

The role of feedback in the design of learning activities

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Abstract

Learning Analytics plays an increasingly important role in informing educational institutions about their performance, and in supplying them with data on which they can guide their future policy. In this paper we analyse the challenges involved in obtaining useful data about learning activities, and in responding appropriately to them. The paper describes a case study carried out at the Open Learning Division of Thompson Rivers University which sought to lay the groundwork for an enhancement of instructional design practice by identifying the factors which are responsible for the success or failure of learning activities. The responsibility for development of learning activities lies principally with the Instructional Design team. The five members of this team were interviewed, and their perspectives were supplemented by interviews with eight lecturers, academic managers, and those responsible for faculty development. The 13 interviews were transcribed, and Qualitative Data Analysis techniques applied to draw out the principal themes. This process identified factors determining the success of learning activities, and requests for feedback, which will feed into the collection of data from students as they take their courses. On examination of the data valuable information was found which went beyond the original scope of the inquiry. This concerned, first, the methods, problems and workarounds in the instructional design group when defining activities; and second, the organisational, technical and policy constraints on the design group, and their consequences. The perceived flows of feedback within the learning activity process were analysed, from the perspective of the instructional designers, and an explanation for the barriers encountered is proposed in terms of variety management. The instructional design team is required to use its experience to resolve issues which are too complex for formal analysis, and the principal problems are identified. It is proposed that (a) documents should be developed to represent agreed practice in dealing with these problems so as to reduce cognitive load on the instructional designers; and (b) that the collection of data on learning activities should be focused on confirming the accuracy of the suppositions and mechanisms implied in this practice.

(NLC Abstract) Keywords

Learning activity, learning analytics, feedback, variety, distributed cognition, viability.

Introduction and background: the problem and its context

The motivation which led to the work reported in this paper is easily stated, and shared by many educational institutions: a desire to increase the effectiveness of the educational activities provided to students. The intention is to obtain feedback from students and lecturers about the learning activities which they find to be effective, in order to make use of the results in improving the design of activities. The use of learning analytics to gather ongoing data on the success of learning activities has been proposed by Richards and DeVries (2011) and the current study was conducted to help determine which data to collect and the context in which to analyse it. The research was carried out in a project within the Instructional Design (ID) Group at Open Learning at Thompson Rivers University (TRU-OL), funded by a grant from the University. Changes in technology have opened up many new possibilities which have changed the character of the courses offered to students. In TRU-OL there has been a progression from print based, to static web courses which reproduce the print courses web-based study, to 'dynamic web' courses with a more active tutor role, and recently to a paced cohort model. Examples of these various methods of course delivery are currently running in parallel, and consequently the range of activities and the resulting implications are highly varied. All new courses follow the paced cohort approach, and hence this model was the focus for this study. These courses seek to provide an enriched educational experience through peer engagement, and are shorter (12 weeks rather than 30 for other courses), and have

scheduled activities. The intention is to help students maintain their focus, and to increase the institution's throughput and completion rates. Interviewees noted both the benefits of paced cohorts, and the drawbacks (especially the constraints of more rigid schedules), but this paper does not seek to pass judgement on this question. The effectiveness of this change in instructional design practice currently being evaluated by a TRU Open Learning internal project, with the following objectives:

- 1 Identify and evaluate learning activity types and patterns in TRU-OL.
- 2 Use learning analytics to correlate activity feedback with student engagement in activity.
- 3 Incorporate the results into developing and improving learning activity patterns for course development.
- 4 Use learning analytics and feedback from learners to inform the revision of new online paced cohort courses after their initial offering.

The work described here relates to the first step in this process: identification of learning activity types and patterns. The results, however, lead to conclusions about how the later stages can reasonably be addressed.

Methods

An initial attempt was made to extract design patterns from a corpus of courses, with the intention to gather data about these patterns, and we mention this work here to provide context. 199 activity descriptions in 32 instructional modules were examined from a variety of courses. Firstly, pedagogic experts were asked to identify patterns as an abstraction of a set of practices following the general approach taken in (Oliver, Harper, Wills, Agostinho, & Hedberg, 2007) and (Conole, 2007). Secondly, activity instruction verbs were identified and supplemented with information on the related outcomes of the activity, and the degree of facilitation, building on the approach established by Bennett in the University of Wollongong, and popularized in the Hybrid Learning Model (Masson, Macneill, Murphy, & Ross, 2008). The results of both approaches were discouraging. Our experience was that while these approaches may be valuable when teachers wish to represent and discuss effective practice they are less effective in identifying activity patterns from a corpus of courses which does not have standard design guidelines. Consequently it was decided to identify the factors which key participants in the design and delivery processes identified as causal in the success or failure of learning activities, so that these could be used as the basis for obtaining feedback from live courses. A total of 13 semi-structured interviews took place with the five instructional designers at TRU-OL, the Director of the ID group, three Academic Directors, the director for Program Delivery at TRU-OL, a trainer on courses for online lecturers delivering courses, and two senior TRU-OL Faculty Members. The interviewer was a visiting scholar, who took notes during the interview, which were transcribed and formed the principal record. The interviews were also recorded, so that key points could be checked for accuracy. The questions were as follows:

- 1 How would you characterize a paced-cohort course? How is the design of paced-cohort courses different from dynamic web courses?
- 2 Can you identify types of learning activities which are more appropriate for paced cohorts?
- 3 Does the success of these activities depend on the design of the course / module? If so, how?
- 4 What can go wrong in the design process of paced cohort courses which might lead to activities being less effective?
- 5 What can go wrong in the delivery of paced cohort courses which might lead to activities being less effective?
- 6 What feedback from students and OLFMs [online lecturers] would be useful to you in your design of paced cohort courses?

All transcripts were anonymised, and all quotations from the transcripts in publications and reports have been subject to approval by the interviewee. The transcripts were analysed using a qualitative approach to tagging following (Saldaña, 2009). The three authors of this paper independently examined the printed transcripts and annotated them when they found evidence relating to:

- areas of convergence or divergence in the understanding of the activities for paced-cohort online courses
- hurdles which may need to be overcome in providing learning activities
- practices which need to be promoted in providing learning activities

The paper-based annotations of the transcripts were merged and transferred into WEFT QDA, a freely available open source Qualitative Data Analysis system (<http://www.pressure.to/qda/>).

Results

When the team met up to compare their annotations there was a large measure of agreement between the three researchers, with three themes being identified in the analysis:

- 1 aspects of learning activities to be considered when analysing their cause of their success or failure,
- 2 organisational, technical and policy constraints on the design process, and workarounds, and
- 3 challenges and methods in the ID group when designing learning activities.

Theme 1: Aspects of learning activities to be analysed

Tagging of the transcripts in WEFT QDA enabled the team to categorise the factors to which interviewees ascribed the success or failure of learning activities, shown in table 1 organised by the actors most directly involved in determining the state of the factors. 24 factors were identified which, in the opinion of the interviewees, determined the success or failure of learning activities.

Table 1: Factors impacting on the success of learning activities identified in interviews

Students	Lecturers	Designers	Delivery team
Accessibility issues	Appropriate group formation	Activity instructions	Promptness/delay in delivery
Student learning process preference	Evident presence of lecturer online	Amount of text and balance of media	Reliability of technical systems
Perceived usefulness to the student	Lecturer 'buy in' to the activity	Degree of complexity	Scheduling of courses
Technical barriers	Level of formative feedback	Facilitator workload	
Time pressure	Preparation for the activity	Familiar activity structures	
Uneven participation levels	Quality of facilitation	Fit of pedagogy, content and student context	
Cultural fit with students		Relationship to learning objectives	
		Rubrics for marking	

Table 2: Responses to the question "What feedback would be useful to you"

Addressed to student and lecturer	Addressed to student only	Addressed to lecturer only
Were the tools usable?	Was the facilitation effective?	What went well/badly in this activity?
What learning objectives did this activity address?	Were there any accessibility issues?	Can you tell if the activity is going well? How?
Is the flow of activities in this course effective?	Was the activity interesting?	
Did the activity lead to student achievement?	Was the activity enjoyable?	
How could this activity be improved?	Do the learners actually do the activities? For how long?	
Are the activity logistics/instructions adequate?		
What makes collaboration work?		
Are collaborative activities useful?		
Do you like collaborative activities?		
How does teamwork on a project work online?		
Was the workload too much?		
Are the resources appropriate?		

The interviewees were also asked "What feedback from students and OLFMs would be useful to you in your design of paced cohort courses?" The results of classification of the answers in WEFT QDA are shown in table 2, organised by the person to whom the question would be addressed. We note that the range of issues identified in interviews was greater than the list of requests for feedback which interviewees provided when they were asked directly "What feedback would it be useful for you to receive?", even though this question followed discussion of the dimensions of learning activities. For example uneven student participation in collaborative

activities was an issue for four of the interviewees, while nine interviews identified methods of group formation as being important. Neither of these issues would have emerged if researchers had limited themselves to asking "What feedback would it be useful for you to receive?". Similarly three interviewees cited rejection of the pedagogic approach by the lecturer as being a key factor, but only one requested an indirect feedback question related to this: "Do you like collaborative activities?". The only feedback requests which do not have equivalents in Table 1 are the two open questions intended for lecturers only, which do not seem to be informed by a particular view on success factors in learning activities. We speculate that the more limited responses to this question is the interviewees' tacit knowledge that only certain types of feedback from students have been permitted in the past, and so their responses remained within these constraints.

Theme 2: Constraints on the design process

A number of organisational constraints were identified by respondents. Particular mention was made of the interactions between the roles and contractual relations of subject matter expert, TRU-OL faculty member, and instructional designer, and we explore some aspects of this in Theme 3. However, the key issue which we focus on in this section was feedback, and 7 interviewees expressed frustration at its lack. To give two examples:

"ANY feedback would be welcome, currently there is very little unless the ID searches for it. ... Most evaluation is oriented to Marketing, or Quality of Service, rather than towards activities. None of the evaluation deals with instruction in detail"
"Feedback from students/lecturers after an activity should be immediate. The whole course feedback doesn't tell you anything about the specifics, so there need to be surveys throughout."

The information which does reach the ID team comes through informal channels, or because the ID team may sometimes take on other roles. For example one designer's husband is an OL lecturer, while in a number of cases the content experts working with the ID team are also OL lecturers. The ID team also observe that additional information about activities exists within the organisation, but does not reach them:

"At the moment we get student success rates, dropouts, marks, and student comments. Nothing comes from the lecturer. That goes to production, not to the IDs. That is not a good feedback loop. A complaint driven system does not improve practice"

An Academic Director concurs that informal problems are resolved without feedback being sent:

"If there is an activity plan and the students don't participate, the faculty member will say to the students in the forum 'This didn't work, how else can we cover this part of the material'... These changes are documented by word of mouth between faculty members. Getting a course into revision takes a terribly long time. You stick with the informal methods because they work."

A lecturer also notes "No one asks us from the University about how they could make the courses better."

Theme 3: Practices which need to be promoted

TRU-OL has adopted the definition of ID proposed by (Devillee, 2006): "the process of using our knowledge of how people learn to develop effective instructional strategies that meet the needs of the learners and the desired learning outcomes". As one instructional designer stated, this is complex and "necessarily messy". The interviews identified the following aspects that need to be balanced when considering design and activity choices (followed by representative quotes):

- Learner considerations (time, level, activity): "Don't ask for a research paper as the first activity. They need to build up to it, (learn how to) integrate a quote" and "You have to choose the activity to fit the course and Students come to us with rich frames of reference, and prior knowledge."; and "WE think group work is good for students, but they don't always like it. They often talk about people not pulling their weight. But at the same time we have evidence that in the paced cohorts the completion rates are way higher. We got a little bit of feedback from a survey. The students like the pacing, but they didn't like the pressure. Some liked the group activities, some didn't."
- Disciplinary type and level of the knowledge: "... the cooperation type ... is to be decided on the basis of the pedagogy and the topic. A 4th year seminar is going to be different from the first year" and " Maybe this is because I am in a practice based discipline". See Qvortrup Chapter 3 for an example of how this might be formalised (Qvortrup, 2006)

- Teaching preferences and pedagogical approaches of faculty: "SMEs tend to think that (more content) ups the rigor. They may scorn collaborative activities as a completely invalid idea. The more seasoned IDs know how to do that, create space for activities. That is a crucial relationship, and the ID has to be very adept: a psychologist, a pedagogue, and with respect for the knowledge in the course". "Biggest problem we have is that we work with SMEs who don't share our pedagogical and philosophical framework, opinion. There are lots who hate the idea of group work. ... Often I am educating and trying to persuade."
- Alignment with learning outcomes: "I'm searching for opportunities for that engagement, interactivity, but it has to match the learning outcomes. ... I'm making decisions about which activity makes sense."
- Instructor constraints: "The person who is delivering the course may not have any training in the tools, technically or pedagogically, and that is likely for us"; and regarding faculty workload "There has been no change in the statement of what faculty members are expected to do, and the collective agreement has not been changed to state how much extra they will be paid".
- Copyright considerations: "So this is where our attention goes. ... interpretation of copyright laws"; and " I want to use this film ... but we can't get permission, or it is too expensive"
- Exigencies of online teaching: "I ask myself how I can mirror the activities you would do online, using technology where necessary", and "The ID can elicit the effective face to face practices and translate them into online form".

Discussion

Table 1 presents a set of factors, identified in Theme 1, which would be valuable to explore with learner feedback mechanisms and questionnaires in order to assess the effectiveness of learning activities. It does not indicate the relative importance of the factors, still less that they are universally applicable. However, given the similarity in broad terms of education systems, we believe it is likely that results of a similar order of complexity would be obtained in other institutions. And indeed, it is the complexity that strikes one on examining this list. How is one to balance the various factors? Is it necessary to obtain information on all these factors before deciding why a given learning activity was effective? Is it even possible to balance 24 factors? How much provision of feedback can be off-loaded to automatically generated data? How much will have to rely on responses from students and lecturers (who may rebel under the load)? These questions suggest that simply gathering data on these factors will not in itself identify effective design practice for learning activities. We discuss our recommended approach in relation to Theme 3 below.

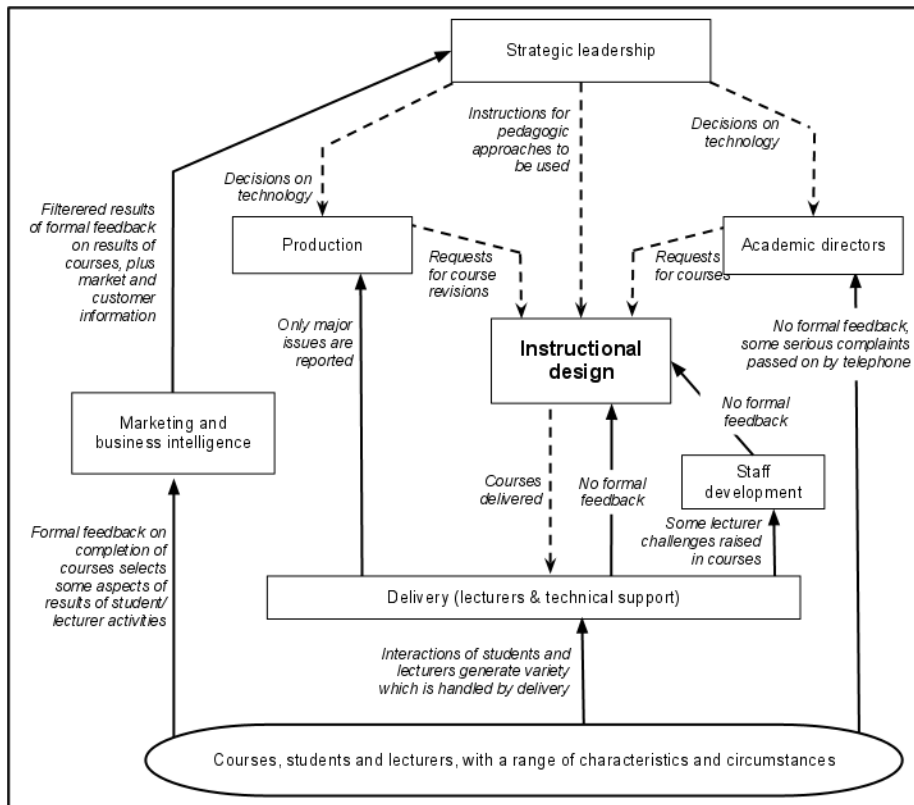
The feedback flows which inform ID at TRU-OL are summarised in Figure 1 below. These represent the perceptions of the interviewees, and the institutional systems which enable them have not been studied. The feedback identified is limited, and focused on marketing and complaints, and we suspect that the same would be found in many institutions. Counter-intuitively there may be advantages to limiting feedback, because this also limits responsibility for responding to it. The interactions of students, lecturers and factors in Table 1 generate very high variety, that is to say "the total number of possible states of a system, or of an element of a system" (Beer, 1972). Beer argues that in order to manage a system, the controller's variety must be as great as that of the system to be controlled. For example educational leaders, authors of resources or technical staff do not have the capacity to address the strategic and practical issues which they are faced with if they also have to deal with the implications of their decisions on the personal lives and learning of their students and staff. To resolve this, either the capabilities of the controller must be amplified, or the variety to which it is exposed must be reduced.

Variety is a universal problem in large organisations, and it is managed by having divisions of responsibility and hierarchies of control which can attenuate the variety of the information flowing between the levels. In our interviews we found evidence of very powerful attenuators. As Figure 1 indicates, tasks are divided into sealed functional units, so that, for example, the instructional design group cannot intervene in delivery processes, nor do they have any ability to adapt courses once they have been launched. This enables the institution to function in a simpler environment. However, this analysis only leads to a second, more pressing question: how can any organisation hope to be viable if it does not know the effectiveness and acceptability of the services which it offers to the people who pay for them? The answer, we suggest, is to be found in the operating environment of education. The discourse of education suggests that its purpose is to provide learning, but educational marketing is aimed primarily at providing certification and acceptability in the labour market and the social circles to which the student aspires. One might further suggest that in some cases the maintenance of the institution and its traditions is the true purpose. This explains why dysfunctional lecturers and sub-optimal courses can survive within the world of education without serious consequences, and the quality of learning activities and interactions is largely an issue of the ethical and professional probity of the individual instructional designer and

lecturer. This state of affairs is, in the authors' personal experience, widespread in education, so they can only interpret that it is an optimal response to ensuring the institutions' viability in the environment in which they operate. The systemic implications of the lack of feedback are reflected in the contractual relationships which have grown up around the divisions of responsibility, and which come into conflict with the need for greater feedback or changed practices. For example in TRU-OL the ID team and Academic Directors are contractually extremely constrained in examining runs of courses.

In response to this systemic lack of feedback on learning activities one can take an ethical stance and maintain that what is optimal for the institution may not be optimal for the students, and campaign for increased attention to understanding the effectiveness of the activities which students carry out. However, institutions may be swayed more strongly by changes in the education market, which is experiencing increasing costs, competition, technological capabilities for monitoring educational processes and student choice. This opens the way to new types of competition, both from private providers and from prestigious universities that are extending their reach. Both of these groups will claim, in their own ways, to provide higher quality learning experiences than available elsewhere. This would place many higher education institutions in the position of the Detroit car manufacturers who did not realize that the production and quality processes of car producers in Asia were a threat to their survival, or who were unable to adapt, as described by Iacoca (Iacoca & Novac, 1986).

Figure 1. The flow of feedback described in the interviews (broken lines indicate relevant inputs)



Consideration of Figure 1 indicates that excess variety is primarily adsorbed by lecturers and technical support (who deal with the complexity day to day interactions with students) and by instructional designers (our concern in this paper), who have to balance competing requests and the factors set out in table 1. In our study we found no algorithm or process being applied in order to attenuate the variety to which IDs are exposed, nor ways in which they could amplify their own variety. Instead the interviews suggest that instructional designers work with abstracted entities upon which decision-making can be based. A simple example may serve to illustrate what we mean. A cook may decide how to sweeten lemonade by means of an algorithm or recipe, measuring the volume of lemon juice and applying a prescribed proportion of sugar. Or they may use their experience to create abstracted entities: look at the volume of juice, ascribe to it a 'need-for-sweetness', consider the honey and sugar available to them and ascribe 'sweetness' to them, consider the 'sweetness-of-tooth' of the potential drinkers,

balance all of these, and decide to start with three spoonfuls of honey, to be adjusted after tasting. Similar abstractions and pragmatic decisions, we suggest, enable the ID to handle the variety implicit in the issues identified in Theme 3, and in this way to decide on activities for inclusion in a particular course in a particular delivery modality. These may be at many recursive levels. For example in designing an online discussion, the designer may characterise 'the typical student', ascribing qualities to them such as 'students' willingness to participate in online discussions', and ascribe motivating power to factors such as 'perceived usefulness of the activity to students'. These abstractions may conceal further levels of recursion, for example 'usefulness' to students has many aspects, which it may or may not be practicable for the designer to explore. At TRU-OL each instructional designer does this alone, relying on their personal experience, and typically they do not document or share their decision-making processes. As one instructional designer said "We haven't done much collaboration [\[with each other\]](#) ... we don't have that established practice, or the time to do it. We don't share our work in progress". We have found the discussion of distributed cognition in (Hollan, Hutchins, & Kirsh, 2000) useful in understanding how this collaboration might be conceptualised. They describe sociotechnical systems such as the bridge of a ship or airline cockpit, where a group collaborates to produce results which they could not achieve alone or in another environment. They also propose a set of core principles (p. 181):

- 1 people establish and coordinate different types of structure in their environment
- 2 it takes effort to maintain coordination
- 3 people off-load cognitive effort to the environment whenever practical
- 4 there are improved dynamics of cognitive load-balancing available in social organization.

Principle 1 is exemplified in the many structures in education, for example timetables, curricula and other documents which enable students and staff to orient themselves in the processes of educational design and delivery. They also attenuate the variety to which they are exposed, as discussed in (Britain & Liber, 2005).

Principle 3 relates to navigation artefacts such as charts or instrumentation which enable the bridge to keep a ship on course. Where are the equivalent environmental structures which off-load cognitive effort in education? These differ from naval practice, because of the contested nature of goals of education compared with the precise goals and methods of navigation. In education we believe that equivalent representations could assist the instructional designer in recognising a situation, and in reaching for an established solution. Like a chart, this document represents the results of prior analysis and experience in a form which amplifies the ability of actors to deal with the flow of variety confronting them. In terms of our earlier metaphor, they provide a recipe, rather than having to judge the sweetness of the lemonade anew on each occasion. It may be objected that this is simply an instructional design pattern by another name. However, there is a distinction. Patterns in the sense established by Alexander (Alexander, 1979) are informed by universal principals, in his case 'the quality without a name', while software patterns according to (Rosengard & Ursu, 2004) provide "proven solutions ". The logic of the solutions moves from the general to the particular. We propose, on the other hand, a representation of 'how we do things around here' which is firmly situated in the specifics of the environment: the student profile, the organisational structure, the staff capabilities, etc. This is coherent with Koper's formulation of design rules (Koper & Tattersall, 2005), which sees them as approximate and situated in a particular social context.

It is difficult to indicate the exact probability of design rules for various reasons, and we are usually not able to do so. One reason is that that probability is also situation dependent. ... Another factor which we have to take into account, and which is also difficult to measure, is that the rules are not value free. People prefer certain learning outcomes and methods above others.

We propose that the issues identified in Theme 3 of our results are candidates for the formulation of design rules. Influenced by Pawson & Tilley (1997), we suggest that rules should state how an intervention in a context leads to an outcome through the operation of a mechanism. Thus an agreed statement on group activities might hypothetically assert that target learners are unused to taking roles in group work, and that providing role-taking practice in an unmarked task leads to better grades, because practice in a non-threatening environment enables them to build skills. This would result in a ["building block"](#) rather than a ["problem to be resolved."](#)

Principal 4 suggests that such documents could improve the "dynamics of cognitive load-balancing". Their audience is not only instructional designers, but also lecturers and students, who can use them as a guide in interactions with the institution. This point is not lost on marketing departments, and for example the University of Phoenix tells prospective students "you will be assigned to a learning team at the beginning of each new

class. Your learning team will likely include three or more students. You'll work together to complete essays, presentations and more" (University of Phoenix, n d).

Principle 2 warns that it takes effort to maintain this coordination. A shared understanding which can take some of the cognitive load off instructional designers will involve the dialectic resolution of ethical, philosophical, pedagogical and political disagreements. A policy driven by marketing will only make their life harder by adding one more pressure to be resolved. Shared pedagogic documents will also have to be validated against feedback from learning activities, and revised in response to this. For example, it may be the case that contrary to the supposition in the previous paragraph, students find taking on roles in unmarked tasks to be frustrating because it does not help them directly in passing the course.

Conclusions: Closing the loop

We commenced this study by looking for factors that determine the success of learning activities, and we ended by discussing representations of pedagogic decision-making. We see these as being closely linked and argue that the aspects of learning activities for which feedback is sought should be determined by the pedagogic concerns of instructional designers. We have described how we identified factors that determine the success of learning activities, and how the analysis of interviews identified the pedagogic issues which are of most concern to the ID group. Our analysis leads us to propose that these factors provide a basis for developing and documenting agreed practice in dealing with these problems, so as to reduce cognitive load on the instructional designers. We further propose that feedback on learning activities should be designed so as to validate this agreed practice. Thus, the data to collect should enable both an analysis of the effectiveness of any one learning activity, but also the representations of pedagogic decision-making within a particular ID group. In this way we propose a method whereby the application of learning analytics techniques to learning activities can become a means of raising the capability of a group of professionals in their ability to resolve the challenges with which they are faced.

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