

Information on demand in the recording studio: Building the case for teaching music technology with an interactive agenda

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Abstract

Education in a contemporary context increasingly requires students to engage with learning technologies. This can present a challenge to both students and teachers who at times struggle to engage with the technical processes involved in navigating these technologies. Outside of formal education settings, on-demand information facilitated through improved access to mobile technologies is widespread. This paper presents a pilot study, which investigates the use of on-demand technologies in the context of popular music education based around the recording studio. The pilot study demonstrates how the complexities of operating a wide range of equipment and software presented a significant challenge to these users. Supporting the delivery of education involving technology through the provision of on-demand information could assist these users with learning specific technical skills. This paper develops an argument for incorporating on-demand information into curriculum involving technology, while developing some initial design principles for sharing these resources.

Key words: Music technology, on-demand learning, popular music education, recording studio operation

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Introduction

Contemporary educational reforms are shifting towards an environment that employs technologies to support various modes of delivery. Some studies have suggested that the delivery of higher education should be moving towards a more interactive agenda (Johnson, Adams-Becker, Cummins, Freeman, Ifenthaler, & Vardaxis, 2013). One of the factors driving this is the wider availability of mobile technologies allowing access to information on-demand (Tozman, 2012). With widespread access to information readily available, many

institutions are now evaluating the impact of this development on the evolving structure of formal learning environments.

Music education has also been impacted by these developments. This has been emphasised through a variety of research perspectives within the area. Some studies have identified that instructional videos hosted through You Tube have been important tools for music teaching and learning (Kruse & Veblen, 2012). Other studies have noted the benefits of delivering procedural knowledge for developing professional musicians through distance education (Jorgensen,

2014). Music education research from a variety of perspectives has also supported the use of technology for enhancing learning (Draper, 2008; Grant, 2013; King, 2009).

Technology in music education

This paper investigates the role that technology can play in supporting the learning of technology in a music education environment. A pilot study conducted at the Queensland Conservatorium's Gold Coast campus evaluated the impact of offering on-demand resources within a program involving the development of skills in recording studio operation. This pilot study found that popular music students supported the implementation of on-demand modes of delivery to support their learning. It is only in the recent past that the field of music technology has become more common as a subject in higher education (Ferreira, 2007). In this environment, successful completion of course work requires the rapid development of a range of new skills and knowledge that are necessary to operate a recording studio (Boehm, 2007). This technical environment can be challenging to both students and teaching teams, because of the evolutionary nature of the technologies that influence the area.

This has been what I have observed through teaching, and providing technical support within the Bachelor of Popular Music program. This program focuses on developing contemporary musicians, while utilising the recording studio as a primary focus for the program's major study Popular Music Production. Observation by Bachelor of Popular Music lecturing staff has noted that students can initially struggle to develop the technical skills required for successful recording studio operation. This can be a constant source of frustration to these non-specialist users, who have a steep learning curve, particularly at the beginning of the degree program. Although this is the case at the beginning of their learning journey, for some students as the complexity

of the recording studios increase, so does their disengagement with acquiring these skills. These students regularly work in the studio 'after hours' to complete portfolio recordings in a "scaffolded, self-directed learning environment" (Lebler, 2008, p. 193). It is during these after-hours studio sessions that students often face technical difficulties with little support, or knowledge to draw upon. This issue has seen an increasing reliance on peer networks working within the facility, or through social media to solve their technical problems as they arise.

Why is this the case? Successful operation of a recording studio requires these students to have knowledge of a range of issues related to the area. During an average recording session, decisions form constantly, and poor decisions can lead to problematic results on many levels. The 'worst-case' scenario where a session cannot proceed because of a major technical issue can occur through a lack of fundamental knowledge. However, poor decisions about microphone choice, their placement, and instrument preparation will also greatly affect the outcome of the produced work. While students get the opportunity to learn and apply these concepts during class tutorials, there is simply a lot to learn. Students in their early days within the program can find the range of new concepts and equipment daunting.

The on-demand model could help support students learning recording studio operation, and could be applicable to an array of other technical skills-based training. Many areas require the use of technology to facilitate the production of creative products, and often tutoring into these areas can be restricted because of limited facilities, and the nature of technical training itself. Providing each student with the opportunity to be 'hands on' with the equipment is not always possible. Experiential learning theorises that students need to be actively engaged to make the connections required for learning (Kolb & Kolb, 2005). The Bachelor of Popular Music (BPM)

program encourages students to learn through self-guided and collaborative work in the studios (Lebler, 2007). Utilising on-demand resources to support this environment is a natural extension of the holistic pedagogical approach already in practice within this program. This pilot study is a preliminary investigation into how this initiative engaged the students involved, while developing some initial design principles for enhancing this delivery method.

Technology in education and pulled learning

A wide range of literature supports the idea that an on-demand model could work in the context of how the BPM program is facilitated. Some literature suggests that the role of technology in education is at a tipping point, and that "pulled learning" is becoming a more relevant delivery model for many aspects of education. This is because of the expanded availability of mobile technologies, which have allowed widespread access to a wealth of information. Addressing the role that this technology plays in the delivery of course work has become a key focus for many institutions in the post secondary education sector. Some education researchers have proposed that higher education needs to keep pace with the world, and the ever-increasing influence that technology is having on education (Bennett & Maton, 2010; Edwards, 2012; Johnson, Adams-Becker, Cummins, Freeman, Ifenthaler, & Vardaxis, 2013). Extensive access to information through mobile, and web-based technologies has given learners the opportunity to access information 'on-demand'. This is driving a range of new learning and teaching models to evolve, with constant reform of pedagogy necessary because of the rapid pace that learning environments are setting outside of education (Tozman, 2012).

Tozman (2012) defines learning 'on-demand' as "a critical moment of need, when a person really wants knowledge about a specific topic

to help them through that moment" (p. 1). He contextualises this approach to learning and defines it as "*pulled learning* because the information required is dynamically pulled by the individual" (p. 1). This is in opposition to the standard education process that delivers prepared material where "a person is exposed to new knowledge regardless of his or her immediate needs" (p. 1). The spread of influence of 'on-demand' learning is now moving at a rapid pace thanks to the availability of mobile technologies. This is creating extended learning communities, and arguably changing the nature of how and when people learn.

So how is this approach influencing the nature of learning? Tozman (2012) proposed that learners who seek learning experiences or so-called pulled learning on-demand have richer learning experiences, because of the relevance and application of the learning. Research also argues that learning on demand delivers better learning outcomes for the student. Trondsen (1998) proposed that because learning is applied in context through the learning on demand model, knowledge retention is significantly superior to "lecture-based learning models" (p. 171). It is also argued that the incorporation of visual information resonates more effectively with the majority of students who absorb information more readily in this format. Trondsen (1998) views the traditional "hierarchical model of knowledge transfer" as out-dated in an age where there is more focus on "empowerment, individual accountability and self-directed learning" (p. 174). The development of an active learning environment delivers a pedagogy that produces deeper, richer learning experiences, and as a result delivers more thorough understanding of the subject matter (Cherney, 2008).

Flipped learning

In a broader context the education sector has already shifted towards these modes of delivery. Esnault (2007) discussed her impressions of

how the process of learning and teaching has changed, driven by the increased availability of information and communication technologies (ICTs). Because of the range of ICTs readily available students are enabled to achieve results using plug and play technologies. The recognised implication of this is that system designers using E-learning need to flip the pedagogical emphasis from teaching to learning, through the integration of a range of technologies into formal learning systems. The 2014 NMC Technology Outlook for Australian Tertiary Education predicts that “mobile learning and online learning, in some form, will likely tip into the mainstream within the next year” (Johnson, Becker, Cummins, & Estrada, 2014, p. 2). They also predict that bringing your own device (BYOD) will slip into the mainstream of tertiary education within the next twelve months (Johnson et al., 2014).

The advent of broader access to technologies has generally provided opportunities for on-demand learning. The influence of technology on education however is the subject of a wide variety of research, emerging from a range of perspectives (Draper, 2007; Edwards, 2012; Oblinger, 2003). Edwards (2012) commented that there is an expansive range of factors affecting the use of technology in education. While society has a strong influence on the ways in which education uses technology, technological changes make it a difficult area to maintain perspective (Edwards, 2012). Perspectives on the consumers of technology in education offer a perspective about how they view technology. Oblinger (2003) argued that students come from diverse backgrounds, or age groups but generally viewed technology “as a part of their natural environment” (p. 38). However there are varying degrees to which students engage with technology, and how this can influence the development of pedagogy. Bennett and Maton (2010) argued that claims of a “generation of tech-savvy young people immersed in digital technologies for which current education systems cannot cater” are unfounded (p. 2). They

proposed that learners from all age groups have different technological abilities highlighting the need for more research in the area. This is also viewed as necessary because of the consistently shifting nature of technology, and its impact on the pedagogical considerations for structuring learning opportunities.

The future of music technology education

This shifting emphasis in delivery modes and learning approaches directly relates to the area of music technology education. Delivering music technology coursework in higher education is an expanding area, fuelled by the increased availability and affordability of recording software. However the pedagogical approaches to delivering music technology course work are still developing (Boehm, 2007).

Some existing literature argues that a supported environment, or the provision of resources for delivering music technology coursework can be beneficial to student outcomes. King (2009) evaluated the implementation of a “learning technology interface” (p. 137) or LTI in a recording studio environment, through a practical project. In this project students were asked to complete a task in the recording studio, and the LTI was made available to support them. Offering a specific perspective into supporting students learning recording studio operation, the LTI was presented as a valuable pedagogical initiative. Allowing students to access relevant material on demand to enhance their learning. King (2009) argues the initiative is more beneficial than conventional sources of information (such as equipment manuals). The LTI in this study is created, as an intervention to solve technical issues that students were experiencing out of hours, when there is little or no technical support staff available. Other studies have noted that these learning approaches are already having a significant impact outside of formal education (Kruse & Veblen, 2012).

Fundamental principles of adult education acknowledge the value of self-directed learning environments to engage adult learners (Knowles, 1970). Further research also supports the idea that a self-directed style of learning is a suitable supplement for education in the field of music (Draper, 2008; Waldron, 2011). Research undertaken by Draper (2007) within a music technology program suggests the value of a holistic approach to creative arts education. Draper (2007) discusses how traditional structured scientific modes of content delivery often create dis-engaged students, particularly in the creative arts. This offers a perspective on the structuring of music technology course-work in higher education, and how on-line technologies can support and enhance pedagogy. A broad range of on-line initiatives encourage collaboration amongst the school's community, allowing undergraduate students to have a chance at "doing the driving" for their own learning (Draper, 2007, p.1). Draper (2007) supports the idea of a "learning ecology" (p.1) where both student and teacher interact through on-line resources, allowing for more contextual understanding of music technology. Draper (2007) suggests that students participate and exchange creative works in an environment that supports collaboration and peer review, as a means of "driving their own learning" (p. 1).

While the importance of sharing and collaboration are important and relevant at a school level, how this interfaces with the wider community is also relevant to the area of music technology education. Other work by Draper (2008) explored the way that Internet technologies are changing and "re-defining music careers" through the use of social media or "Web 2.0" (p.137). Through the use of a social networking styled ontology, the paper details a dynamic environment designed to create an authentic context for music technology coursework. This area is also the subject of Waldron (2011) who investigates the importance of the "community

of practice" and the role of informal learning over the Internet (p. 97). Her study also discusses the need to evaluate and further develop research methodologies to interpret these new ways of working. Apart from the development of purely technical skills, higher education needs to also accommodate higher order skills as a part of the curriculum. Macedo (2013) suggests that technology has changed the expectations of the students, and this is directly relevant to music technology because of the role technology plays in this area. Through gaining this additional perspective, students will develop enhanced critical and perceptual skills. This is important in the creative arts where perception and critical perspective are necessary skills to deliver successful outcomes. Delivering a pedagogical initiative that mirrors problem-solving processes used outside of education prepares students for entering a post university environment.

On-demand resources: a pilot study

A pilot study investigated the potential for the use of on-demand resources to assist BPM students with learning fundamental skills related to recording studio operation. Initial consultation with music technology lecturing staff identified the skills to be developed. These consultations, combined with anecdotal student discussions informed the resource development, with the resources to focus on a range of primary skills relevant to BPM students.

The planning identified that resources covering music production techniques including microphone selection and placement, mixing techniques and other relevant music production fundamentals would be beneficial. It was recognised there should also be a strong emphasis on sharing technical information. These resources were to include comprehensive overviews of digital audio workstation (DAW) operation, software configuration, audio patching, and outboard audio equipment operation.

Resource development and delivery

Resources were then developed and delivered to students based on this initial research planning, through a variety of on-demand modes of delivery. The resources were video tutorial presentations, and screen-capture video, created by Queensland Conservatorium staff. In total 27 instructional videos were created for the project, covering the information identified through the student and staff consultation process. These resources were then shared in a multiplicity of ways, which allowed students a variety of ways to access the on-demand information.

1. YouTube channel created for the project.
2. Blackboard Organisation Site.
3. A media embedded iBook was also created to allow students to download the resources to their mobile phone, laptop or tablet.
4. Resources were also shared on the studio computers and student computer lab (via iBook).

In conjunction with this, resources were also regularly shared through the school Facebook page. This was done to support the resource project, and promote general awareness of the resources availability.

Information gathering: student surveys and focus group

Following the delivery phase of the project, information gathering was conducted to gauge student support for incorporating on-demand resources to support their learning. The survey and focus groups were open to all year levels of study within the BPM program. This was because the generic nature of the research topic was transferrable across all year levels, though the resources were aimed at delivering fundamental concepts at this early stage. The survey primarily sought attitudinal responses via means of a Likert scale, together with one open question. The survey was designed to:

- provide background information on the BPM cohort and their previous experience with music technology
- investigate the frequency that students experienced technical issues and the ways that students currently resolved these issues
- explore student perceptions of the value of on-demand resources in helping them to learn recording studio operation

This information was supplemented with a student focus group conducted with ten students from across the BPM cohort. The focus group participants were asked a series of questions related to how they felt about their learning in this area including:

- their experience of learning to operate a studio
- whether having access to on-demand resources had helped them learn some of the technicalities involved in recording studio operation

There were two aims to this initial pilot study. The first aim was to understand the cohort in relation to their prior use of resources, as well as to explore if these students felt incorporating on-demand resources would support their learning in this area. The second aim was to develop a set of initial design principles for the development and delivery of on-demand resources in the area of music technology education.

Student survey responses

In total 36 students participated in this survey from a potential cohort of 125 students. Question one asked: What year level of the Bachelor of Popular Music program are you currently enrolled in? The survey had a reasonably even spread of respondents across the three year levels of the undergraduate program, with slightly more first year students participating in the survey than other year levels (Figure 1). Because the resources at this stage of development focused on

fundamentals, it was anticipated that this would be the case.

The second question asked students to rate their prior experience with recording studio equipment before involvement in the Bachelor of Popular Music? This question asked students to rate their experience from very limited experience through to highly experienced. Most of the respondents identified as having very limited or limited prior experience, with one third of the respondent identifying as having some prior experience (Figure 2).

This is an accurate representation of the student cohort within the BPM program. Some students noted that they had “some experience” in the area prior to entering the program, though through prior experience of working with students in the program it has been recognised their prior experience in this area is limited. The focus of the

BPM program is very much on the development of potential singer/songwriter/musicians with a smaller number of students fully focussed on learning skills in audio engineering and music production. The students who develop a flair for this area usually develop as they move through the program.

The next question asked students about their experience with technical problems while using the studio. The majority of students surveyed had experienced some technical difficulties while using the studios, often seeking assistance from their peers to solve these issues (See Figure 3)

The next series of questions sought information about whether students felt they would use on-line tutorials if they were provided. It also asked if they felt this would help them to learn these concepts, and when they thought they might use them. When asked if the students felt they would

Figure 1: Student Year Level.

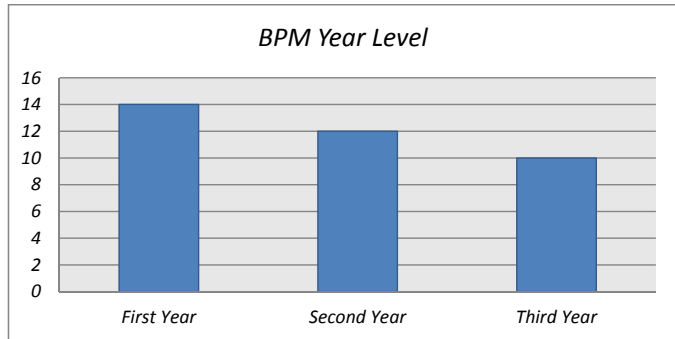
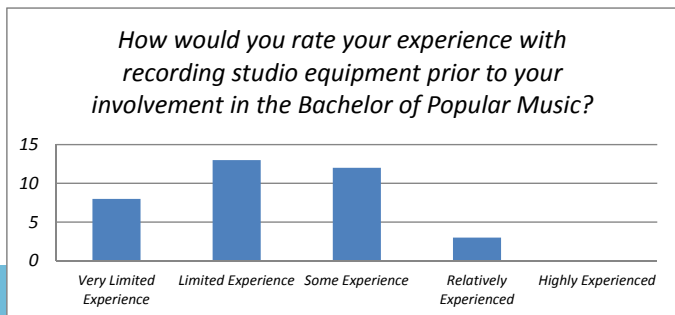


Figure 2: Previous experience with recording studio equipment.



use on-line resources to support them in this area, a strong majority said that they were either highly likely or likely to use these resources (Figure 4).

The next question asked if students felt that on-demand resources could be valuable to their learning. The response was that students agreed

or strongly agreed that this would be of benefit to their learning of operating a recording studio. Thirty-three of the respondents either strongly agreed or agreed that the use of on-line resources would help them to learn to use the recording studio more effectively (Figure 5).

Figure 3: Have you experienced technical difficulties?

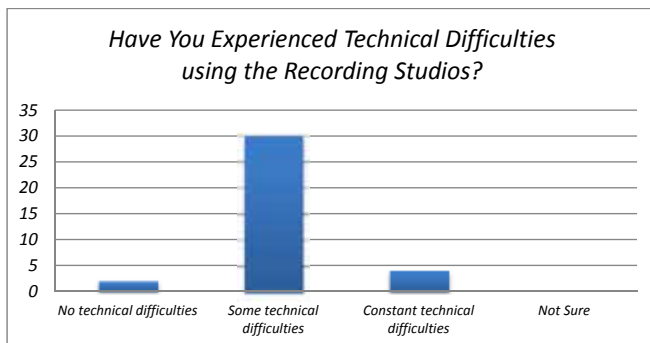


Figure 4: Would you access on-line resources if they were provided?

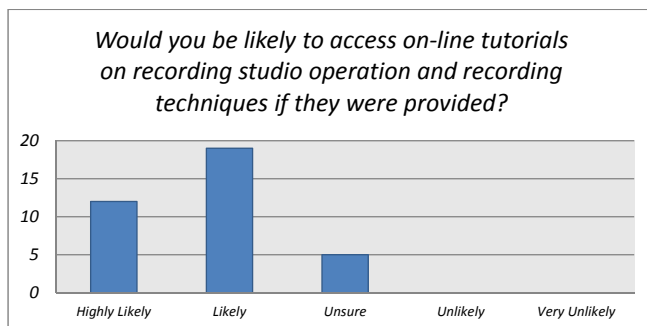
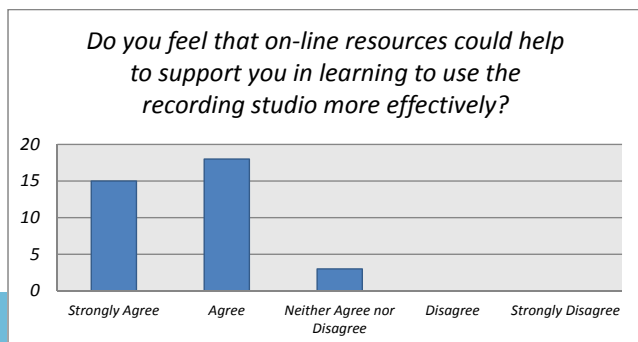


Figure 5: Do you feel that on-line resources could help to support you in learning to use the recording studio more effectively?



Students were then asked when they felt they would access the resources. The majority of students identified that they would use this kind of resource to help them when necessary (Figure 6).

The final question asked students about their preferred delivery methods for the delivery of on-demand resources. Students were given the option of downloading to mobile devices, access via social media, through the Blackboard learning management system and via the local computer. Overall fifteen students felt that a download to their preferred mobile device would be their preferred option, with Facebook and Blackboard displaying similar preferences at nine and seven respectively (Figure 7).

Open Survey Question

Along with the questions seeking attitudinal responses, an open question was set to give student the opportunity to guide the conversation. This question asked “What sort of resources do you think would be most useful to support you in learning to use the recording studio and music production”. The responses to this question were analysed using thematic analysis, to identify common recurring themes. The most common theme identified through this process was troubleshooting of equipment usage, which appeared frequently throughout the text. This was closely followed by requests for basic set-up procedures, which detailed studio-specific equipment usage (see Table 1).

Figure 6: When would you most likely use this sort of information if it were provided?

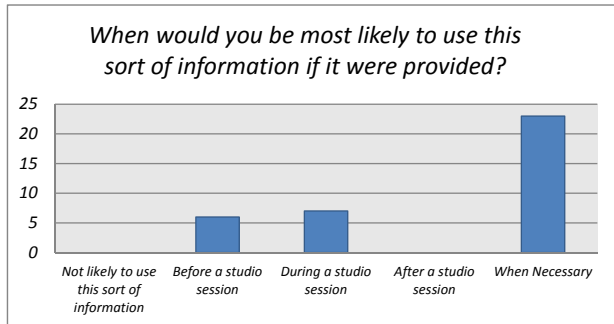


Figure 7: What delivery method would you be most likely to engage with if technical information regarding the recording studios was provided?

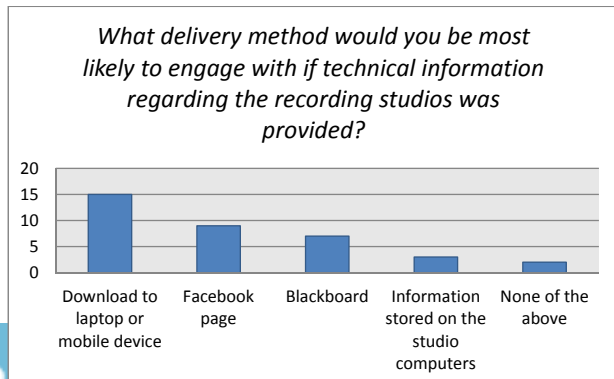


Table 1: Open question responses.

Theme	Student responses
Troubleshooting Theme	<p>Information on what to do when settings have been changed, or equipment isn't working as it usually does.</p> <p>Problem solving methods from simple- advanced.</p> <p>Learning how to troubleshoot the studios.</p> <p>I believe that collating the most common studio issues, and then making some sort of page on either Facebook or blackboard with easy steps to follow would be great.</p> <p>Troubleshooting issues.</p> <p>Instructions on how to resolve issues that occur frequently in the studio.</p> <p>Maybe some troubleshooting guides for when specific problems occur.</p> <p>Troubleshooting videos.</p> <p>Video tutorials on trouble shooting</p> <p>What to check if Pro Tools isn't recording. For example how to reset Pro Tools to studio D settings the settings have been fiddled with. The only reason I could record one day was because a third year came in and reset it to studio D, knowing this was really helpful.</p> <p>A tutorial on how to trouble shoot for things that aren't working in the studio, and what you can try to find what's causing the problem.</p> <p>Problem solving methods from simple- advanced.</p>
Basic Set-up Procedures	<p>Tutorial on how to utilise the SSL analogue desk in Studio A to its full potential.</p> <p>Tutorial videos and/or pdf documents with basic setup guides, basic EQ and compressor settings.</p> <p>Pro Tools Shortcuts (would be handy to have a pro tools cheat sheet handed to us at the start of 1st year)</p> <p>General microphone models and their uses (what instruments they're best for).</p> <p>DAW desk operation manuals. Headphone Amp patching tutorial (including new headphone unit in studio A). I know a lot of these resources are already available, however a central hub (website/Facebook page/LAG Module) that has all this information collated and presented in a user friendly way could help a lot of students that are lacking basic studio knowledge.</p> <p>Studio specific information such as creating headphone sends.</p> <p>Instructions on how to do things step by step. For example patching headphones in Studio B, as they are weirdly labelled.</p> <p>Gear specific tutorials.</p> <p>Tutorials on how to use the devices in the third post room e.g. French Connection Modular Synth, Virus and Voyager Synth racks, Maschine and Korg Drum pads etc.</p> <p>How to patch correctly in all the different studios/post-production rooms.</p> <p>How to set up all the different DAWs with your pre amp inputs.</p> <p>How to get sound out of the midi keyboards.</p> <p>SSL desk support – using the reverb console.</p> <p>Headphone set up in Studio A.</p> <p>Online tutorials on how to use studio equipment as well as how to use DAW's and plugins.</p> <p>Tutorial on how to clean and prepare the tape machine in Studio A.</p> <p>Tutorials on the more advanced outboard gear (specifically in studio A)</p> <p>Control desk tutorial.</p>

Table 1 continued: Open question responses.

Theme	Student responses
Audio Mastering Tutorial	A detailed tutorial on Mastering outlining the entire process with some examples. Mastering tutorials.
Audio Mixing Tutorials	Mixing tutorials for different genres of music. Mixing tutorials. Video tutorials on mixing approaches.
Microphone Techniques	Studio tutorials on general microphone placements on different instruments. Microphone techniques and tone/timbre setting of instruments. Quick easy diagrams showing microphone placement options, gear configurations etc. Further details which can be found in relation to these diagrams, that way you can do further research if you need/want to. Various microphone/recording techniques Microphone techniques and creative use of outboard gear.
Knowledge Extension	Videos or texts on alternative/ unconventional methods used to record that may not be taught in lectures/ tutes. FAQ's and Instructional Videos including links to videos/tutorials by professionals outside the conservatorium.

Student focus group

A student focus group was also conducted as part of the data collection, to seek in-depth perspective of how students feel about learning recording studio operation. It also sought to clarify the role that on-demand learning could play in helping them to learn. Similarly to the open question where troubleshooting came up consistently as a theme in the students responses, the idea of information that supported them with having technical information on-demand was again evident. The focus group initially asked the students how they felt about learning to use a recording studio (Table 2). Was it challenging? Some students found it to be relatively straightforward, while others highlighted that they felt that learning these skills was quite challenging.

The next question investigated if the students thought that on-demand resources would help them to learn the technical processes involved in recording studio set-up and operation (Table 3). There was a lot of support from the students involved in the focus group for this form of

information sharing and the provision of a supported learning environment. The theme of troubleshooting issues and basic equipment configuration came through as a primary concern for the students involved in the group, similarly to the open question responses.

The student perspective: engaging with learning technology

This paper has explored a range of literature to support the argument that on-demand resources could support students learning to operate technical equipment. The pilot study demonstrated student support for learning through using on-demand tutorials, with many users already utilising on-demand learning outside of the formal education environment. This approach to training students to develop technical skills could also be applicable to many areas using technology. The pilot study also sought to establish a starting point for sharing technical information with students within the

Table 2: Focus group question 1.**Have you found learning to use a recording studio challenging?**

Student 1	In first year it took me a while to get my head wrapped around things... There is a lot of information thrown at you in a short period of time.
Student 2	I found the general operation of the studios pretty easy. Everything comes down to common sense unless of course there's an unexpected technical issue. Like most other people here learning the basics has been pretty straightforward. I felt pretty comfortable with getting sessions set up and signal flow pretty early on in first year, however it wasn't really until mid-late second year that it became a lot easier to deal with technical issues quickly without them affecting the session.
Student 3	Before this course I've had very minimal experience with studios and recording software and what not. The first few weeks of first semester were a little daunting, but I found myself slowly getting used to it.
Student 4	I've found the basics of the studio to be relatively easy so long as you think logically about the signal flow.
Student 5	I definitely wasn't confident, or capable coming into the course and it took me a long time to even get the basics down.
Student 6	The fundamentals of learning how to use the pre amps and patch bays to get into Pro Tools has been easy to get used to, but learning how to use the software and C24 has sometimes been a problem if something has been changed.
Student 7	As a not technically minded person who had never worked in a studio before I struggled a lot in first semester of first year, but definitely got the hang of it by second semester.
Student 8	Learning all the basics was pretty straightforward and both listening in lectures and doing individual projects helped me to learn all the foundations to record.

BPM program. The project established a number of key points related to the characteristics of the BPM cohort through the research.

1. the students entering the BPM program of study generally have limited prior experience with recording studio operation
2. that some students find that learning recording studio operation is more challenging than others, though generally students found there is a lot of technical information that could benefit them across the degree program
3. that most students are experiencing some form of technical difficulties with learning to use the recording studios

The pilot study also identified some key points related to how these students viewed the availability of on-demand resources could potentially support their learning experience.

1. the majority of BPM students involved in the research felt that the additional support of

on-demand resources could benefit them in learning to use the recording studio

2. that generally these students felt having on-demand information would give them the opportunity to use the information when necessary. The findings displayed that students valued an on-demand model for assimilating this information.

Initial design principles

The data gathered through the pilot study has led to the evolution of initial design principles for sharing on-demand resources with these users. The design principles that evolved could be grouped into some distinct themes. The identification of hurdles that these users might experience in these environments is a major theme. This means that resources need to strongly connect with overviews of basic set-up procedures for a range of equipment relevant to these users. These overviews should empower the

Table 3: Focus group question 2.**Do you think having access to on-demand resources would help you to learn some of the technical processes involved in recording studio set-up and operation?**

Student 1	I think having access to on-demand resources specifically regarding problem solving issues like the C24's not interfacing with the system and all that kind of thing and also to do with what I've said earlier with the nitty gritty of the specialties of each unit and how they work would be totally invaluable.
Student 2	I think having on-demand resources would be an awesome way to learn some of the technical processes!
Student 3	I think being able to have access to a resource that will show the I/O paths and other settings that are needed to get signal into Pro Tools correctly and get the C24 online would be beneficial when operating the studio.
Student 4	The on-demand resources would help if you don't pay attention in your lectures or think about things logically. I believe they would be more suited to very early first years that may take more time than others to pick up the skills and knowledge. If these resources went into more technical details I could easily see them being very helpful across all years and skill levels.
Student 5	I think all the basic stuff is relatively straightforward and can be solved through trial and error/ common sense. On-demand resources for more advanced studio techniques would be really helpful too
Student 6	I think having access to on demand resources would be helpful for sure, I think a lot of what frustrated me in first year is I would know things to a certain point however if things went wrong I had no idea how to fix them.
Student 7	The on demand resources would be awesome for these situations in particular, where people may not have enough of an understanding of actually what is going wrong to troubleshoot. I feel like most of the issues, especially in first and second years, came down to changes in hardware and software settings (sometimes very minor). I think it would be important to place emphasis on how to 'zero' the studio and reset everything to standard settings before sessions to avoid anything like this interrupting the recording. Looking back on most of my issues they were almost always stemmed from a single setting being left that way from the previous session or I/O settings being messed up from moving sessions between different computers and PT systems
Student 8	I feel that having access to on demand resources would have been extremely helpful, as it was often the little things that were tripping me up.
Student 9	Having on demand resources would definitely be a big help in my opinion. For instances like when the desk is suddenly not working, how to get it running again. Or the process of using headphone sends in D and C, like having to turn off main to cue. And also how to reset the I/O setting when someone has changed them, or getting the HDX to work when the sound is coming from the computer instead of the monitors. Just little technical things that are skipped over in class.
Student 10	I think that on demand resources would be an awesome idea for exactly those little mishaps like the desk not working and other weird things that you can't get your head around.

users to troubleshoot common technical issues experienced while using these environments.

Another theme that emerged was that students felt information exchange needed to be quick and accessible. While students engaged with the resources in a variety of ways, there was strong support for delivering these resources through mobile technologies. This supports the assertion

of the literature that mobile learning is now becoming a mainstream consideration. It also demonstrates that the need for information to be available quickly and easily is highly relevant to these users. The resources shared with the students were screen capture or video content demonstrating equipment usage. However the development of documents detailing studio

specific information was identified as useful tools for demonstrating quick set-up procedures. This would assist users in solving common issues quickly. Quick and easy access to information was also relevant to the creation of video resources. The inclusion of chapter markers and shorter video content would also speed up access to information, minimising the disruption to creative practice because of technical issues.

Another major theme that emerged was that the resources needed to be relevant to the technical equipment used in these sometimes very individual environments. This means that the resources should be grouped accordingly, and be up to date with current operating procedures. Because of the dynamic nature of technology, often these environments are updated with new equipment. A virtual space where the latest information can be shared, with updates on equipment outages and issues could be highly beneficial to these users. Managed by a central facilitator, equipment repairs, fault reporting and equipment demonstrations could be managed from an accessible, mobile, on-demand resource hub.

My experience of working within the BPM program has led me to recognise that often, new students need a high level of technical support. Working outside of normal support hours, these students can benefit from virtual on-demand support to develop their knowledge and skills. This pilot study sought to establish a starting point for sharing technical information with students within the BPM program. However, these principles are applicable to a range of situations arising in higher education, where technical skills or information is required at crucial junctures in the learning process.

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