Measuring creativity in collaborative design projects in pre-service teacher education

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Pre-service teacher education in the use of information and communication technologies (ICTs) has been the focus of numerous studies. In this paper, we further extend this body of research by examining the functions of creativity and how creative outputs are measured in pre-service teacher education, chiefly by discussing how students are assessed in terms of their creativities in design projects. The research aimed to evaluate the measures that had been put in place to ensure that the creative value of the student tasks was assessed objectively. Several strategies were used including a process-based task design, opportunities for students to revisit and refine designs, collaborative brainstorming, self-assessment, rubrics, panel marking by experts, and a design space that supported creativity. It was found that while interpretations of creativity were subjective, the students' aim to develop creative outputs was fostered by the peer review and self-review processes adopted for the study.

Keywords: creativity, assessment, collaboration, design learning, pre-service teacher education

Introduction

In pre-service teacher education in the use of Information and Communication Technologies (ICTs) there is a need to not only provide skills in evaluation and using technologies, but also to promote innovation and creative use of a range of tools that can enhance teaching and learning. Once pre-service teachers move into the classroom, they need to be able to work creatively within this environment. Creativity in this sense, is a functional skill in that the students need to develop a range of ICT enhanced learning experiences, whether it be a web quest, a website, or an app, for example, where the product itself needs to function. Designing and assessing creativity, however, is complex. Miller's observation (1986) that a creative product is "something easy to recognise but hard to explain" captures the intangible, rather nebulous position of creativity. Hence, while we, as teachers, may easily recognise a design or artefact as creative, that does not mean that everyone will arrive at the same judgment about the level of creativity involved in the output, no matter what rubric or criteria are adopted. Creativity is also culturally bound, in that different people coming from different cultures, religions or races may show different criteria or judgment as to what they value as creative products. In the context of our study, we are assessing the creative design of artefacts that can be used for teaching and learning within the Australian school environment, itself a strongly diverse cultural setting. Drawing upon Cram et al. (2014), the students who participated in this study were provided with a solid grounding in the requisite design and technical skills before being given space to apply their own creative judgment in the design and development of a product. Functional creativity underpinned much of the design work in that the nature of the design space enabled and supported functional creativity. Functional creativity is a desireable quality for many professions, such as teaching, architecture and filmmaking, wherein creativity is valued highly. The affordances of technology for creative processes are equally attractive as students can work in three dimensions: they can revise a design in a low-stakes space and they can use innovative approaches to the design, from a dynamic viewpoint. Considering these possibilities led the research team to the question of how to assess creativity. More specifically, how does a teacher assess an artefact or design objectively as being more than mundane? This raised a subsequent question: How can we, as pre-service teacher educators, assesses the creative outputs of our students? The study was conducted in a pre-service teacher degree program at an Australian university. It is part of an ongoing research project on curriculum redesign in the use of ICT in education. The current paper focusses on the objectivity of the assessment and presents the preliminary results.

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Creativity and assessment in higher education

Creativity is gathering attention across the Australian higher education landscape as a graduate and as a desirable workplace attribute. Florida (2002) predicted that as much as one-third of the future workforce will be defined as being a 'creative' because of the nature of their roles. Creativity, in this respect, is favourable as it is linked with imaginative and innovative responses to future-oriented challenges and research, in a "workforce of generalists" (Altbach, Reisberg & Rumbley, 2009, p. 115). Given the responsive nature of higher education to global trends, the question of how to incorporate creative learning outcomes into programs has implications for course structure, task design and pedagogy. As with the concept of design, creativity can be understood to have a range of meanings. This paper will not participate in the arguments about mini-c (interpretive creativity), little-c (everyday creativity), pro-c (expert creativity) and big-c (legendary creativity) (Beghetto & Kaufman, 2013), but rather on how we assess creativity in the use of ICTs in design projects in pre-service teacher education. Sternberg (1991) declared that "assessments of creativity are in need of serious re-consideration and especially broadening," implying that more consideration needs to be placed on how we assess creativity. There are a number of arguments that have been put forward about creativity; however, these can be distilled down to the judgments about the processes or products by an expert in the field (such as a teacher), in an educational context. So, in this sense, the rating of assessing of creativity depends on the subjectivity of one who is evaluating the creative output (Sternberg & Lubart, 1995). There is a general consensus across the field that it is an almost impossible task to set up objective criteria to qualify or assess students' work as being creative.

The authors adopted collaborative design assessment tasks to attempt to objectively assess the creative design of artefacts that can be used for teaching and learning in schools. Earlier papers by the authors have investigated the benefits of collaborative design (see for example, Authors, 2014) and agree with previous findings that within in the field of technology enhanced learning, the benefits of long-term design teams and the use of peer feedback have been well documented and successful (see for example, Jeong & Chi, 2007). What is missing from these studies is an understanding of how educators assess the creative outputs of their students. There are several strategies that have been put forward to establish measures of objectivity in assessing creativity in design or creative works to ensure equivalence across student outputs. What this means is that, without guidelines or structure, students have no boundaries on what the task may encompass, which makes it difficult for assessors to judge the equivalence of students' creative works. There are countless strategies that have been applied in this endeavor, one of which is to in the actual design of the task. Tasks need to be designed as a process that enable students to receive guidance on their progress across three experiments, with each task using the skills and knowledge acquired in the previous task. The process should provide students with space to engage with two key aspects of creative design – the recognition and definition of the problem – both of which provide students with space to visualise the problem's solution corresponding to the task specifications (Taylor, 1969).

Research Design

The first design task was two-dimensional, to give students a place to develop basic skills before progressing onto the open-ended design task. In the second task, the students were provided with a somewhat open-ended task. The marking criteria provided guidance on what features needed to be included. Therefore, while the tasks did not constrain students' creative design of the product, they did constrain the boundaries of the task. Another strategy to support functional creativity is through group interactions that enable the generation of divergent ideas and critical reflection. Lucas et al. (2013) argue that one of the crucial aspects of creativity is divergent thinking, or, as they explain, the "ability to generate many ideas for a range of perspectives without being limited by preconceived thinking" (p. 14). They clarify that the ability to think divergently is important, but not a proxy of creativity. In regards to assessment design, there are a number of arguments that have been put forward on the value of having formative assessment built into the process (see, for example, Leahy and Wiliams, 2009). However, the nature of assessment in higher education necessitates an assessment instrument or rubric, and it is at that precise point that assessing creativity becomes objective. Ideas explored in the literature that support assessment of creativity include the use of descriptive rubrics, assessment by peers, assessment using portfolios, mixed methods of assessment and self-assessment (Lucas et al., 2013). The value of formative feedback in developing creativity is supported

by Beghetto and Kaufman (2013), who hold that educators can help students to develop creativity by providing timely and nuanced feedback relevant to the student's own work. The rubrics were designed to identify the beyond-mundane functional designs using two qualitative criteria, "distinctive and significant". For a design to be successful it needed to be both distinctive (demonstrating a unique combination of decisions) and significant (meaningful and relevant). Hence, the rubric was fairly flexible and did not limit or restrict the creative design process, nor did it judge designs using a more standard continuum of 'developing' or 'developed'.

The government regulates education degrees in Australia and all students must have exposure to a range of ICT in learning and teaching contexts as part of their course requirements. Students are assessed on their use of ICT during their professional experience placements. Hence, there is a focus on providing students with authentic (classroom) activities in order to develop the skills and knowledge to be able to use ICT. The study was conducted in a primary education course 4th year unit on teaching English, in which all students had previously completed the compulsory core first year unit on ICT in education. There was an expectation that students would have a basic understanding of interactive whiteboards, mobile devices and personal computers to support learning.

The students were under-taking a weeklong summer school in intensive mode in January 2015. The students had lectures in the morning on English language teaching and language acquisition theory; they also had a design workshop in the afternoon. Students assigned themselves, before the start of the summer school, to groups of four on the basis of a school stage (1–3). There were four tutorial groups. The students were given their task in the week prior to the summer school so that they had time to think about curriculum areas. For the task, they had to find two ICT resources and build two ICT resources that could be used to support the development of English language and literacy in the context of their curriculum area/s (e.g. science, history, English, art, drama). The group assessment formed 70% of their course mark (30% for the rationale and 40% for the teaching) and the final 30% of the course mark was an essay exam on language teaching methodologies. The students needed to develop a sequence of three lessons using the resources and applying a range of language teaching methodologies. At the end of the week, the students would teach the class for 30 minutes using at least two of their resources. They would also submit a 500-word overview of their design approach and a rationale for why they used the language teaching approaches in that context. Students were advised that marks would be awarded for creative use of ICT; that is, they could pass the task if they found and built useable (authentic) resources, but students that developed innovative approaches to using ICT in education would be rewarded for their effort.

The students worked with their tutors in the design workshops for the whole week. The workshops were unstructured in that they were able to select their own stage and curriculum areas. The students were also not given explicit technical support as they needed to be able to collaboratively problem solve and trouble shoot their technical issues. The assessment model built in two peer-review and feedback stages. The first was on the Monday, day one of the summer school, to clarify ideas and curriculum areas, and the second was on the Wednesday two days before the presentation of the final assessment on Friday. All of the tutorials were conducted in computer laboratories; however, students were also welcome to use other areas of the campus (such as the Library). For the assessment, students could use whatever resources they felt best supported language acquisition (e.g. iPads, interactive whiteboard, laptops). The group-teaching task was conducted on the Friday. The tutors video-recorded and took photos of the presentations for moderation purposes. All of the tutors used the same rubric and tasks were moderated post-assessment. The feedback from the tutors revealed that the tasks were difficult to assess in terms of creativity as there was only one person marking the task at the time. They noted that it would be of benefit in future offerings of the unit to have a peer-evaluation process in place. Despite tutor feedback, analysis of the unit grades indicated that the grades were evenly distributed across the trials.

Results and discussion

Students were administered with a survey in the lecture on the Thursday morning of the summer school, in order to gain an understanding of their views of the approach to the unit and assessment. The surveys were administered during the lecture. Preliminary analysis of the survey results indicated that students liked four aspects of the unit: a) that the problem was open-ended so that they could work to their limits; b) that they were not restricted by technology so that they could select resources that they felt would be of benefit to their students; c) that they had time to work with their peers in

class, so the three hour design workshops were long enough to get work completed; and d) that they had the opportunity to teach with their resources. The issues that the students raised were fairly consistent: firstly, finding and building four resources in a week was too time consuming; secondly, that there was not enough time to trial different language teaching methods, so once they committed to one method they had to stick to that method as there was not have enough time to change; finally, students also suggested that the assessment provided space for them to be creative in their approach to using technology, but that they felt restricted due to time constraints. They did however, responded positively to participating in their peer classes.

When assessing creativity in the school environment two important questions need to be considered: firstly, we need to consider the definition of creativity that is being followed; and, secondly why we are assessing creativity in the first place. Both of these questions are important, as they make a significant impact on the form of assessment used. We also need to consider whether we are assessing programs or attempting to identify individuals who are gifted in this area. If we are assessing individuals then consideration of the type of definition for creativity is imperative. For example, if we consider creativity to be a concept that crosses all subject areas, then we would not be concerned about assessment tools that purposefully measured for creativity in specific subject areas. The purpose of creativity being assessed is also an important consideration, as different measures would be used for assessing a program versus an individual gifted in this area.

The researchers also measured creativity in terms of the range of tools used and how they were used. We looked for groups that moved away from traditional teacher-led pedagogies and might bring innovation into the classroom. It was evident that assessing \ students' resources in terms of creativity was difficult because it was subjective. In one instance, the tutors with cohort two indicated that they marked higher for students that had more innovative technologies. The tutors were felt that they were marking the tool and not the creative use of technology to support language learning. One technique for assessing creativity is the Consensual Assessment Technique (CAT), which utilises panel judging. According to Kaufman et al. (2008), in CAT experts evaluate an artefact or product, not the process. This method of panel judging is fairly common in other forms of talent assessment, such as Nobel prizes and grant applications. In creativity assessment there may be a range of formats for the judging panels, such as blind review or conferral; however, the common evaluation criteria is that the judging panel are all assumed to be experts. As such, after students had their design subjected to the rigours of self- and peer-review, the final stage of the assessment of creativity should be undertaken by a panel of experts. Hence, the validity of CAT is premised on the use of discipline experts as judges (Kaufman et al., 2008).

The use of CAT or other similar panels of experts raises questions of who the most valid judges are in educational contexts. Are they the teachers or the industry experts? Is it necessary to bring in an external stakeholder to judge the designs as creative or valid? It is reasoned that perhaps the best choice of experts will depend on the purpose of the assessment. If the goal is to find the most accurate assessment of a creative design then the teaching staff would be the most logical choice of assessors. However, bringing in an industry expert may present students with another level of feedback to inform their designs.

Conclusions

This paper aimed to discuss processes that were put in place to attempt to objectively assess the creative design of artefacts made by pre-service teachers for use in the classroom. Several strategies were used including a process-based task design, opportunities to revisit and refine designs, collaborative brainstorming, self-assessment, rubrics, panel marking by experts, and a design space that supported creativity and was not constrained by two-dimensional limits. This paper does not intend to be a thorough investigation of the data, the technical capabilities of the pre-service teachers or the pedagogical underpinnings of their design rather it is a work-in-progress. The literature on creativity suggests that creativity is a quality perceived to be of value in the workplace. The authors offer a platform for discussions over how functional creativity can be measured in the context of learning design. If creativity is a desirable workplace attribute, we as educators need to provide space for our students to demonstrate their creativity and we also need to assess and provide valuable feedback to students so that their creative processes can develop. The question must be asked, how can we best design learning experiences that provide students with space to be creative?

And how does this creativity become functional in the workplace? Creative functionality is generally tied to a measurable output and needs to be tangible to students to have any real value

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Note: All published papers are refereed, having undergone a double-blind peer-review process.

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