Chapter 6

Gathering, visualising and interpreting learning design analytics to inform classroom practice and curriculum design: a student-centred approach from the Open University

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Introduction

Developments in learning analytics practice now provide the classroom educator with a vast array of data that can be used to better understand the *academic achievements* of students (Bakharia et al., 2016; Dyckhoff, Zielke, Bültmann, Chatti, & Schroeder, 2012; Ringtved, Milligan, & Corrin, 2016; van Leeuwen, Janssen, Erkens, & Brekelmans, 2015). In fact, educators have never had access to more data about a student's progress in terms of the *knowledge, content and skills* they have acquired. In this environment externally administered testing regimes, such as the National Assessment Program - Literacy and Numeracy (NAPLAN) in Australia, give educators the tools to get closer than ever to accurate measurements of students' academic ability (see also Wass and Golding, 2014).

However, how well informed are educators about the types of activities that students actually *do* and the implications that might have for teaching and learning? How can educators get closer to what students *do* in the classroom or online? Tracking student activity in the Virtual Learning Environment (VLE) has been proven to provide evidence of the success of an intervention (Adlington & Wright, 2012), but explaining performance by utilising only VLE data remains difficult. How can we better understand the types and combinations of activity that impact on the measurement models for student success outlined above? Or, on the satisfaction of our students? Or, even, on retention? Once the means for gathering data of this kind has been established (Bakharia et al., 2016; Tempelaar, Rienties, & Giesbers, 2015), we believe great insight into the student experience can be gained by visualising the data in a way that can inform design. Interpreting these visualisations and comparing the outputs with other data sources can be used as a powerful research and scholarship tool that can inform both curriculum design and learning and teaching practice.

Building on an emerging body of literature on learning analytics and the role of the educator in particular (Bakharia et al., 2016; Dyckhoff et al., 2012; Ringtved et al., 2016; van Leeuwen et al., 2015), part of this chapter will outline an approach the Open University (OU) has developed that it calls 'learning design'. That is, an approach in which educators gather, visualise, and interpret data on what students are expected to do, rather than where they are at.

The OU uses the term learning design to describe this approach which includes the design of learning using visualisations, referred to as learning designs or learning design visualisations, but also the review and evaluation process. A key question for educators is whether learning actually can be *designed*? Some teachers might argue not, pointing out that different classes often respond to learning activities in different ways at different times, which may well lead to different outcomes.

But teachers design learning in the way they interact with the class. For instance, teachers might give learners the option to choose from several activities they have had a hand in creating, or in contrast, they might set a specific task in quite an authoritarian manner. This is why learning design is often described as a tacit knowledge (Bakharia et al., 2016; Conole et al., 2008; Dalziel, 2016; Lockyer & Dawson, 2011). Teachers might not even be aware of the methods they apply, but they are still designing the learning. Furthermore, teachers may be able to glean an immediate impression or insight into whether the lesson went well or poorly and perhaps some reasons why, but the drawback is that in these circumstances the entire way the lesson is designed and delivered cannot be shared or understood fully.

As highlighted by Ringtved et al. (2016), an increasing number of teachers and schools are starting to use blended and online learning designs to complement face-to-face provision. Similarly, at the Open University UK (OU) a vast range of different blended and online designs have been implemented over the years. Established in 1969, the OU is the United Kingdom's largest university with four out of ten part-time undergraduate students in the UK studying there. The OU offers 180 qualifications and 600 modules to choose from. Roughly three quarters of its students study whilst also working. The OU's inclusive, open-to-all model means students from a wide range of backgrounds and abilities are able to access OU modules and qualification pathways. Modules are typically delivered at distance. The central campus in Milton Keynes is largely student free, and increasingly online.

This operational model provides several challenges for the OU educator. The learning modules are authored by subject matter experts who, despite being teachers, may never interact with students directly. In order to be cost effective, modules must be designed with multiple presentations in mind and for an audience of many diverse abilities and needs. Changes in staff assigned to the production of materials during this process also means that modules need to have designs created up front so a seamless transition can be ensured and work is not lost. A key challenge in this context is therefore, how can the OU measure that 'good' learning design has taken place?

However, as well as challenges, this model also provides opportunities for OU educators. The online setting means advances in learning analytics can be harnessed to provide powerful and meaningful insights (Bakharia et al., 2016; Rienties et al., 2016). The OU has developed an approach to learning design that seeks not only to put the student front and centre in design decisions, but also to use these learning analytics to establish a framework to better understand what students are doing (Conole, 2012; Rienties & Toetenel, 2016). Visual learning designs are generated, through coding learning activities, that can be compared with other data sources

such as surveys and data from the VLE. This chapter will explore this learning design approach, and explain not only how learning can be designed, but will also demonstrate the benefits in doing so with teachers in mind. We believe there is much the classroom teacher can learn from this approach. Therefore, we have provided specific exemplar text-boxes entitled *To the Classroom* in order to describe how principles of learning design developed at the OU can be translated into practice.

The learning design approach – a brief overview of the context, history, development and approach

The learning design approach to curriculum design

Learning design is not only widely studied in the Higher Education sector, but is also a term widely used in training and education settings (Agostinho, 2011; Conole, 2012; Dalziel, 2016; Lockyer & Dawson, 2011; MacLean & Scott, 2011; Mor, Ferguson, & Wasson, 2015; Ringtved et al., 2016; San Diego et al., 2008). The definition of learning design has various meanings in these different settings. For instance, many training providers use the terms learning design and instructional design interchangeably (Conole, 2012; Dalziel, 2003). Research in the design of learning and instruction "has been carried out under such names as pedagogical patterns, learning patterns and pattern language" (Lockyer, Heathcote, & Dawson, 2013, p. 1441). Some of this work originated in an attempt to save costs by templating module materials, but more recently the approach has been to utilise learning design data to help build a richer picture of the learning behaviour of students (Agostinho, 2011). For example, according to Bakharia et al. (2016, p. 330), "the field of learning design allows educators and educational researchers to articulate how educational contexts, learning tasks, assessment tasks and educational resources are designed to promote effective interactions between teachers and students, and students and students, to support learning".

Conole (2012, p. 121) described learning design as "a methodology for enabling teachers/designers to make more informed decisions in how they go about designing learning activities and interventions, which is pedagogically informed and makes effective use of appropriate resources and technologies". The OU Learning Design Initiative (OULDI) (Cross, Galley, Brasher & Weller, 2012) built on this work, and this was further developed in consultation with eight higher education institutions.

In the rest of this section, we will describe how the OU has developed and implemented the OULDI approach in practice through the explanation of the three underpinning principles. Based upon five years of experience of running dozens of OULDI workshops for 100+ modules, we believe that curriculum design is most effective when the workshop approach is: student-centred; collaborative; and effectively supported with activities and tools.

Curriculum design is most effective when the approach is student-centred

A significant challenge in higher education, especially in larger institutions, is to reduce the distance between the curriculum design (learning and instructional designers) team, the central academic (content specialist) team, the teacher (i.e., associate lecturer in OU jargon), and the student. In an OU environment where members of the module team may never encounter a student in real life, it is vital that valid attempts are made to reach an understanding of student motivations, expectations, backgrounds, experiences, and study skills that are as authentic as possible. Although this kind of division of labour might not be applicable to all schools, the trend of dividing the role of the teacher between different colleagues is becoming more widespread. In an online environment, learning activities are not designed for 30 students, but often for 500 or 5000. It is therefore even more important to consider the needs of each learner as part of the learning design.

This student-facing learning design approach almost juxtaposes traditional module design approaches (MacLean & Scott, 2011), as in a traditional module design approach content is normally based upon the content to be delivered. In contrast, in a student-facing learning design approach, where the needs of the learners are central and directly influence the choice of learning activities, the content is of secondary importance. The student-facing learning design process supports teams in asking questions such as: What will students do in this module? How much will they be reading? What practical activities will they do? This student-centred approach can sometimes feel alien to academic teams and subject matter experts, as they traditionally have prioritised the module content before making any decisions about the delivery (Norton, Richardson, Hartley, Newstead, & Mayes, 2005; Rienties, Brouwer, & Lygo-Baker, 2013). It feels natural to practitioners, both classroom and online, to first allocate content to the time available and then consider the best method of delivery, rather than establishing an overall design profile, or curriculum plan, upfront.

Curriculum design is most effective when done collaboratively

More relevant than the development of templates for learning is the idea that learning design enables a shared vision for the learning to be created (Conole et al., 2008). Bringing academic staff together with experts from other units within the institution helps the module team to focus on areas of expertise outside their own discipline or expertise, and think about the module in a more holistic way (Rienties et al., 2016). Designing learning materials is a collaborative process and, as such, it is difficult to share 'the idea in your head' until it has been developed. Visualisations of learning design can "support teaching staff in better understanding what is happening on their course" (García et al., 2012, p. 111). The use of visualisations helps to make these decisions collaboratively, often through the use of web based tools (Bakharia et al., 2016; Toetenel & Rienties, 2016a, 2016b). For example, Verbert, Duval, Klerkx, Govaerts, and Santos (2013) have illustrated the benefits of using 15 different types of data visualisations in assisting teachers to make more informed learning design decisions.

At the same time, Thompson et al. (2013) stress that an appropriate theoretical framework is essential to make learning interactions and designs visible to teachers and learners. At the OU,

a large-scale implementation study of 148 learning designs by Toetenel and Rienties (2016b) found the introduction of systematic visualisations of initial learning designs helped educators to focus on more balanced learning designs. That is, when the design teams were given visualisations of their initial learning design activities they adjusted their designs towards more student-active activities, such as communication and finding information, while reducing the emphasis on assimilative activities. Therefore, visualisations help to make design decisions apparent, providing benefits that are as similar as possible to immediate feedback (Whitelock & Watt, 2009). This approach allows teachers to learn from previous design iterations in order to make informed decisions.

Using visualisations also allows for a more collaborative approach to learning design by making it easier to "play back" and review decisions made to arrive at a shared vision (Agostinho, 2011; Bakharia et al., 2016; Dalziel, 2003; Conole et al., 2008; Toetenel & Rienties, 2016b). For instance, including members of the library and employability teams in the process means that their specialist knowledge can inform skills development in the module material right from the initial design stage. This collaborative approach, arguably made easier by the developments in collaborative technologies, fosters empathy amongst members of the institution who may not run across one another very often in their day-to-day activities. Our collaborative approach enables more innovative design decisions and has been found to be more effective when compared to teachers working as individuals (Hoogveld, Paas, & Jochems, 2003; Toetenel & Rienties, 2016a).

Curriculum design is most effective when facilitated with activities and tools

In the OU learning design workshop, a range of activities are undertaken to help the design team reach consensus on areas such as: a shared vision, who their students are, and how they might best go about meeting students' needs. There is a focus on analysing the data of the student population for similar modules, understanding the place of the module in the qualification, and producing visualisations of individual students. Design challenges are also identified by the design team. Through considering potential issues and restraints for the design in advance, the overall process aims to address these foreseen challenges and enable progress to be measured throughout the rest of the design and production process.

Further activities focus on identifying features for providing support and guidance, such as assessment, content and demonstration of learning, supporting the introduction of employability skills, digital literacy, and constructive alignment. The alignment of skills in terms of employability is key. Guidry and Stevens (2014, p. 40) suggested that "comparing skills required by employers must exist to ensure adequate preparation for students". Their assertion also inferred that this alignment is not just important for students when they enter the workforce, but also to support them during their studies.

The learning design approach outlined in this section also supports the notion of constructive alignment (Biggs & Tang, 2007), where activities that are undertaken by learners are matched to the learning outcomes and assessment. It is important to note here that learning outcomes are aligned to the overall module design, content and assessment, rather than a more singular

approach where “nothing is taught that is not assessed and nothing is assessed that has not been taught” (MacLean & Scott, 2011, p. 561). Skills are developed over time, for many learners over a period of years, and not all skills are necessarily assessed in each learning design at the OU.

Although traditional approaches might have been valid in historic educational settings where the key consideration was what students need to know (Conole, 2012; Norton et al., 2005), nowadays it is important to consider what students need to be able to know or find out, do, experience, produce, and convey to be successful and find employment in a given subject area. As careers are likely to change over time, students need to develop approaches in identifying content themselves in order to adapt to a continuously changing employment market.

Our experiences with implementing learning design on a large scale indicate that once design teams have engaged with this new learning design approach, their experiences are generally positive. Design teams consider these learning design workshop approaches as a good way of making substantial progress in the initial design. Comments from faculty staff include: “I am feeling very proud of what has been achieved in a very short period of time”.

To the classroom

Putting the students at the heart of the learning experience is something that is generally easier for classroom teachers than learning designers involved in online or distance learning. The day to day interaction with students builds a relationship which fosters empathy between student and teacher resulting in greater scope for flexibility when needed. Classroom teachers have, to some extent, the benefit of being able to respond to fluctuations in class mood, spend extra time reinforcing particularly difficult concepts, and receive visual cues that genuine learning has taken place. Classroom teachers can also employ strategies to gain immediate feedback from students to better understand their progress and understanding. Tacit knowledge and common sense can drive design.

However, there still may be much for the classroom teacher to learn from this learning design workshop approach when designing curriculum. For faculties or subject areas that want to encourage a consistent student experience across classroom settings the OU learning design principles can provide a framework for groups of teachers to work collaboratively to design curriculum which is focused on the student. Application of the approach can also assist with ensuring that the reasons for curriculum design decisions are able to be clearly communicated to new members of staff and the pedagogical rationale is not lost.

Using qualitative data in the curriculum design process

The monitoring and evaluation of feedback on the student experience at a module and qualification level plays a key part in quality-assurance and quality-enhancement activities (Ashby, 2004; Li, Marsh, Rienties, & Whitelock, 2017). Many educational institutions offer a semester and/or yearly survey in which learners are invited to take part. Most of these surveys include topics relating to teaching, learning and assessment such as feedback on tutors and the module overall. Surveys can be useful when students are asked to respond to a combination of open and closed questions. This type of survey generates a large amount of data which can be analysed and combined with other sources of data to give a picture of student satisfaction with their experience (See Li et al., 2017 for an example of a large-scale study of 115,000 students at the OU).

One example of the potential use of this data is a frequency analysis of the language used by students in the open comments of a survey designed to elicit views on satisfaction which can be turned into a Learner Experience Wheel (Open University UK, 2016). The Learner Experience Wheel is a tool that design teams use to establish a priority or vision for their module early in the design process by asking themselves the question, 'What do we want students to say about our module?' and using actual student comments to support that assertion. These overarching principles for the module will then inform the learning design of the module materials and can be used as a reference point throughout the design and production process.

Table 6.1 shows the most frequent words students at the OU used in the open comments section of their responses to the OU Student Satisfaction on a Module survey (Li et al., 2017), which have been broken down into three levels. The Learner Experience Wheel is best used in a workshop setting when only a very basic brief of the module to be designed is understood. The wheel serves to deepen and expand that understanding further. Participants are typically asked to select a high-level word they would like learners to use to describe their module (e.g. professional). Then they are asked to choose one of the three specific words that describes the first word more precisely (e.g. practical). Finally, they are directed to select one of the three more granular words that describes the second word more precisely (e.g. functional).

Table 6.1: OU Learner Experience Wheel words. Source: Open University UK (2016)

PROFESSIONAL			SUPPORTIVE		
Skills	**Independent**	**Practical**	**Effective**	**Rewarding**	**Confidence**
Ability	Self-sufficient	Pragmatic	Relevant	Worthwhile	Encouragement
Capability	Self-supporting	Functional	Applicable	Valuable	Buoyancy
Proficiency	Self-regulating	Competent	Constructive	Fulfilling	Trust

INNOVATIVE			DEMANDING		
Different	**Amazing**	**Interactive**	**Ambitious**	**Complex**	**Challenging**
Distinctive	Extraordinary	Collaborative	Enterprising	Involved	Thoughtful
Innovative	Ingenious	Cooperative	Adventurous	Multifaceted	Stimulating
Pioneering	Exceptional	Connecting	Aspiring	Intricate	Questioning

For example, Alex and his team were designing a module about online technology. The design team decided that they would primarily like learners to consider this module to be 'innovative'. So they selected that word at the high level. By engaging in the selection process, the design team will inevitably discuss their own interpretations of this word; a design conversation. Then, drilling down further, the team will have a conversation about prioritising which of the three words on the next level they would like their students to use to describe their experience on the module. In this example, the design team reached consensus on 'interactive' as being the most appropriate and justified their response to one another. In the final stage Alex and his design partners selected 'collaborative' to complete the set. By consistently engaging with one another throughout this process, and being forced to engage in such a prioritising activity, this team have undertaken a valuable and structured design conversation. The design team are now in a position to reach a wider consensus on the priorities for the curriculum design, and begin to consider how they might successfully meet these priorities.

Despite there being conflicting interpretations and justifications for the choices within the design team, the value is held in the *design conversation* that is taking place. As a further extension activity the design team could be required to generate an aspirational Tweet, in 140 characters, from a hypothetical student that could form a vision statement for the design of the module. For example:

> *You should definitely take this module! The **collaborative** activities really encouraged me to be **innovative** and **interact** with both the other students and the content. Very valuable.*

These vision statements can be revisited at the beginning of each phase of the design process to reiterate the priorities of the team. Design success can then be measured against this established and agreed upon benchmark. Crucially, where this is different from other learning design approaches, is that it puts the student learning experience at the heart of the design process, rather than the teacher experience.

To the classroom

If this approach is of interest, it is suggested that teachers, schools, faculties, or clusters should first spend time considering how they might gather the data required to inform their own design priorities - as long as it is based on student language. There are clear benefits for teachers in conducting their own surveys and building their own set of qualitative data to inform this approach. The words in the Learner Experience Wheel will not be relevant for every context. This language works well in the context of the OU, since it has been produced through analysis of feedback by OU students, but is probably not appropriate for every setting.

As part of a push towards the use of a more evidence-based approach to teaching and learning, teachers may find themselves already collecting data from their students using common online tools, such as *Surveymonkey*, or paper based approaches to obtain feedback on questions such as 'how I teach' and 'what I teach'. This set of qualitative data can then be used to demonstrate at review a teacher's learning and teaching practice, or in this case, how curriculum design has been informed.

Relevant data could be extracted from feedback sources such as institutional learning and teaching surveys, capacity matrices, student focus groups or from selected elements of surveys aimed at measuring student attitudes. This approach can become especially powerful when multiple sets of data are combined from across faculties or schools to generate a rich library of student design language (Bakharia et al., 2016; Rienties & Toetenel, 2016; Ringtved et al., 2016).

It is easy to produce your own word wheel. First collect feedback about modules or courses, then enter the data in an excel spreadsheet. Several word frequency counters can be found on the internet. Once you have identified the words that are used most frequently, you can use these to produce synonyms to provide the range of words required for the word wheel. For the online version of the OU Learner Experience Wheel see: www.open.edu/openlearn/wordwheel

Gathering learning design analytics through the 'module mapping' process

Module mapping refers to the process of 'mapping' or 'coding' the curriculum through the application of a commonly accepted student activity type classification and an allocation of time consistent with student workload conventions (Rienties, Toetenel, & Bryan, 2015). These conventions vary based upon the subject, the topic and the level of the students. They have also been agreed upon with a range of stakeholders across the university, as their main use is to compare modules within the institution. The data produced from this mapping exercise is

then visualised in the learning design tools, allowing the user to analyse the spread of activity types and the student workload in detail (Toetenel & Rienties, 2016a, 2016b).

The Activity Type Classification Taxonomy

Our learning design approach in classifying student activity concentrates, once again, on what the student is actually engaged with *doing*, as opposed to other taxonomies which tend to concentrate on cognitive skills that are being applied or inherent styles of learning. It uses a taxonomy of student activity types developed by Conole (2012; 2008) and can be viewed at an individual module or combination of modules level to show a view of student activity.

Each activity within the module's weeks, topics, or blocks is divided up and categorised according to the Activity Type Classification Taxonomy:

Assimilative (attending to information) - students study and think about theories and concepts encountered in materials and resources. *Read, Watch, Listen, Think about, Access, Observe, Review, Consider, Study.*

Finding and Handling Information (FHI) (searching for and processing information) - Students are actively and critically engaged in gathering and manipulating information. *List, Analyse, Collate, Plot, Find, Discover, Access, Use, Gather, Order, Classify, Select, Assess, Manipulate.*

Communication (discussing theories and concepts with at least one other person) - Through dialogue, students begin to take a position in relation to problems and debates, and internalise complex and interrelated concepts. *Communicate, Debate, Discuss, Argue, Share, Report, Collaborate, Present, Describe, Question.*

Productive (generating an artefact) - Students apply their knowledge and skills together or alone in order to create a piece of work. *Create, Build, Make, Design, Construct, Contribute, Complete, Produce, Write, Draw, Refine, Compose, Synthesise, Remix.*

Experiential (applying learning in a real-life setting) - This student activity is most often found in work-based learning or practical science modules. *Practice, Apply, Mimic, Experience, Explore, Investigate, Perform, Engage.*

Interactive/Adaptive (applying learning in a simulated setting) - Students apply their knowledge and skills in a simulated setting, receive feedback and are then given the opportunity to adapt their approach. *Explore, Experiment, Trial, Improve, Model, Simulate.*

Assessment (assessing a student's learning) - Includes continuous, summative and formative types of assessment) *Write, Present, Report, Demonstrate, Critique, Peer-review, Self-assess, Receive feedback.*

For example, the sample activity detailed below consists of watching a video clip, reading some text, answering three questions, and engaging in a discussion on the online forum. In this example, the learning design specialist has broken these activities down into the corresponding activity types and through the use of institution-wide conventions, which include estimated study speeds, arrives at a total time. Here, the study speed applied for the reading is medium, or 70 words per minute and a multiplier of 2 is included for the video. The learning design specialist has allocated times to each of the different activities; 45 minutes for assimilative activities (watching the video clip and reading the text), 20 minutes for productive (answering the questions), and 20 mins for communicative (engaging with discussion on the forum). All the activities that take place in a week are analysed in this way and then entered in the activity planner to generate a set of data that reflects what the student is being asked to do per week, as illustrated in Table 6.2.

Table 6.2: Sample activity mapped using the Activity Type Classification Taxonomy

Section	Title	Assimilative							FHI (mins)	Comms (mins)	Prod (mins)	Exp (mins)	Int/Adp (mins)	Assess (mins)	Total (mins)
		Word count	Photo (qty)	Fig (qty)	Equ (qty)	Table (qty)	Video (mins)	Audio (mins)							
2.1	Poles	1300					6			20	20				82

Once a module has been mapped in this way a simple histogram can be constructed that will reflect the amount of time a student would be expected to spend on each activity type for the duration of the module, as illustrated in Figure 6.1.

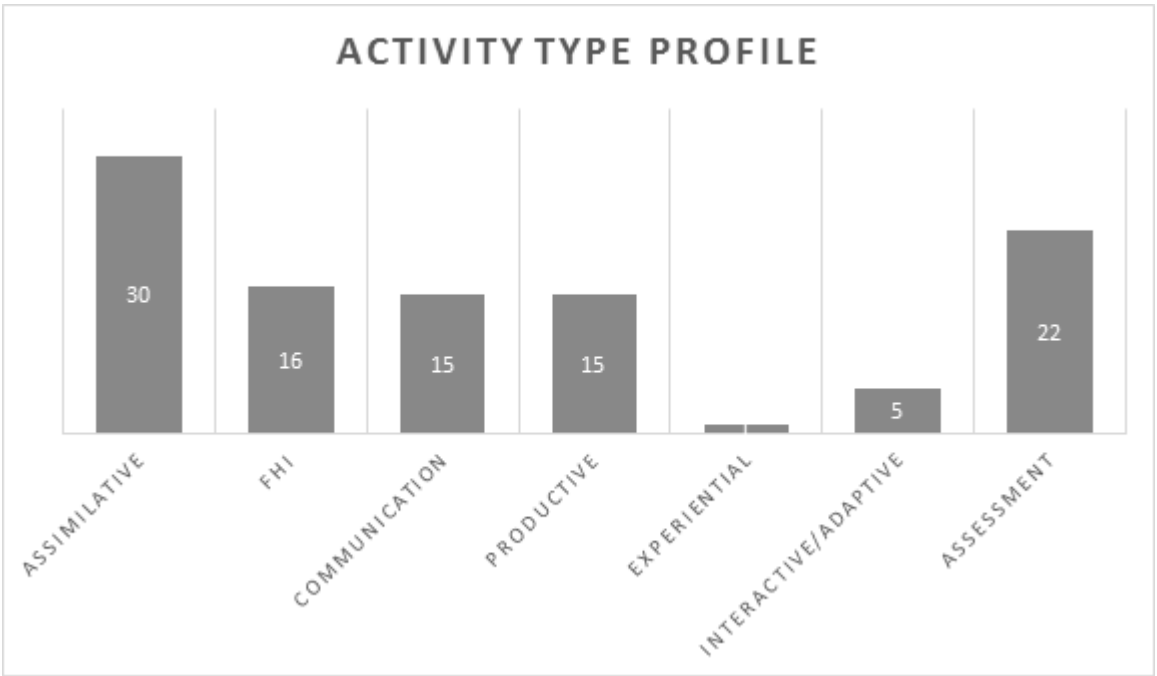

Figure 6.1: Sample activity type profile histogram

Module mapping processes

Over the last 5 years, our experience highlights that module mapping can provide value during three different phases. It can be undertaken:

1. as a **design** activity, before the production begins;
2. **retrospectively**, once a module has been finished and is being delivered to students;
3. **iteratively**, during the production process.

There are benefits and drawbacks to all three phases that are discussed in more detail below. Creating the visualisations currently requires the expertise of a learning designer to apply the taxonomy accurately across modules. Quality control meetings regularly take place across the University to ensure that a consistent and rigorous approach to the mapping is followed. In this way it gives a clear indication of what the student is expected to do and offers a level of detail to module development teams into the phases of design and iteration that would otherwise be absent. Important design and development conversations can then be facilitated using the language of the taxonomy.

Mapping or 'coding' as a design activity

Just as using the Learner Experience Wheel can help a team to build a vision statement for their module, so can using the Activity Type Classification Taxonomy to generate an aspirational profile for the student experience within the module before any writing has begun. In the learning design workshop setting, participants are asked to allocate proposed percentages of student time to each of the activity types. This is usually done in pairs and then the outcomes of that discussion are shared with the design team in order to reach a consensus. This profile or 'blueprint' is captured in an 'activity planner', sometimes referred as to as a pedagogy planner, which is a planning and design tool supporting the development, analysis and sharing of learning designs (San Diego et al., 2008).

This activity planner profile has several purposes. Firstly, the activity planner provides a framework to generate a learner-centred discussion. Reaching consensus within design teams at this early stage can often be difficult, and views can differ widely as to the proposed student experience. Therefore, the action of having the discussion is vital in achieving consensus. There are occasions where the learning design workshop may be the first time that members of the design team have ever met.

Secondly, the output of the activity planner provides the design team with a baseline profile to start writing learning activities. It is a starting point for design and can be referred to during the production process to assist in discussions about the student experience. In institutions that design modules for large populations, the productions of large modules can often take more than a year during which time personnel can change. Developing and agreeing on the activity

type profile early on helps guide a consistent approach towards a continuing collaborative methodology.

Thirdly, the consideration of all the different activity types that the student *can* do, can inspire innovation and creativity in the design of the module, which in turn can lead to a much richer student experience. It will come as little surprise that often the default setting, particularly in distance education, is for assimilative activity to be prevalent. More creative approaches to learning require careful design and development and can fall by the wayside when time constraints are preeminent. Indeed, analysis of 157 learning designs used by the OU suggest that by visualising the design upfront, educators focused less on traditional teaching patterns and created more student-centred and creative designs aimed at developing a range of skills (Toetenel & Rienties, 2016a).

Mapping or 'coding' existing curriculum retrospectively

A module which is already in presentation can be mapped retrospectively and, when combined with other sources of data, can reveal design issues. The learning design team, as well as some designated faculty members, currently map modules in this way to allow module teams to investigate issues of student retention, satisfaction, outcomes and experience. This mapping is done in collaboration with strategic projects and to contribute to research and scholarship work into student workload and activity type use (Rienties et al., 2016). Projects are currently underway, tasked with developing automatic ways of collecting this data.

Mapping or 'coding' curriculum during the design process

Ideally, modules are mapped iteratively as they are produced. This assists with the design process and prompts module authors to produce content and activities that are consistent with the shared vision established in the learning design workshop. This process supports the production of pedagogically sound modules, provides a mechanism for module teams to engage in robust discussion, and supports the application of university guidelines that have been developed according to research and scholarship projects.

Recent innovations have provided space for the learning design team to be involved in coding the curriculum in a more iterative way. That is, *during* the design and production process rather than retrospectively. The intention of this approach is for the coding data that is produced to be more practical so it can better inform and shape the overall pedagogical design of the module rather than reflecting only on the design once it has been written.

To the classroom

The introduction of mandated subject coverage in the UK, Australia, and other countries means that developing and documenting a transferable (between teachers) curriculum has never been more important. Valuable resources are wasted year-on-year reworking curriculum that is unclear or that only concentrates on content rather than the student

experience. Increasingly high turnover of staff can mean valuable expertise and consistency is lost as teachers move between schools or move into other fields of education. Due to this turnover it would seem sensible, and it is suggested, that teachers consider establishing an activity profile early in the design process when presented with new curriculum.

Therefore, in the first instance, it is suggested that teachers might gain benefit from mapping their practice retrospectively in order to generate some usable data for their fellow teachers and their students. That is, taking five minutes after a lesson or at the end of the day to jot down the approximate time spent by students on different activities. Further, students might have a very active role to play in this. Why not get the class to do it? Or, alternatively, it could be included in peer observation sessions.

Coding student activity in this way will allow teachers greater insight into their own practice. For it may be that it is only through assigning numerical values to student activity that teachers will step back from their work and reflect on how their practice may have impacted their students. For example, it is likely that teachers may be surprised if presented with data that suggests that their students are predominately required to engage with assimilative activities. Especially when they may believe they are promoting communicative activities in their classroom. An action arising from this might be to build more group work activities where appropriate.

Without the hard and fast deadlines of presentation schedules it is likely that most schools' design processes are already more iterative than those focussed on online learning in so far as teachers design as they go. With the increased use of online learning in all learning institutions, the introduction of upfront learning design will become more and more important.

Typical curriculum plans for units of work often consider what the students will be doing during class time, but rarely seek to classify this activity according to a taxonomy such as the one described above. This can be a very powerful way to generate data and provide an evidence-based way for teachers to reflect on their own practice.

Visualising and interpreting learning design analytics

Tools for review

In addition to the benefits of visualising learning activities when designing new curriculum, the use of the activity planner can also be helpful when reviewing entire blocks of curriculum or modules for quality purposes or if changes need to be made. Visualising the learning design of a module or other piece of curriculum iteratively can provide information at a glance that can clearly indicate issues in the design. It has been found that face-to-face review sessions, conducted between an experienced learning designer and an online author, can be very helpful to monitor and support the development of curriculum (Rienties et al., 2016). Visualising the

learning design can provide the *common language* required to facilitate a discussion and help to establish consistency in terms of student workload and support pedagogical design choices.

For example, a series of review sessions were recently conducted with several module teams at the OU who participated in a pilot project on this innovative approach. Using the online Learning Design visualisation tools (see Figure 6.2 below) the first four weeks of study were mapped once they had been uploaded to the virtual learning environment (VLE) and a review session was organised. The mapping revealed insight into a number of areas:

1. the commitment to communicative activities established in the learning design workshop (12%) was unclear and this meant that the overall design of the curriculum, of which this module was a part of, was at risk.
2. the spread of student workload across the weeks was inconsistent and at times outside the guidelines of 12 hours per week for both module and student-directed workload.
3. there was a need to reduce student workload in some weeks and that this was often due to large pieces of external reading.

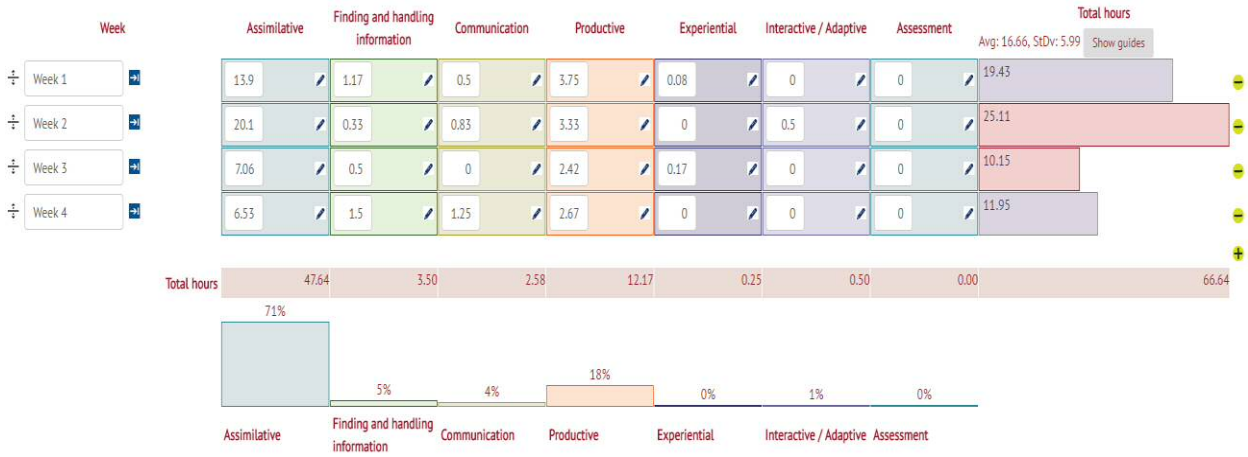

Figure 6.2: Visualisation of first 4 weeks of module before revision session

After review of the visualisations, informed decisions about some content and activity choices the following outputs were made which achieved:

1. reduced Assimilative activity across the four weeks by 9% (71% to 62%).
2. increased FHI, Communication and Productive activities by a combined 10% (27% to 37%).
3. student workload spread evened out from high/low difference of 14.96 hrs (25.11 hrs – 10.15 hrs) to a high/low difference of 3.19 hrs (13.03 hrs – 9.84 hrs).
4. total student workload across the four weeks reduced by 21.19 hrs. (66.64 hrs to 45.45 hrs).

Figure 6.3: Visualisation of first four weeks of module after revision

According to Olney (2017), authors participating in the pilot scheme supported the assertion that the visualisations were of value with comments such as:

> *Seeing the workload mapped into different types of activities enabled me to think more clearly about the different kinds of skills I want students to develop, and to adjust the balance of the activities accordingly.*
>
> *I found it helpful to use the calculations to consider how to spread the activities over the weeks…*

Tools for advanced learning analytics

By extracting the data from the online Learning Design visualisation tools into a web-based database these designs can be explored in more detail. Use of a database enables the designs to be compared to those of other modules, either in the same discipline or across the University. It has also enabled learning design data to be combined with other data sets, such as retention, student outcomes, student satisfaction data, and data relating to student behaviour on the VLE in order to ascertain which design features are most effective. For example, an OU study was conducted linking activity type data on 151 modules (111,256 students) with student behaviour, satisfaction, and performance data using multiple regression models. In particular, the study found that the primary predictor for academic retention was the time spent on communication activities in blended and online environments (Rienties & Toetenel, 2016).

Further research by Nguyen, Rienties, Toetenel, Ferguson, and Whitelock (2017) on longitudinal design decisions by OU design teams indicated that 38 learning design activities per week significantly predicted 60% of VLE behaviour per week. The analytics captured from the VLE was compared against the Learning Design visualisations. Follow-up fine-grained analyses across six case studies in the same study indicated substantial variations in the learning designs and assessment methods in particular (i.e., assignment, face-to-face exam, final assignment and interactive computer-marked assessment).

Figures 6.4 and 6.5 below represent individual modules and are examples of the kind of

visualisations that can be created. They suggest that assessment and assimilative activities dominate the learning designs. There are gaps in weeks 12 -13 and week 24 due to Christmas and Easter breaks, as well as breaks in the schedule to prepare for the next learning activities. In Figure 6.4, a continuous line of assessment can be seen (the dark peaks) where students are working towards four assessments. A positive relationship between assessment and time spent on the VLE per week is also reflected in both modules as VLE engagement usually went up in weeks with assessment activities. The workload fluctuated considerably between assessment weeks and non-assessment weeks.

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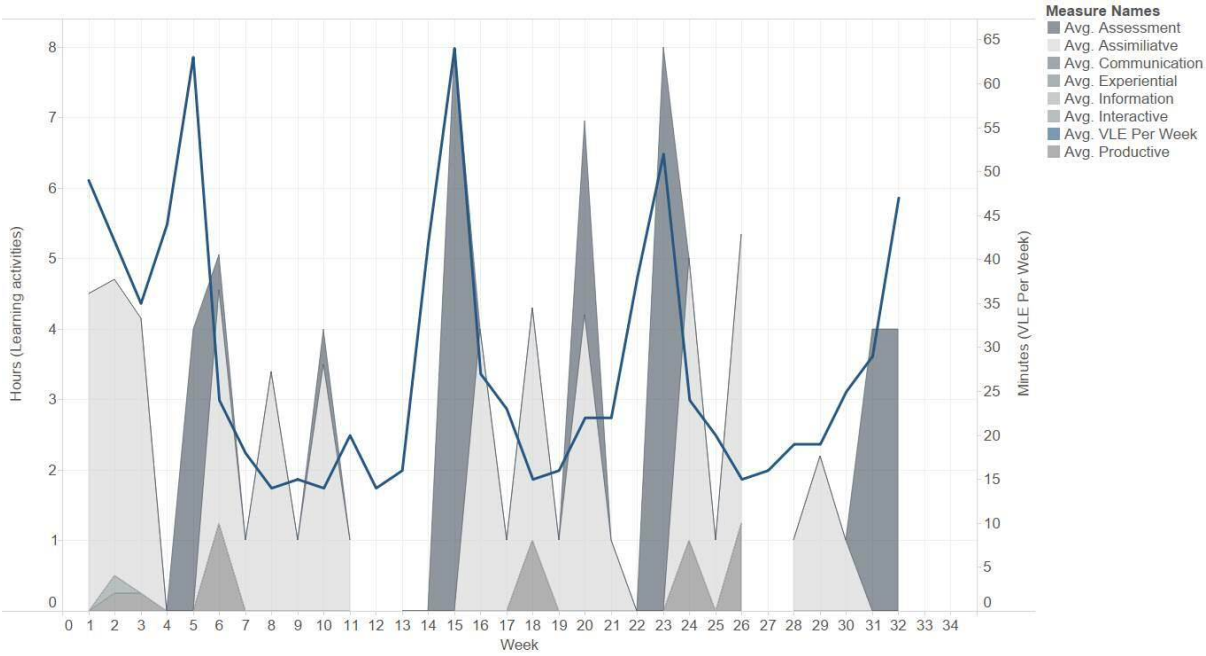

Figure 6.4: Longitudinal visualisation of learning design (greyscale blocks) and average students' engagement (solid dark line) in the VLE each week for CS2, from Nguyen, Rienties, Toetenel, Ferguson, and Whitelock (2017)

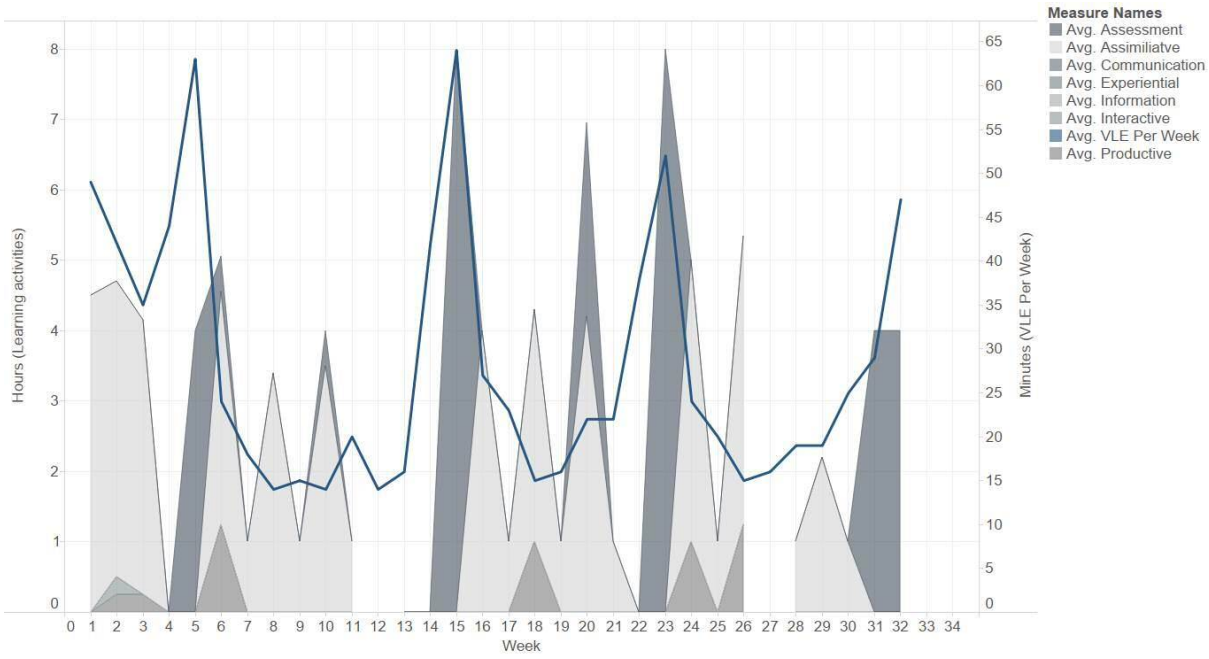

Figure 6.5: Longitudinal visualisation of learning design (greyscale blocks) and average students' engagement (solid dark line) in the VLE each week for CS3, from Nguyen, Rienties, Toetenel, Ferguson, and Whitelock (2017).

These studies highlight the opportunities to combine fine-grained learning design data with data from the VLE and student feedback to better understand the complexities of learning. They also show how teachers can optimise the learning design and provide effective support to different learners

To the classroom

Once the learning design taxonomy has been applied, and included in the unit of work schema, it can provide a rich source of data that can be analysed and compared with other forms of relevant data, such as student outcomes or satisfaction, to get a little closer to understanding what makes good learning design.

Further powerful insight could be gained by combining this data with learning design data generated by teachers during the learning of specific units. Might students respond better to a learning approach that incorporates increased communicative or finding and handling information activities in particular units or to particular questions presented to them in exam questions? Further, analysis of this data may also empower students to design class activities for themselves, or better understand the way in which their own outcomes are impacted by the learning activities they undertake.

Schools are increasingly encouraged to develop a blended approach to learning where a significant proportion of their students' time is spent online. However, the pedagogical value of these activities is not necessarily well understood. Teachers may set tasks for students to do at home or in the classroom that are online and delivered via education suites in a flipped-learning context. Companies such as Edrolo offer support and measurements of a student's academic progression. However, how are the types of skills that students are using being tracked, measured or monitored? How might the ratio of assimilative to communicative tasks influence or impact on the outcomes for particular groups of students?

Earlier in this chapter we explored the idea of developing a learning experience wheel from the language used by students when they talk about their satisfaction with learning and teaching. Further to this, the Attitudes to School Survey annually asks how satisfied students in Victorian schools are with secondary order factors such as student relationships, wellbeing, and teaching and learning. Once gathered, schools might be interested in comparing learning design data with factors from within these groups such as 'stimulating learning' or 'learning confidence' to explore more deeply how they might positively impact these measures for students. Australian schools' ability to bring students through from year 9 to 12 and complete the state-specific exams are flagged up as headline measures.

Despite having some advantages over the classroom, the online setting can easily become little more than a large repository for assimilative content, not dissimilar to a library. As has been discussed earlier, the distance between student and teacher in the online environment can be challenging for educators. Without training and tools it can become easy to design online learning materials in a very traditional way. Since it has been designed for a distance and online learning environment it is suggested that teachers might find the Activity Type Classification Taxonomy particularly useful in this context.

Discussion and moving learning design forward

Student retention is vital to the continued success of the OU and learning design is playing a key role in attempting to understand what factors, such as student workload, may play a role in motivating students to continue studying a module and working towards a qualification (Li et al., 2017; Rienties et al., 2016; Toetenel & Rienties, 2016a). Learning design at the OU continues to gather pace as it grows, informs, and is informed by, new developments in educational practice. Using a learning design taxonomy provides a common language with which teachers can compare their teaching and learning practice with other teachers, schools and cluster groups who are teaching from the same curriculum and generate a data set that when visualised and analysed can provide insight into the student learning experience (Nguyen, Rienties, & Toetenel, 2017; Nguyen, Rienties, Toetenel, et al., 2017). The approach allows for the measuring of what the student is doing, giving a different and unique view from those that

only measure students by their academic ability.

OU learning designers have presented the model to representatives of academic higher education institutions from India, South Africa and China who recognise its value. At conferences and groupings, such as the Learning Design Cross-Institutional Network, and European Distance and E-learning Network it has received a warm reception and continues to develop. Increasingly, commercial companies from law enforcement to the energy sector are identifying the benefits of the approach to their own work-based training approaches. To the classroom seems a logical step.

Indeed, adoption and application of a learning design taxonomy can provide a mechanism by which evaluation of many different significant and interesting approaches to teaching and learning can be explored (see for example: Nguyen, Rienties, & Toetenel, 2017; Nguyen, Rienties, Toetenel, et al., 2017; Rienties & Toetenel, 2016). Teachers interested in designing modules of work using inquiry-based learning may see merit and potential in the approach to map and then compare their curriculum and classroom practice against more traditional approaches. Even if student outcomes are similar, such a study continued longitudinally, might reveal differences for student retention or satisfaction.

As highlighted by Bakharia et al. (2016, p. 329), when looking at VLE data visualisations without these fine-grained learning design data it is hard to obtain an "understanding of the pedagogical context that influences student activities, and how identifying patterns in students' learning behaviours can be used to influence and contribute to more positive teaching and learning experiences". In line with Nguyen, Rienties, Toetenel, et al. (2017) as well as recent reviews of learning analytics (Ferguson et al., 2016; Papamitsiou & Economides, 2016), we encourage teachers to look beyond "cold" learning analytics data (such as weekly learning design activities, student engagement, clicking behaviour). A rich diversity of practice is present within the OU about how teachers design and implement blended and online education. Although the recent study of Nguyen, Rienties, Toetenel, et al. (2017) highlighted a strong relation between weekly learning design activities and student engagement, it is important to bring teachers and educational researchers on board to unpack the complexities of learning.

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