students' views of dashboards qualitatively and as 'tools in use' rather than
19 as technical artefacts. This conception foregrounds the purpose of the tool in that it considers how
20 students make use of information presented via the dashboard and how it might change their
21 behaviour as a result. Framing dashboards as 'tools in use' focusses attention on the perspective of
22 the user, the learner, and on the purpose of dashboards as tools that provide feedback to students
23 to encourage them to make more informed decisions about their study behaviours (Bennett 2017;
24 Howell et al. 2018)
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32 This paper draws on Prinsloo and Slade's (2016) ethical principles for the adoption of learning
33 analytics as the interpretive lens. Prinsloo and Slade (2016) argue that in order to redress the
34 asymmetrical power relationships associated with use of learning analytics in higher education, the
35 ethical adoption of learning analytics needs to increase student agency and empower students as
36 participants in their learning. In doing so adoption of learning analytics moves students from
37 "quantified data objects to qualified and qualifying selves" (Prinsloo and Slade 2016 p.159). This
38 conceptual lens presents an emergent way to understand design of student dashboards, which are
39 frequently atheoretical (Jivet et al. 2017). It moves beyond the most dominant way that dashboards
40 are being envisaged, as tools to make students aware of the progress, to develop their use to engage
41 students in acting upon this feedback to improve cognitive, behavioural or emotional competencies
42 (Jivet et al. 2017). The approach is supported by Wise (2014) who suggests agency is one of four
43 principles for designing learning analytics interventions (alongside Integration, Reference Frame and
44 Dialogue).
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54 Thus, the paper takes a student-centred perspective to understanding learner facing dashboards
55 through seeing them as 'tools in use'. It aims to identify principles to inform the design of learner
56 dashboards that will enhance student agency and empowerment.
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Methodology

The study aimed to understand the ways that students interpreted the dashboard and the extent to which it might impact on their learning behaviours. Thus, it employed semi-structured interviews that enabled students' responses and the meaning that they attach to dashboard elements to be gathered. The interviews were undertaken in two rounds, initially a self-selecting group of 10 students from a cohort of 178, but the second round was targeted at a smaller cohort and 14 out of 16 participated. Thus the second round of interviews helps to overcome the bias inherent in self-selecting samples. Both data sets were analysed to provide a rich understanding of how students interpreted the dashboard elements. The academic range of the sample varied from 1st to 168th out of 178 in the group for the first round, and in the second from 1st to 16th in a group of 16 students, for a particular assignment presented on the dashboard. The dashboard displayed the overall degree classification that the student was on track to achieve, and this ranged from 51% (low 2:2) to 74% (1st) for the first round, and the range of participants in the second round was from 60% (border of 2:1 and 2:2) to 76% (1st). Slightly more students were doing worse in the assignment presented on the dashboard than their overall on-track score. Therefore, the sample 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 disappointment that it was lowering their mark. The dashboard used in this study contained seven descriptive elements: Figure 1 shows four of these elements and Figure 2 illustrates the other three elements.

Figure 2: Three elements of the student dashboard

This was the first time that the students had seen their data presented in this way and the semi-structured interview format enabled them to ask if they wanted clarification about their interpretation of their data. The interviews lasted between 10 and 30 minutes (typically 15 minutes) and addressed 3 questions: What were your feelings on seeing the data? Whose responsibility do you think it is to act on this data? Would you take any action/do anything different as a result of reading your data?

The study was sensitive in nature, given its focus on students' academic performance. BERA's (2018) ethical principles informed the study. Participation was voluntary, and students' identity has been anonymised through the use of pseudonyms. There was a responsibility to ensure that the students were supported during this process and this was achieved by preparing the data carefully to ensure

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3 that it was valid, and by helping students to interpret their data in a way that would encourage
4 positive outcomes. For instance, explaining how the on-track score was calculated and how it will
5 change according to future module results. The students were also encouraged to reflect on their
6 progress and plan how to approach their final year of study. Ethical permission was given by the
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10 Ethics Committee of the School of Education at the case study University.
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13 The analysis used a 4-stage inductive approach outlined by Bryman (2012) in which themes were
14 identified through interpreting the data in relation to the ways that it appeared to support students
15 to become both agentic and empowered (Prinsloo and Slade 2016). This inductive approach led to
16 identification of four key principles which have been developed and refined through a reflective
17 interpretative process. The aim was to identify principles that position students as active in the
18 process of interpreting their dashboard data and enable students to translate their understandings
19 into practical actions. The principles that were identified relate not only to the design of dashboards,
20 but also to the way that the tools are used in practice reflecting the need to focus on 'tools in use'.
21 They identify the things that students particular valued when they saw their dashboard and focus on
22 how dashboard design might support positive impact on students' behaviours.
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32 The study has some methodological limitations in that it uses a small sample of final year students
33 from one academic discipline in one UK university. However, a strength of the study is that nearly a
34 whole cohort was interviewed thus avoiding the bias that arises from self-selecting samples. The
35 interviews provided a rich source of insight into students' responses that enables the details of
36 individual's dispositions, experiences of study and other factors to be considered thus providing the
37 study with depth and nuance through these qualitative interpretations. The study focusses on
38 students' responses to their dashboard, but the study was not able to track the impact that
39 dashboards have on students' actual behaviours which is an area that is worthy of further research.
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49 Findings: Four principles for learner dashboards

50 51 52 Principle 1: Customisable by the student

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54 Throughout the data, there were many examples of how students engaged in a personal
55 interpretative process as they viewed their learner dashboard. Their interpretations appear to be
56 influenced by a range of factors including the individual's disposition and the way that they approach
57 their studies, their graphical and data literacy, and a range of contextual factors, such as the type of
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3 course that they are studying (face to face, online, exam orientated, compulsory attendance,
4 professional components etc.).
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7 The need for students be able to customise their dashboard was particularly evident when
8 considering how criteria-referenced data is presented. RAG (Red/Amber/Green) rating is a common
9 technique for presenting data because it conveys simply three benchmarked levels of achievement
10 (You, 2016). In Figure 2 the Course Summary shows a RAG rated flag to indicate a student's
11 performance with green for 'good' which was allocated to scores over 60%, amber suggesting a
12 result that was acceptable for scores 50-59%, and red for scores below 50% that could suggest a
13 problem. The data illuminated the way that RAG rating imposed the institutional perspective on the
14 learner in the way that the flags had been colour-coded according to the institutional priorities.
15 Some students wanted to set their own RAG criteria to reflect their own personal goals (for instance
16 Jasmin and Asmah) whilst others were happy for the institution to set the flags (for instance Marcia):
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25 *The thing about the green flag is some people will be getting a 2:2 and actually that will be*
26 *an incredible grade for them. For me, I obviously want a first, and it is possibly still doable as*
27 *long as I work my socks off. [Jasmin]*
28

29
30 *I don't really get this bit, because this is green, and it's just a B [Asmah]*
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32 *I'm happy for it [the flag colour] to be decided for me because I think it motivates me more to*
33 *work harder, whereas if I set it myself, I'd just [set it] too low. [Marcia].*
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36 The student's interpretation of the data and how it contrasts to dashboard displays that are pre-
37 determined is clear in these quotes: both Asmah and Jasmin wanted to get a first and thus are
38 aiming for marks in the 70s so did not like the green flag being used for marks in the 60s.
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41 The need for customisable displays is supported by Sluijter and Otten (2017) who noted some
42 students were satisfied with the minimum required score to pass whilst other students may aim to
43 get the highest mark possible. As dashboards become technologies owned and supported by the
44 institution, it is likely that their adoption will tend to be shaped by the institutional values, indeed as
45 the institution pay large sums of money to buy proprietary systems, they will expect to see 'return
46 on their investment' driven by institutional measures of success such as retention. Placing a focus
47 on the customisation of a dashboard helps to redress this institutional focus.
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54 The issue of comparison with others in their cohort resulted in a range of reactions reflecting the
55 student's disposition and this supports the principle of allowing them to customise what they see. In
56 Figure 1 the elements in the top and bottom right give the student information about where they sit
57 in relation to the others in the cohort. In the quotes below Nulla found this comparison motivating
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3 whereas Justine preferred not to know this information, whilst Malcolm and Ingrid thought it was
4 irrelevant:

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7 *With every class you've always got the people that are really smart and then, you know, the*
8 *people you want to kind of be like* [Nulla]

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11 *I don't think I need to know what position I am in [...] then I kind of know that fourteen other*
12 *people have done better than me* [Justine]

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15 *The average of everyone else, doesn't really mean anything to me personally. As long as I'm*
16 *doing what I need to do.* [Malcolm]

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19 *There is no point in seeing an average of everybody's marks, only because it doesn't really matter*
20 *what other people get because it's only your marks that matter.* [Ingrid]

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23 Whether a student is able to see their performance compared to others in the group (i.e. norm
24 referenced data presentation) is an unresolved and contentious topic in the learning analytics
25 literature with one study identifying that students liked comparison with others (Konert et al. 2018)
26 whereas another found that students preferred to see only their own data (Tabuenca et al 2015) and
27 others showing that it depended on the type of student and who they are being compared to (Davis
28 et al. 2017). Similarly, this study identified a range of responses whilst many students valued being
29 compared to others (e.g. Nulla and Ingrid) this was not universally experienced (e.g. Justine) and
30 indicates the importance of students being given a choice in the way that their data is presented.

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33 There are many aspects to this customisability: what is displayed, how it is ordered, the way that
34 comparisons to the rest of the cohort are displayed (or not), how norm referenced and criteria
35 referencing displays are employed etc. However, the overriding message is that dashboards need to
36 be customisable by the student to reflect the way that individuals interpret their data influenced by
37 the student's disposition in ways that are not easily predicted (Bennett, 2017). Similarly, Roberts et
38 al. (2017) concluded that students should have the ability to decide if they want to see a dashboard,
39 and whether comparison data is presented.

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42 To summarise *Principle 1* argues that because dashboards are individually interpreted then displays
43 need to be customisable by the student to respond to their individual needs and in this way helps to
44 support a student's sense of empowerment and agency.
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Principle 2: Foreground students sense making

Principle 1 illustrated the personal interpretive process that students go through as they use their dashboards, and Principle 2 extends this idea and demonstrates how students can be supported in the interpretation process through the design features of the dashboards. There are many features that influence sense making including: the level of granularity, the level of aggregation, the form of display (pie chart, bar chart line graph or narrative etc.) and the type of data e.g. ipsative, criterion referenced, norm referenced. The following discussion of principle 2 illuminates some of the features that support student agency and empowerment, however a detailed discussion of data visualisations is beyond the scope of this paper. (For discussion of this topic see for instance Sedrakyan et al.'s (2018) mapping of data visualisations and educational conceptions.)

Students use their understanding of their particular experiences and context to inform their interpretation, so designs need to support this process. For example, when looking at the data students can draw on their memories of the experience of studying to interpret what they are seeing. Dashboards can be designed in ways that support or hinder the process of interpretation. For instance, the level of granularity in the data needs to enable a student to pinpoint precisely features of the data; being able to identify the source of the data (i.e. to distinguish between attendance from Virtual Learning Environment, VLE clicks) helps students to interpret the data as well as to trust its validity. Hence dashboards need to facilitate this rather than aggregating several sources together. Malcolm knew that the timing of a particular assignment was when he was dealing with some particular personal difficulties:

The reason I got this marks is due to family circumstances. I just had all on to get it in and it was just rushed [Malcolm]

For Sarena knowing which subject the mark relates to helped her to assess its significance:

I didn't really like that course anyway [Sarena].

The elements were presented in a variety of different forms including the use of graphs, bar charts, pie charts and words (see Figures 1 and 2) and it was evident that they affected the interpretation process:

They [the RAG rating flags] make it more obvious, because obviously you know green's good and red's bad and then yellow's like average [Sarena]

I'm not really a bar chart kind of person [Lydia].

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3 Students wanted to be able to select which displays were most relevant to their course study
4 patterns. For instance, if they were attending a course that was primarily delivered face-to-face they
5 did not see any significance in the VLE data:
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9 *I don't care how much I've spent on it [the VLE] [Nulla]*

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11 Similarly, some were hostile to the display element which showed their usage of the library saying
12 that they had other ways of engaging in their studies:
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15 *Don't feel this is relevant as people may have bought the books. [Pavan]*

16
17 *It's pointless to know how many visits you've made. [Rebecca]*
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20 Hence *Principle 2: foreground students sense making* is significant because it draws attention to the
21 student as the agent doing the interpretation and draws attention to the design features that
22 support this interpretation process including the form of the display, the way that students can
23 apply their understanding of context to understand the data given its level of aggregation and
24 granularity.
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31 **Principle 3: Enables students to identify actionable insights**

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33 One definition of learner analytics is that it should identify actionable insights: "Analytics is the
34 process of developing actionable insights through problem definition and the application of
35 statistical models and analysis against existing and/or simulated future data" (Cooper, 2012, p.3).
36 However, this definition gives power to the learning analytics and its algorithms. It suggests that the
37 dashboards will provide the student with the insights. Instead Principle 3 focuses on how students
38 can be active in the interpretation process and the ways that learner dashboard design, enable and
39 encourage students to become active and empowered in relation to their studies. This principle
40 could be realised in various ways, including helping the student to identify goals or behaviour
41 change. It might also be achieved through providing displays with a level of granularity that enables
42 the student to contextualise and interpret the display based on their course requirements and study
43 patterns. Dashboards can support students to be active and empowered by enabling and
44 encouraging students to interrogate their displays, to drill down and to identify how the display is
45 constructed and how the student's behaviours have affected the data being displayed. As suggested
46 by Principle 2, dashboards need to foreground the student to understand the provenance of the
47 data, (rather than aggregating data) support sense making and have the potential to enable students
48 to identify actionable insights.
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3 The analysis demonstrated that learner dashboards were generally motivational in that many
4 students identified actions that they would take that support positive engagement in their studies:
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7 *I need to get on those computers and check the marking criteria [Asmah]*
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10 *It shows me that I should be putting in a lot more hours than I am [India]*
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12 Changing behaviour is often challenging, see for instance Heath and Heath (2010), and learning
13 behaviours are similarly complex. Whilst the analysis presented here suggests that students will go
14 on to make changes in their behaviour, for instance India suggests that she will put in time to her
15 studies, a longitudinal approach would be needed to establish whether this change did occur.
16 Notwithstanding, *Principle 3: enable students to identify actionable insights* is a central principle
17 because it places the student as the active agent in the interpretation process. It focuses on the
18 need to consider how students might change their behaviour as a result of using the dashboard.
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27 *Principle 4: Dashboards are embedded into educational processes.*

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29 Context plays a significant role in the uptake of all technology artefacts into educational practices,
30 and as discussed above, these need to be viewed as ‘tools in use’ (Boyle and Ravenscroft 2012; Lund
31 and Stains 2015). Principle 4 focusses on the way that dashboards need to be embedded into other
32 educational processes and draws attention to the other people and systems that influence the value,
33 relevance and significance of their adoption.
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38 Within the institution, each student is allocated to a Personal Academic Tutor (PAT), who is expected
39 to meet with their tutees five times a year. These meetings provide students with someone who
40 knows about their academic development and could support students in the interpretation of their
41 dashboards and help them to identify goals and actions. The dashboard appeared to offer potential
42 to enhance the PAT-student relationship, leading to more informed conversations about a student’s
43 progress, and other development and support needs:
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49 *So if I can provide this data to them [their PAT] and they can help me to push to a first, I think*
50 *it’s really helpful. [Harry]*
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53 *I think it [taking the data to the PAT] would be very handy...because then they’d be able to*
54 *assess your data and you’d be able to discuss where you’re falling short and where you’d be*
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56 *[Lydia]*
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3 In addition, the students felt that having the dashboard data would give their PATs a more well-
4 rounded view of their engagement and effort beyond just their assessment marks:

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7 *For even the tutors to see the effort you're putting in [Lydia].*
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10 It needs to be recognised however that dashboards are a part of a much wider system of feedback
11 and support for students and therefore need to be considered within this context. They are just one
12 tool an institution has at their disposal to help support students, but at the heart of the student
13 experience is human interaction. Indeed, others have identified the significance of human
14 mediation in relation to student support (Thompson and Mazer 2009) and as illustrated above, the
15 dispositional aspects of interpreting dashboards appear significant. Torrance (2012) reminds us that
16 “providing and receiving feedback is a highly demanding emotional process, impacting on learners’
17 identities and notions of self-worth” (p.334).
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24 The fourth principle for dashboard design is therefore to make sure that the student dashboard is
25 embedded into other educational processes these might be a formal academic support system, or a
26 reflective developmental process and that include human interaction.
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32 Conclusions

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37 There is a growing use of data within Higher Education, yet to date, most of institutional adoption
38 focuses on how this can be used to support the organisation’s processes and practices, with little
39 attention being paid to students’ perspectives and how data might support the student experience
40 (Roberts et al. 2017). This study has addressed this gap by understanding students’ responses to
41 data. In doing so it takes up the moral imperative articulated by Slade and Prinsloo (2013) that
42 learning analytics should work with students so that they are “engaged as collaborators and not as
43 mere recipients of interventions and services” (p.1519). This paper illustrates students’ responses to
44 receiving data about their learning presented to them in dashboard format and draws on an
45 interpretive lens of student agency and empowerment (Slade and Prinsloo, 2013) to identify four
46 principles to inform the design of learner dashboards. The four principles: 1) *designs that are*
47 *customisable by students; 2) foreground students sense making; 3) enable students to identify*
48 *actionable insights; 4) dashboard use is embedded into educational processes, provide a road map*
49 *for developers and higher educational institutions in guiding their design and implementation of*
50 *learner dashboards. The significance of these four principles is that they shift our attention from the*
51 *technical features of dashboard design to foreground instead the ways that they are interpreted by*
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3 students. In doing so the principles emphasise values of student agency and empowerment which
4 Prinsloo and Slade (2016) propose as a key tenet of ethical adoption of learning analytics.
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7 The principles have significance particularly for developers of dashboards to guide and evaluate their
8 designs. For instance, principle 1, *customisable by the student*, suggests practical ways that the
9 function and form of dashboards might be designed so that students can tailor the displays to suit
10 their particular needs which would reflect their aims and aspirations, their personal dispositions (e.g.
11 response to peer comparison). Principle 2, *foregrounds students' sense making*, suggests making
12 available the data sources so that students are able to interrogate these, and not aggregating
13 sources so that their provenance is lost. It suggests enabling students to contextualise the displays to
14 their particular programme and circumstances. Principle 3, *enables students to identify actionable*
15 *insights*, suggests that designs should help students to interpret the data rather than digesting it for
16 the student. This might mean providing guidance to the student about what is on view and prompts
17 to help them to identify what actions they could take next.
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20 The final principle, *dashboards are embedded in educational processes*, places attention on the ways
21 that the tools are integrated into the educational systems and processes. We know that uptake of
22 learner dashboards has been low (Bodily and Verbert 2017) so a key focus in terms of the design is
23 how it is embedded into student behaviours. The literature about how students respond to feedback
24 draws our attention to the importance of moving from "transmission of comments from marker to
25 student, towards a more dialogic focus on student engagement and the impact of feedback on
26 student learning" (Winstone and Boud 2018; p.1) and emphasises the role that staff play in
27 facilitating students' understanding of feedback (Carless and Boud 2018). Similarly, for the learner
28 dashboard to have an impact we need to ensure that institutions embed this new technological tool
29 in teaching and learning regimes and draw on lessons of technological adoption (see for example
30 Brown 2013).
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