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Abstract

Testing creativity in tertiary learning activities is a young field of research, and current assessment methods are difficult to apply within the diverse context of media production education, where disciplines range from journalism through to video game production. However, the concept of remix is common across this wide range of media, and offers practitioners 'endless hybridizations in language, genre, content, technique and the like' (Knobel & Lankshear, 2008, p. 22). The conceptual commonality of remix indicates that the study conclusions will have useful implications across a range of media production disciplines. This study aims to consider new methods for testing creativity in media production learning activities and to provide better assessments for learning design. This study focused upon a learner cohort of music technology students that were undertaking a work-integrated learning programme with a record label. To make the students more work-ready and inspire greater creativity, they remixed tracks recorded by professional music artists as part of a unit assessment. Subsequent self-report surveys (N = 29) found that the process of creating a 'remix' enhanced their creativity and provided suggested improvements to

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the design of the learning experience. Importantly, we found no relationship between the survey responses and objective assessments, indicating that the self-reported improvements in creativity were not simply a measure of how well the students performed the formally assessed tasks. Although more research is needed to establish effective measures of creativity, these findings demonstrate that self-report survey tools can be a powerful tool for measuring creativity and supporting improved iterative learning design.

Keywords

Creativity, learning design, music technology, remix, produsage

Introduction

Transformative learning is a creative experience, and facilitating such a learning moment takes creativity. Remixing loops of learning and teaching experience between a number of disciplinary experts, this article explores the concept of 'remix' as both a methodology to measure creativity and a teaching tool for creativity. This study suggests a new mixed methodology approach for the testing of creativity in learning activities, and it is also a collaborative effort between experts in music technology, psychology, creativity and education to remix approaches to learning. We argue that whilst creativity is domain-specific, re-mix as a creative technique crosses domains and disciplines. We situate this work as part of a collaborative effort to engage in a form of distributed remix which engages with the issue of how to design, assess and incorporate professional skills and creativity into higher education courses. In this respect, we are both exploring the practice of content creation via the remix and mashup *produsage* by students in a music technology unit and performing a mashup *produsage* as academics from diverse research areas. A conventional creative practice is described as a 'production process that is orchestrated and coordinated from a central office and proceeds in a more or less orderly fashion to its intended conclusion (the completion of a finished product)' (Bruns, 2010, p. 26). *Produsage* involves projects that harness the creativity of a large range of participants to build on and extend an existing pool of artistic materials (Bruns, 2010). The distributed nature of these projects means they are predicated on unique creative principles which are largely alien to conventional music production practice—and we would add to conventional research into the processes and practices of learning and teaching.

Research literature on creativity varies widely across disciplinary approaches such as social psychology (Amabile, 1996; Sternberg & Lubart, 1995), educational science (Csikszentmihalyi, 2014, pp. 47–61; Csikszentmihalyi & Wolfe, 2014) and creative arts perspectives (McIntosh & Warren, 2013; Weisberg, 2006). Integrating these perspectives can increase the capacity to understand how to teach creativity in higher education. Research literature on creativity is well

established in both education (e.g. Bonk & Smith, 1998; Craft, 2003; Jeffrey, 2006; Lytton, 2012; Parnes, 1970) and psychology (e.g. Deci et al., 1999; Feist, 1998; LeBoutillier & Marks, 2003); these inform the development of our methodology. In addition, the meta-review by Scott, Leritz and Mumford (2004) supports our approach with respect to how creativity could be used to support learning. However, we also acknowledge that the notion of measuring creativity—particularly musical creativity—is inherently fraught with problems associated with defining and measuring creativity (McLennnon, 2002, p. 35). Music technology students were chosen as music composition is the archetype of creative behaviour; it is, therefore, an ideal candidate for inclusion in improving and assessing creativity.

Why Remix?

The process of remix offers students the chance to act 'simultaneously as readers and writers, consumers and producers, a stance many media scholars say is indicative of today's new media environments' (Burwell, 2014). Re-contextualizing existing content potentially creates new meaning. The action can empower students creatively when they realize that their remix action can have powerful meaning. It may be considered an affirmation of personal creative worth. By a similar token, the crafting of digital media can also bring some sense of personal social empowerment from the activity of creating meaning. The development of digital cultural capital (Buckingham, 2003) is an attractive participatory proposition, especially when the outcomes are so easily distributed across networks.

Remix is a powerful tool for both creative development (e.g. Knobel & Lankshear, 2008; Navas, 2012) and having educational purposes. Lessig (2008) has referred to the significance of remix as an educational paradigm. 'Members of a [remix] community create in part for one another. They are showing one another how they can create' (Lessig, 2008, p. 77). Notably, it is the showing that is often the most valuable learning experience and not necessarily the resulting content. Indeed, Watson (2011) suggests that the creative skills developed in composition of music are the same skills used to problem solve in everyday life. When a composer accepts a commission, there are structural parameters that must be included within the work, such as musician costs, musical style, duration, possible picture synchronization, mood and likely destination. The needs of a composition brief outline these issue/s which then must be solved with an aesthetically pleasing artefact (Watson, 2011). There is also a strong self-development value for students from music composition. For example, Kaschub and Smith contend that 'creating music where none previously existed is a powerful act of self' (Kaschub & Smith, 2009, p. 105). Students can gain comfort and confidence in organizing notes, rhythms and melodic phrases, strengthening their sense of self and often powering their new found musical talents and creativity to greater sophistication.

We acknowledge that the process of remix itself does not itself create great artefacts—there is bad remix and good remix as in all creative endeavours—but 'it is one way to learn' (Lessig, 2008, p. 82). The remix exercise of the music technology education paradigm immerses students in digital audio, provoking creativity and learning. The initial intent of using audio remixing as a learning activity was to explore student creativity and investigate its potential for developing, enhancing and evaluating creativity. Whilst many of the learning activities focused on skills acquisition, the secondary outcomes of individual creativity and empowerment were also important. In part, the learning loops we want to remix from our own disciplinary expertise is to be creative about ways that learning technology—which provides accessibility to low-cost software tools—might be used for innovative learning designs in all disciplines. If we give students appropriate technological tools that allow them more opportunities to be creative, how far along their own learning journey can they self-design? Similar to Watson's observation that 'non-traditional music[1] (NTM) students thrive in elective music courses that emphasize creativity and technology' (Watson, 2011, p. 983), other higher education students may flourish if given sufficient 'learning loops' to remix.

The ability to generate alternatives or to see things uniquely does not occur by chance; it is linked to other more fundamental qualities of thinking, such as flexibility, tolerance of ambiguity or unpredictability, and the enjoyment of things heretofore unknown (Franken, 1994, p. 394).

Method

Undergraduate students ($N = 29$) studying a music technology unit at Murdoch University were given the opportunity to collaborate with the record label Hidden Shoal[2] for their final major assignment. Five of the label's existing artists offered one of their previously released songs to the students as source files to craft a new remix. As an incentive, students were advised that particularly good remixes would be considered for release by Hidden Shoal.[3]

In designing our methodology, we drew on Cropley (2010, p. 72) who offers a summary of approaches to measuring creativity: he identifies 255 types of data collection methods which he divides into 'creative products', 'creative processes' and 'creative persons'. Our methodology sought to combine measurements around 'creative persons' and 'creative products'. We chose to focus on 'creative persons' because, as student-centred researchers, we wanted to explore students' perceptions of personal creativity and how that influenced their development of 'self'. We brought an assumption—from music technology—that students strengthen and develop their sense of self through the creation of music (Kaschub & Smith, 2009, p. 105), and in doing so, they are practicing 'the most complex cognitive process' and the development of higher order thinking skills. We used Cropley's sub-categories of 'special personal properties' and 'procedures based on [an] adjective checklist' (2010, pp. 75–76), which focus on self-rating tests to

survey students who did the audio remix process as to whether they felt specific attributes of creativity had occurred for them or been enhanced by the activity. A questionnaire was developed which drew on: the Creativity Checklist (Johnson, 1979), Creative Behaviour Inventory (Kirschenbaum, 1989), Group Inventory for Finding Creative Talent (Rimm & Davis, 1980), Creative Styles Questionnaire (Kumar, Kemmler & Holman, 1997), Abedi-Schumacher Creativity Test (O'Neil, Abedi & Spielberger, 1994), Villa and the Auzmendi Creativity Test (O'Neil, Abedi & Spielberger, 1994) and the Creatrix Inventory (Sweeney, 1968). These approaches converge around the practice of asking the study respondents to self-rate aspects of their perceived creative practice. For example, concepts such as *idea production*, *imagination*, *ingenuity*, *innovation*, *positive self-referencing* and *originality* (Cropley, 2010, pp. 74–76) were drawn from these studies. Those concepts were used to write statements–in the audio remix context–against which students rated their agreement on a five-point Likert scale. (See Table 1 for the full statement list.)

As a further data point, the study drew on the remix product assessment data that students had received from their expert tutors. Expert assessment of finished creative outcomes is the most obvious starting point for evaluations in industries that involve some form of consensual assessment (Hennessey, 1994). The assessment criteria focused on (a) Project layout, structure and labelling, (b) Quality samples and/or sample/loop editing, (c) Use of industry stems, (d) Mix balance and (e) Creativity/originality. These assessment criteria resemble the Creative Product Semantic scale (Besemer & O'Quin, 1999) commonly used to assess the creativity of design.

There was a further analysis of the relationship between the self-report data and objective expert measures of performance of the assessment task. Students completed the survey after the release of assessment results. There was a possibility that students who had received higher marks in the expert assessment would self-rate highly on their perceived creativity in the survey, so we tested for any such relationship using correlation analysis.

In summary, the analysis of the data from the student self-rating survey and the expert assessment sought to, first, identify what students perceived about their improvements in creativity after conducting an audio remix, second, validate the internal consistency of the survey data and, third, identify any correlations between the self-rating survey and the expert assessment.

Results

There were 29 survey respondents, and the summary data (averaged across respondent) are shown in Table 1.

The survey displayed strong internal consistency (Cronbach's alpha = 0.88), indicating that the survey is a reliable psychometric test. The only exception was Question 6, which correlated with the other questions at $r = 0.26$ (the other

Table 1. Survey Responses Averaged Across Respondents (*N* = 29)

Question	Score	St. Dev.	Question Wording
1	1.79	0.68	*The project encouraged the development of novel or original audio content*
2	1.86	0.74	*This assignment helped me access my musical ideas*
3	1.90	0.86	*I became more open to new audio perspectives or production strategies*
4	2.31	0.97	*This project made me feel good about my abilities as a music producer*
5	1.97	0.87	*This assignment generated a large number of creative ideas*
6	2.03	0.68	*This project developed my problem solving skills*
7	2.03	0.68	*This project helped to stretch my musical or creative boundaries*
8	2.07	0.84	*This remix project has provoked my audio imagination*
9	1.90	0.67	*This assignment has enhanced my ingenuity when working with sound and technology*

Source: Authors' own.
Note: responses were on a Likert scale of 1 (strongly agree) to 5 (strongly disagree).

questions intercorrelated at an average of $r = 0.48$, $SD = 0.10$). Note that Question 6 is the only one to mention 'skills' specifically.

The respondents broadly agreed to the statements/questions with the exception of Question 4, which is slightly different in that the focus is on whether the respondent is happy with their abilities. It could simply be the case that the other questions having been exposed to the range of possibilities there is acknowledgement that skills and abilities have been improved, but Question 4 highlights the respondents' realization of the amount still to learn.

To test if the questions aligned with different underlying themes, the data were submitted to a principal components analysis that explained 68 per cent of the variance with two components (eigenvalues 4.8 and 1.3, explaining 53% and 15% of the variance respectively). The component matrix (Table 2) shows that most questions loaded well onto the first component, and only Question 6 loaded strongly on the second component. This suggests that the second component can be interpreted as representing improvement in skills. The questions that loaded best (i.e., positively and selectively) on the first component were Questions 2, 5 and 7, all of which specifically mention 'ideas' and/or 'creative', suggesting that the first component most likely corresponds to improvements in creativity.

Comparison of Self-perception with Formal Assessment

Of the 29 respondents, 20 agreed to a post-hoc linking of their assessment marks and questionnaire responses (with the approval of the Human Research Ethics

Table 2. Loadings of Survey Questions to Extracted Components

Question	Component 1 (Creativity Improvement)	Component 2 (Skills Improvement)
1	0.683	0.386
2	0.877	0.008
3	0.560	–0.568
4	0.882	0.178
5	0.926	–0.049
6	0.441	0.615
7	0.802	–0.024
8	0.638	–0.643
9	0.619	0.153

Source: Authors' own.

Committee of Murdoch University). This allowed additional analyses to inspect the relationship between the self-report survey data and objective measures of performance in the assessment task. The students' work was assessed on five criteria: (a) Project layout, structure and labelling, (b) Quality samples and/or sample/loop editing, (c) Use of industry stems, (d) Mix balance and (e) Creativity/originality. An initial bivariate correlation analysis tested for relationships between the nine survey questions and the five assessment criteria.

Only one correlation was significant, namely, that the students who agreed more with the statement 'This assignment has enhanced my ingenuity when working with sound and technology' scored higher on the second assessment item 'Quality samples and/or sample/loop editing' ($r(18) = 0.57$, $p = 0.009$). However, caution must be taken interpreting this finding as it was only one of 45 correlation values, and it would not be significant with a Bonferroni correction to the p values for multiple comparisons ($\alpha/45 = 0.001$ as threshold for significance). Furthermore, using the extracted components of 'creativity' and 'skills' showed no significant relation between any assessment item, as shown in Table 3 (all p values >0.1).

The lack of a significant relationship between survey responses and assessment criteria indicates that the improvements that students self-reported in creativity and skills were not confounded with their overall performance. In other words, the survey was not simply a measure of how well the students did as assessed by others, but how much they felt they learned.

Table 3. Correlation Coefficients Between Survey Components and Assessment Criteria

	Assessment Criterion				
Assessment components	a1	a2	a3	a4	a5
Creativity Improvement	–0.145	–0.334	–0.361	–0.106	–0.070
Skills Improvement	0.177	0.236	–0.143	–0.009	–0.179

Source: Authors' own.

Discussion

The respondents agreed that the process of creating a remix enhanced their creativity. The lack of a significant relationship between the survey responses and objective assessments indicates that the self-reported improvements were not simply a measure of how well the students performed the formally assessed tasks. Indeed, the process of taking part in the course itself, rather than completing the formal assessment components, may contribute significantly to the self-perception of an improvement in creativity or other aspects of music production.

Twenty respondents agreed to a post-hoc linking of their own self-perception with the score received as part of their assessment. The assignment was assessed using five criteria which were designed independent of the needs of the creativity survey. Only one of the assessment criteria specifically relates to the area under research (Component 5: creativity/originality). Although the results are indicative, a more in-depth survey with before and after testing points is an important next step in determining whether any causal relationship exists between the remix activity, formal assessment of creativity or learning experiences, and the self-perception of creativity.

It should be noted that the assessment task itself may partially conflict with the desired aim of an improvement in creativity, and/or in the self-perception of an improvement. By providing a large range of materials with which to work, the scale of the task may have been so overwhelming that it may initially have impeded progress in making creative work, simply due to the wealth of materials from which to choose. Students may have encountered 'options anxiety' and the paradox of choice. The survey included space for qualitative comments and there were indications that for a couple of participants the scale of the task was indeed daunting. One student stated: 'I have self-confidence issues… This assignment didn't help'. Five different song tracks were supplied for the assessment task, with each track being supplied in component form meaning the individual instruments were supplied as separate items. So, a single song of three minutes may typically be comprised of 20 separate component tracks—60 minutes of raw material per song. Students had five songs with which to work and so had approximately five hours of raw material available. Even listening to each of the available elements in turn might be so time-consuming as to act as a brake to a creative impulse. Whether this 'paradox of choice' occurs or not is dependent partly on the individual's ability to discount certain options as they narrow down their choice to a few promising pathways (Reed, Kaplan & Brewer, 2012). Strategies for developing techniques to use when presented with large sets of options would perhaps alleviate some of the potential problems in this case in future assessment tasks.

For most remix processes, loops are an essential starting point as they enable a fast and effective way to start re-contextualizing thinking and learning. Educators vouch that young students are often intimately immersed in their own rich musical and sound cultures (Ruthman, 2007). In remixing, students can choose musical loop elements associated with their own musical world, and they can begin

composing without prior traditional musical experience. Just as the skills required to compose music are sophisticated, so the skills to learn how to learn in higher education have been set within a traditional educational style. Drawing on the challenge faced by music educators to engage NTM students on their own musical terms—which began with offering respect and understanding of student's musical lives (Sloboda, 2001, p. 243)—it may be that by allowing students to remix their own 'learning loops' educators will better engage with non-traditional students across the university. Perhaps if students were offered 'learning loops' to link and to play with, they may find creative and alternative perspectives on learning how to learn.

Crow (2006) argues that organizing and choosing loop elements is ideal for engaging students with rhythmic structures, sound timbres, the roles of instruments within ensembles, the emotive qualities of sound and its arrangement. Rather than traditional composing, loop-based activities can be defined as 'organising sound musicality for personal expression' (Ruthman, 2007, p. 40). Similarly, all learning in higher education involves organizing and arranging categories of concepts; the challenge is to create this into a meaningful learning experience for non-traditional students.

Conclusions and Future Research

Participants' ratings indicated that the remix activity enhanced their creativity. There was no relationship between the measures of objective expert assessment and students self-reported creativity. This indicates that students were not simply reporting how they had been assessed by academic staff but their sincere perceptions of improved creativity. Additionally, the psychometric validation of the survey questions demonstrates that the survey has promise for further research in creativity assessment and improvement.

By building upon notions of creativity in the literature and bringing together researchers from psychology, media and education, we were able to develop a mixed methodology approach to analysis of creativity in learning activities, providing an important contribution to learning design with remix focused activities. Important methodological considerations for the future were also brought into focus.

The survey questions could be improved with the addition of inversely-worded questions, negative questions and the randomization of the question order, all of which would increase the ability to ensure internal validity of the survey. The questions themselves could also be improved to increase both the range of components being targeted alongside creativity and skills improvement. Areas of interest include correlating self-perceived creativity and skills with problem-solving techniques, familiarity with audio technologies and dealing with a large number of audio options. Care should also be taken to ensure that the number of audio track options provided to complete the task does not act as an unintended impediment to exploration.

Surveys and assessment tasks could also be conducted at the beginning and conclusion of the course to enable both pre- and post-data points. This would enable an analysis to better explore the effect of the course on both the objective/expert assessment and the student self-perception of the different components under investigation. In this survey the questions relate directly to the classes and learning tasks of completing the course. A modification to the questions/statements to make them less specific to the remix course would allow the potential inclusion of a control group who do not take the course.

Aside from the methodological considerations for further research, there is another research question that future studies should consider. This study is confined to the activity of remix within a music technology unit, but there is no reason why testing this methodology (and refined future methods) cannot be applied to an array of media production learning activities. When remix is a conceptual approach and production activity common to a range of cultural forms, this study has wider implications across other media production disciplines. Media production educators may wish to follow the creativity testing methodology or pursue the remix activity as a way to enhance creativity in learning for all students.

Acknowledgements

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Notes

1. NTM students refers to those students not educated via the classical cannon of music.
2. See http://www.hiddenshoal.com/
3. Hidden Shoal was instrumental in choosing students that were possible candidates. The label also acted as an expert industry assessor in part towards student's overall remix grades.

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Authors' bio-sketch

Simon Order is a Senior Lecturer in Sound and Radio at Murdoch University, focusing on music technology, audio production and community radio research. Simon continues his practice as a composer and has received much acclaim as a producer of Australian "electronica". He has pioneered the practise of audio remix in tertiary music production classrooms and is known for his creative approaches to audio education. His professional background includes audio production roles in the UK television and music industry, radio station manager and professional photographer.
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Leo Murray is a lecturer in sound at Murdoch University, Australia. Leo has worked in audio for 25 years including nine years as an engineer with BBC Radio in London. Currently he teaches in sound design, sound studies and popular music. His research interests include sound for film and television, audio technology, sound design and forensic audio.

Jon Prince is a psychologist specialising in music cognition, a research area concerned with the mental mechanisms that enable us to understand music. He has a BA in Brain and Cognitive Science from the University of Rochester, and both an MA and PhD in Psychology from the University of Toronto. He completed a postdoctoral research associateship at the University at Buffalo before taking a position at Murdoch University in 2010, where he is now a Senior Lecturer.

Julia Hobson is a Senior Lecturer, Centre for University Teaching & Learning, Murdoch University where she specializes in supporting students' critical thinking skills. She has published in the areas of assessment and evaluation in higher education and subject centred learning. Currently she is researching into the phenomenon that she has noticed over the years that sometimes thinking arrives in the room as an active presence. When thinking does arrive in the room – often sitting quietly in a corner- everybody in that room whether they are talking or listening or writing or reading, perks up a little. There is a general rise in the level of intelligence and it is a collective rise, like catching a wave and all are carried along to a greater height.

Sara de Freitas is a world renowned digital learning. For more than 10 years, Sara has directed her research in areas of educational technology including scientific studies that prove the efficacy of educational games in digital learning. Her research interests are focused in learning analytics, technology enhanced learning, higher education policy and leadership and advanced educational games research and development.