A TEL System for Teaching and Supporting Creativity in Tertiary Students: Incorporating the Views of Experts

Diana Ragbir-Shripat[1], Permanand Mohan[1],

[1]Department of Computing and Information Technology, The University of the West Indies, St. Augustine Campus, Trinidad & Tobago
{diana.ragbir, permanand.mohan}@sta.uwi.edu

Abstract. This paper details a context of use study of an assessment system for creativity taking into account the views of experts. A TEL system called The Muse was designed for teaching and supporting creativity skills in students while they undertook assignments or coursework tasks. However, assessment of creativity is no simple task. What creative output should be assessed and how should it be assessed? Creative output in The Muse takes the form of assignment solutions (the product) and the creative process of the student. Assessment of creativity must be performed on both product and process. The views of experts in their respective science fields were sourced via a survey to determine exactly how instructors in the sciences would assess creativity at the tertiary level, in their respective courses. The results of this survey have informed the development of the assessment portion of The Muse. This paper describes how creativity can be assessed via a student's product and process within the sciences at the tertiary level.

Keywords: Creativity, Assessment, TEL, CAT, CSDS.

1 Introduction

The Muse is a TEL system designed to teach and improve creativity skills in tertiary students whilst they undertake coursework assignments/tasks in the sciences. A context of use study has been carried out with respect to one component of The Muse, the creativity assessment component. This component is an important one and its design has benefitted from user input. Instruments for creativity assessment were taken from the literature and informed an initial design of the creative assessment component of The Muse. However, many questions surfaced, such as what criteria should be used for assessment? Should criteria be changed depending on the type of coursework assigned? Should we measure the creativity of the student, or how the student becomes creative or produces creative work [1]? A questionnaire was thus administered to instructors from the sciences to gather data on how best to assess creativity within their respective courses. The data gathered was then analyzed and used as input to improve the creativity component of The Muse.

Assessment of creativity is a complex task and is a valuable one in education. In order to ensure pedagogies used for teaching creativity are successful, creativity must be assessed at some level. What should be assessed and how should it be assessed? These questions are addressed in Section 2. Section 3 gives a short literature review on assessment in creativity. Section 4 describes the methodology, the details of the questionnaire and the results gathered. Section 5 then discusses the meaning of the data gathered and explores how this has impacted changes to the creativity assessment component of The Muse. Section 5 then explains how these findings could be useful for any creativity assessment tool. Section 6 concludes the paper and gives avenues for future work.

2 Background

The term 'creative' can refer to novel products of value, to the person who produces the work, to the capacity to produce such works, and to the activity of generating such products [2]. Educators regard creativity as anything different as opposed to novel, 'new to me' as opposed to new, and 'good' ideas as opposed to high quality ideas, once the 'creative' thing is pertinent to the task at hand [3].

Creativity has been categorized in terms of magnitude, that is, *mini-C*, *little-C*, *pro-C* and *big-C*, ranging from more subjective to more objective. *Mini-C* creativity focusses on the personally meaningful interpretation of things that occurs during the process of learning and is important for observance in the classroom in order for teachers to recognize student's creative potential for development into *little-C* creativity [4] [13]. *Little-C* creativity is called everyday creativity and includes problem solving and the ability to adapt to change [5] and is most relevant to educators in the classroom. The *pro-C* category refers to those who have gained professional expertise in their field, whilst *big-C* refers to genius level creativity and to those who make a great impact on society through their work [4][15]. The Muse, discussed shortly, focuses on teaching and supporting *mini-C* and *little-C* creativity skills in students, thus, assessment also focuses on these levels.

The Muse was developed for teaching creativity skills in students and supporting their creativity process while undertaking coursework assignments or tasks. The Muse is integrated within a social network and consists of several creativity pedagogies containing activities and tools to guide students through their creative process. There are two main views of The Muse, that of the student using the system to complete a task, and that of an instructor using the system to create tasks and to assess the creativity displayed by students on those tasks. In this paper, we are concerned with the instructor's view, specifically the component that deals with creativity assessment.

Firstly, we must examine what should be assessed? The four P's of creativity are used to organize many of the issues in the study of creativity; they are Product, Process, Person and Place [4]. Product refers to the creative entity produced, Process, the method followed, Person, the personality traits, and Place, the environment in which creativity is supported. In The Muse, we focused on student assessment via Product and Process as these are most relevant and useful to students who are being taught creativity skills. The Person aspect, that is, personality traits of the student does

not matter as the view taken and supported by educators is that creativity can be taught, without reference to innate ability or traits. "Teachers are in the business of starting wherever a child is and working from there" [3]. Finally, the Place aspect is very relevant as it represents the environment that The Muse provides. This environment will also be assessed by the students via questionnaires and also via instruments from the literature such as the Creativity Support Index (CSI) [6], however, analysis of the Place aspect is out of scope of this paper.

In order for creativity assessment to take place, the creative Product and Process must first be available to the assessor/instructor. The Muse stores the students' creative process as they interact with the system, via the creative pedagogy guidelines, activities performed, use of the creativity support tools provided, and all interaction and communication within the social network component of the system. This creative process is stored digitally and is represented as an outline of the creative pedagogy that was followed by the student. Thus, on completion of the coursework task by the student, the instructor has a Product, which is stored as a file, and a Process, represented textually, for assessment of the student's creativity.

In the following section, we look at how students' creativity is assessed from their Product and Process.

3 Creativity Assessment

The solution to the task/assignment that the students submitted (Product) can be measured for creativity using a wide range of instruments. These include various creativity tests – the Consensual Assessment Technique (CAT) [7], the Creative Solution Diagnosis Scale (CSDS) [8], the Evaluation of Potential for Creativity for children (EPOC) [1], Creative Learning Assessment for children (CLA) [9], divergent thinking tests such as Torrence Tests of Creative Thinking (TTCT) [10], convergent thinking tests, judges ratings, testimonials, citation indexes, prizes, awards and social recognition. Specific product creativity measurement tools were compared [11], and found that the rating scales have been tested in a variety of domains [8]. However, very little research has been done to assess creative products that are scientific, tangible or technological [8].

The Creative Solution Diagnosis Scale (CSDS) was developed to fill this need and is focused on functional creativity, which means novel products that serve some useful social purpose [8]. The CSDS is a 24 item scale used to judge a product's creativity. The items are broad properties of products that can be used to describe the level and kind of creativity they possess. The 24 items are based on 5 core criteria: Relevance & Effectiveness, Problematization, Propulsion, Elegance, and Genesis. The CSDS is the closest instrument available that fits the needs of assessing creative products of students in the "hard" sciences.

In addition, CAT has been in widespread use by researchers of creativity. The CAT is based on the idea that the best measure of creativity of an artifact is the combined assessment of experts in that field. It does not use a checklist or apply a general assessment rubric as the CSDS does. The experts rate the product within a range, e.g. 1 – 5, where the rating is based on the expert's sense of what is creative in their

domain. The CAT has not been tested in the situation of students' *mini-C* and *little-C* creativity within the domain of sciences. However, it could be applicable and appealing for instructors to judge what is considered creative within their courses.

Creative Process is typically measured in the literature using interviews, study of working habits, anecdotal reports, autobiographical statements, etc. However, these assessments were all related to *big-C* creativity and were done in hindsight of the validated creative output. Furthermore, the literature has not shown that a creative process could be tracked digitally; thus this research is novel and leads to a digital representation of a creative process that could be held up to analysis similar to creative output. The digital creative process, in this case, refers to mini-C and little-C levels of creativity within the constraints of the coursework task set for the students.

In the next section, we describe the questionnaire, and then explain how the results of the questionnaire shaped the design of assessment in The Muse.

4 Methodology

The literature on creativity assessment was used to design the instructor view in The Muse for grading students' product and process. This entailed providing instructions on how to use the CAT and CSDS instruments, providing the instruments for use in grading, and providing the creative outcomes for grading. However, at this point there was no user input into the process. Hence, a questionnaire was designed and conducted with 25 instructors in the sciences at The University of the West Indies, St. Augustine.

The questionnaire was designed to gather data on how instructors in the sciences view creativity as a requirement in their coursework instruments and how they think it should be best assessed. The inclusion criteria for participating in the questionnaire were instructors of The University of the West Indies who lecture science courses. Participants were from the domains of Computer Science, Chemistry, Mathematics, Physics and Life Sciences.

The results of the questionnaire were taken into consideration to refine the assessment portion of The Muse by modifying existing features of the system and adding new features. Section 4.1 outlines the design of the questionnaire and section 4.2 gives the questionnaire results.

4.1 The Questionnaire

First, an overview of the questionnaire included the following questions. Instructors were asked to select their domain or field of teaching. A short description of The Muse was given and instructors were asked whether they would use such a system in their courses. They were then asked which coursework instruments they would use to judge a student's creativity. Finally, they were asked whether creativity should be kept as a separate mark or should be included as part of the overall mark for the coursework task.

The main part of the questionnaire focused on selecting which of the 24 criteria from the CSDS instrument were relevant to assessing creativity of a Product in the instructor's course, as well as the significance of the criterion from a range of Very Important to Unimportant. Instructors were unaware at this point that the criteria came from the CSDS instrument. After selecting the criteria, instructors were asked whether there were any additional criteria they would add, whether there were any reasons for choosing or not choosing any of the listed criteria, and whether they thought the selection of criteria should be adjusted specifically to a coursework instrument.

Additionally, a comprehensive list of criteria for assessing students' creative processes were outlined, and instructors were asked whether these criteria were an accurate description of how a creative Process should be judged, how any of them could be improved, whether any should be added or deleted from the list, and whether they should be weighted. The list of criteria is as follows:

- Evidence of divergent thinking - generation of numerous quality ideas & alternatives.
- Evidence of convergent thinking - combination or integration of elements in new ways.
- Associative thinking.
- Evidence of logical and not so logical thinking used, connected & integrated.
- Evidence of documented intuition.
- Use of knowledge & understanding applied to coursework context.
- Critical thinking, including unlearning, relearning and new learning.
- Evidence of documented reflection.
- Responsiveness to new materials and data.
- Drawing previously unrecognized parallels between models, topics & situations. Transfer of ideas from one context to another.
- Recognition of creativity in others. Responsiveness to ideas of others.
- Sense making.
- Evidence of fluency in communication via clear & concise writing, drawings and models.
- Construction and connection of arguments.

The next section of the questionnaire dealt with the two assessment instruments, CSDS and CAT. Both instruments were described and instructors were asked which they preferred for assessment of creative Product and which for Process. Further questioning asked whether CAT should be used alongside CSDS and whether the same instrument should be used throughout the semester or changed for each coursework instrument.

The concluding section of the questionnaire asked whether creativity should be assessed informally in the sciences, whether it should be assessed formally, and whether it should be done as part of coursework assessment. Finally, an open field for free comments on creativity assessment in the domain of the instructor was provided.
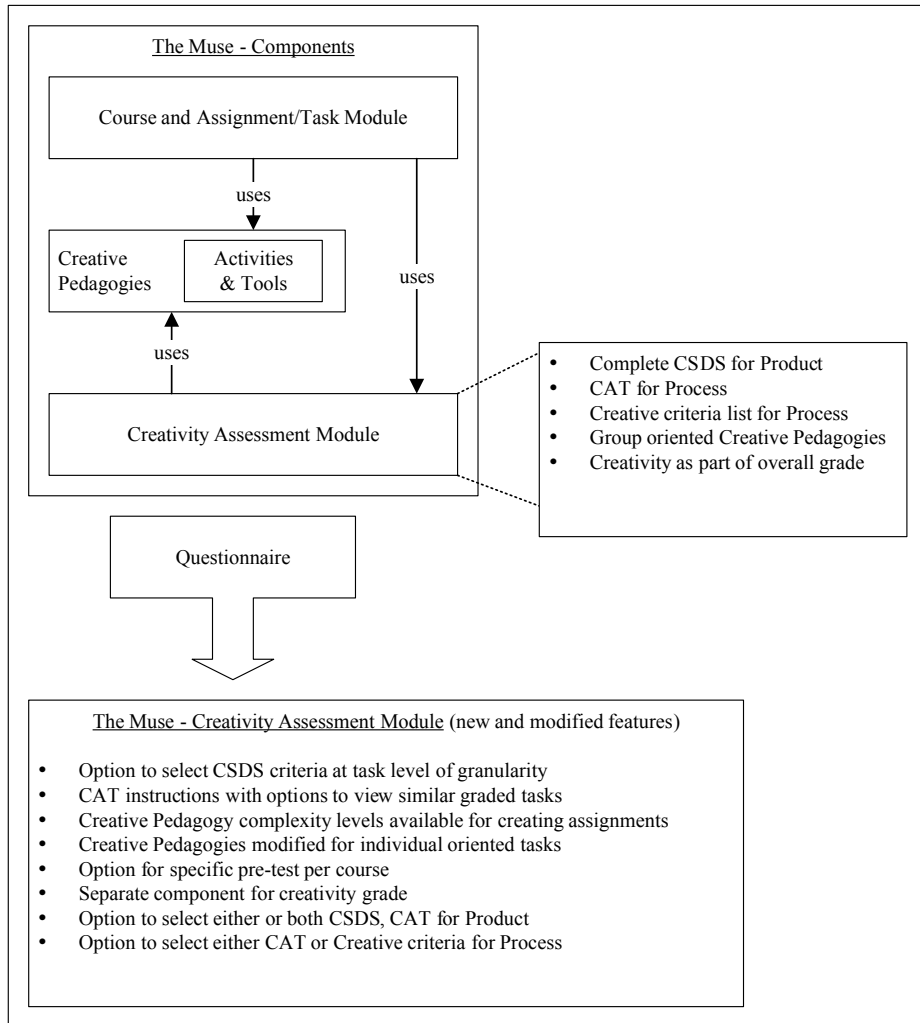
4.2 Questionnaire Results

The Muse - Components

Course and Assignment/Task Module

uses

Creative Pedagogies

Activities & Tools

uses

uses

Creativity Assessment Module

- Complete CSDS for Product
- CAT for Process
- Creative criteria list for Process
- Group oriented Creative Pedagogies
- Creativity as part of overall grade

Questionnaire

The Muse - Creativity Assessment Module (new and modified features)

- Option to select CSDS criteria at task level of granularity
- CAT instructions with options to view similar graded tasks
- Creative Pedagogy complexity levels available for creating assignments
- Creative Pedagogies modified for individual oriented tasks
- Option for specific pre-test per course
- Separate component for creativity grade
- Option to select either or both CSDS, CAT for Product
- Option to select either CAT or Creative criteria for Process

Fig. 1. New and Modified Features of The Muse After Questionnaire Data Analysis.

Figure 1 shows the initial components of The Muse, the features of the creativity assessment module, and the new and modified features that were derived from analysis of the data gathered from the questionnaire. These new and modified features are discussed shortly with respect to the actual data from the questionnaire.

Figure 2 shows the spread of domain of participants. Figure 3 shows whether instructors wanted to use a system such as The Muse in their respective courses. Some concerns were "I'd want to see how this system works. I'm not sure how creativity can

be measured", "out of curiosity", "sounds like too much work for the instructor" and "depends on how much more work would be added to the assignment".
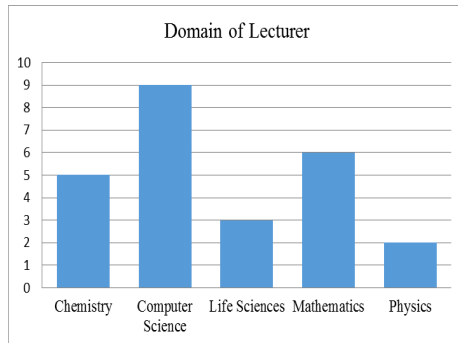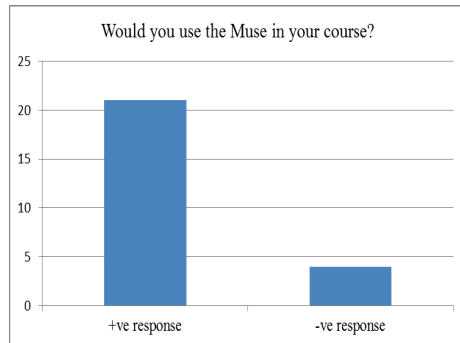

Fig. 2. Domain of Instructor

Fig. 3. Use of The Muse by Instructors

Figure 4 shows the coursework instruments in which creativity assessment could be included by instructors. Additional comments in the "Other" option in Figure 4 were "I would gain a gauge of the student's creativity from their class participation, the type of questions they ask..." and "random puzzle they know nothing about". Figure 5 shows whether instructors preferred to include creativity as a separate mark or include it as part of the overall mark for coursework. In Figure 5, other suggestions were "relevance to Math is strained" and "Creativity can show itself in all aspects for example in a software project, the design and code development can involve lots of creativity so I would suggest a creativity mark within each aspect".
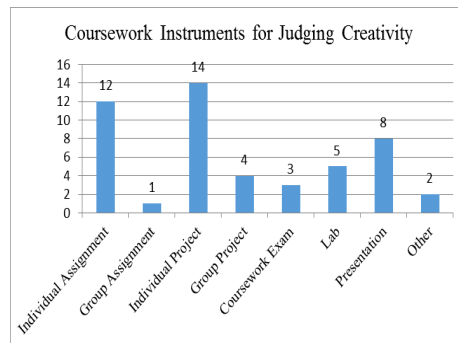
Fig. 4. Coursework Instruments
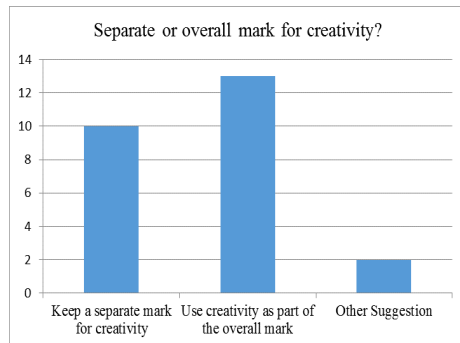
Fig. 5. Separate or Overall Mark

Figures 6, 7, 8 and 9 show the range of views on whether specific criteria from the CSDS instrument are important to instructors in assessing creativity. Figure 6 shows that most instructors agreed that the six criteria under the sections "relevance & effectiveness" and "problematization" were relevant for assessing creativity in their respective domains. Figure 7 shows that the five criteria under the heading "propulsion" were thought to be of value for assessing creativity.
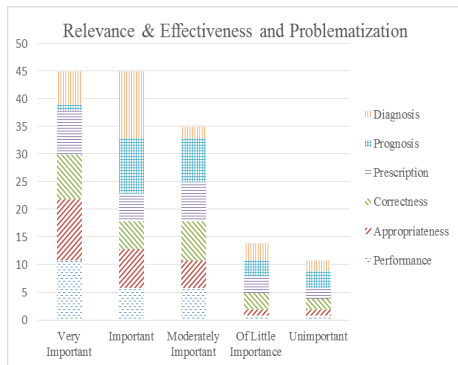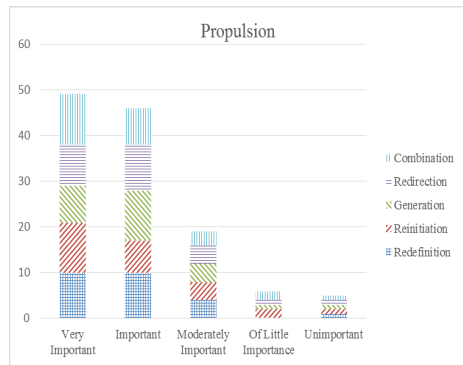
Fig. 6. Relevance, Problematization

Fig. 7. Propulsion

In Figure 8, instructors gave many responses rated as Unimportant for the criteria Safety, Gracefulness and Sustainability. In Figure 9, the criteria for the section "genesis" were thought as valuable for assessing creativity.
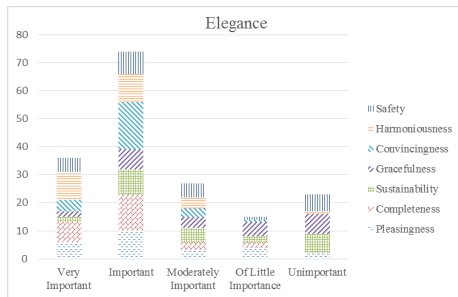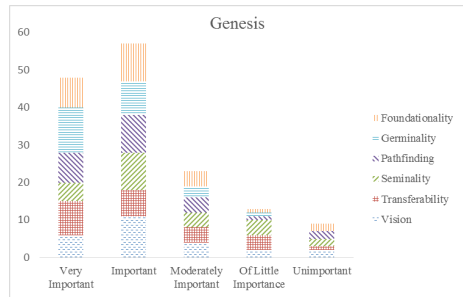

Fig. 8. Elegance

Fig. 9. Genesis

In Figure 10, instructors were divided on which instrument was best for assessing creativity in their domain. This divide was noted in all of the domains except for Chemistry in which all participants preferred CSDS and Computer Science in which two thirds preferred CAT. Figure 11 shows that instructors preferred to use the criteria listed in Section 4.1 above for assessing Process rather than the CAT instrument.
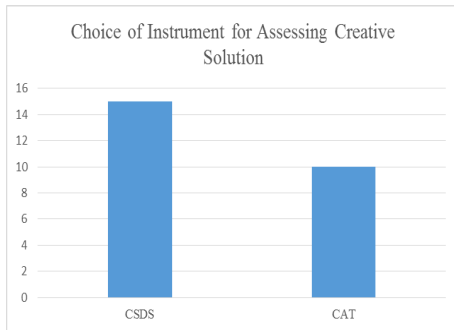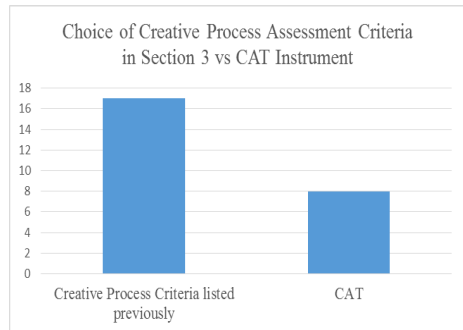
Fig. 10. CSDS or CAT

Fig. 11. Process Criteria or CAT

Instructors were equally divided on whether to use the CAT instrument alongside the CSDS. Instructors were also equally divided on whether to use the same assessment instrument throughout the semester or to vary according to coursework task.

Figures 12 and 13 show that instructors prefer to assess creativity informally in their coursework and they were divided on whether it should be assessed formally.
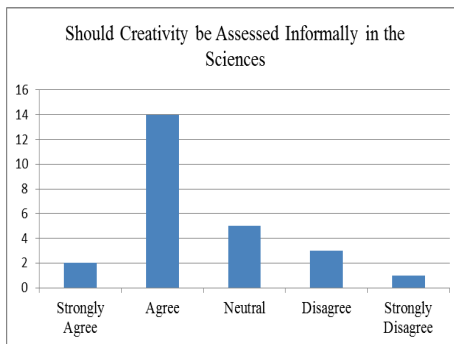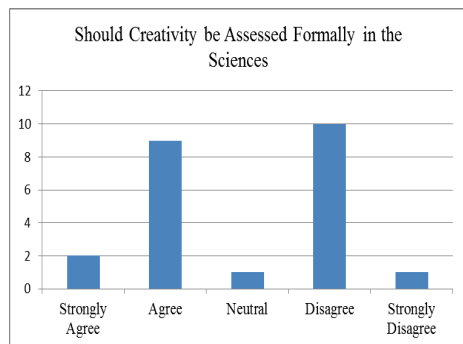

Fig. 12. Informal Assessment

Fig. 13. Formal Assessment

Figure 14 shows that instructors were divided on whether to assess creativity within coursework in their courses.
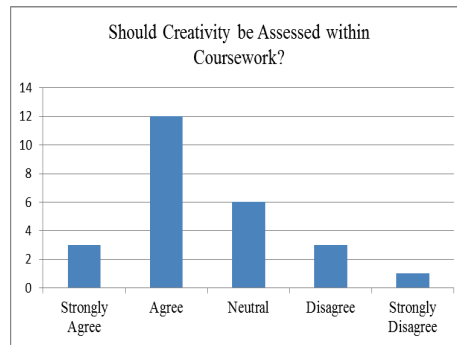
Fig. 14. Should Creativity be Assessed?

In the next section, we discuss how these results impacted changes to the initial system, and describe the resulting assessment component of The Muse.

5 Discussion & Results

The findings from the questionnaire were used as input to improve the existing system. These findings are also invaluable as design principles for the development of creativity assessment tools in education. Before the questionnaire was conducted, the CSDS instrument was provided in its entirety for assessing the creative Product, and CAT instructions were given for assessing the creative Process of the students.

Firstly, the comments from Figure 3 showed concern for the amount of additional work for both the instructor and the student. The Muse was designed to be used to support students in undertaking assignments so that no additional content or module needed to be added to a course to teach creativity skills. This is valuable to instructors who want to encourage and teach creativity in their courses without extra work added to the existing curriculum. The Muse allows simultaneous accomplishment of both goals, providing the necessary efficiency and effectiveness to instructors.

Another concern was additional work on the coursework task for the student. However, when instructors create an assignment in The Muse, they can select a particular creative pedagogy to be used as a guideline by students to complete the task. The creative pedagogy can be chosen based on its complexity, the nature of the task and the level of creative thinking involved. Thus, the creative thinking aspect can be set to match the complexity of the assignment, preventing the requirement of excessive pedagogical techniques for simpler tasks.

Furthermore, two principles can be derived from Figure 3 that can serve as design guidelines for creativity assessment tools. The first principle is that the tool should support some aspect of the course while at the same time enabling practical, hands on learning of creativity techniques. The second is that the tool should provide a range of pedagogical complexity to match various levels of tasks.

Figure 4 showed that instructors had a preference for individual work as opposed to group work with respect to the coursework instrument. The Muse was initially designed for collaborative work on activities and tools. However, it can also support individual coursework tasks. This must be taken into consideration when explaining the use of The Muse to instructors for uptake in their courses. Furthermore, comments concerning the requirement for grading creativity based on in-class activities and for using random puzzles for assessment, led to the design of features in which the instructor can enter grades for offline activities, i.e. in-class activities, and create specific pre-tests. The original version of The Muse focused on those coursework tasks that engaged the students wholly or partly within The Muse. These findings not only influenced the current design of The Muse but add to the design principles that creativity assessment tools should provide recording of offline activities and creation of pre-tests by an instructor.

In Figure 5, the instructors' views were split on whether creativity should be part of the coursework mark or a separate grade. This may have implications on how seriously a student regards the creativity component of the coursework task. Initially, The Muse was designed to record creativity as a component of the total grade, meaning that the students' grade for the coursework task depends partly on their creativity shown. However, given the results from Figure 5, the creativity grade is shown as a separate input field and an option is given to the instructor whether to include creativity in the overall grade. One comment stated that within a given task, there are many subtasks that should be graded separately for creativity. The Muse thus presents the instructor with the opportunity to enter the subtask and the creative grade for that subtask.

Another comment was that creativity was not applicable to the undergraduate Math coursework tasks. Several instructors also verbally gave this view. The Muse may thus be more applicable to larger Math projects or postgraduate Math courses rather than undergraduate ones which focus on learning the rules of Math, leaving little room for creativity. However, further interviews need to be conducted to gather more insight into why creativity is not applicable as a part of Math coursework. A design principle derived here is that fine granularity of grading tasks and definition of levels of subtasks must be provided in such a tool.

Figures 6, 7, 8 and 9 showed the range of views on whether specific criteria from the CSDS instrument were important in assessing creativity. Since there were varied opinions, with the majority selecting most of the criteria as important, The Muse was redesigned so that instructors can choose which criteria they want to use for a particular coursework task. Instructors will also have the option to set a weighting for the criteria.

Figures 10 and 11 both show that instructors are highly divided on what is the best instrument for assessing creativity from the choices of CSDS, CAT and the creative process assessment criteria given in Section 4.1 above. Therefore, The Muse has been modified to allow for selection of these choices per coursework task by the instructor. Thus, comparison of creativity is only done with similar coursework tasks within a course, as well as whether there was overall improvement of creativity skills of students.

The design principles derived from Figures 6 to 11 include providing the instructor options for the selection of assessment technique, options for creation and

modification of assessment criteria at the task level within an assessment technique, as well as options for setting the weights of the chosen criteria.

Figures 12 and 13 show that instructors prefer to assess creativity informally in their coursework and they were divided on whether it should be assessed formally. This does not affect The Muse since marks will be entered into the university's online student information system, and it is up to the instructor to decide whether to include the creativity mark or not. However, with the availability of a system such as The Muse, it is hoped that as students start showing little-C creativity in several courses, that other yet unconvinced instructors will be encouraged to integrate creativity as part of their courses.

Finally, Figure 14 has shown that instructors are almost equally divided on the foremost question in creativity research, that is, should we assess creativity in our coursework and courses? Given these views, it is necessary to sensitize instructors in the sciences on the importance of creativity as a skill in our students, how it can be taught and assessed and how The Muse can be used for effectively accomplishing this.

Overall, the data gathered from the questionnaire has informed how best to assess creativity in the sciences at the tertiary level within coursework tasks. Summarily, creative pedagogy guidelines will be provided in a range, from simple to complex to support different levels of complexity of coursework tasks. Creativity scoring must also be made available separately from coursework tasks, to cater for in-class activities. The option for inclusive and exclusive grading for creativity will be given. Figure 15 shows a screenshot of the assessment page in The Muse. Instructors must select their course, assignment and assessment technique before grading can begin. The instructor can also select between the two creative assessment instruments, CSDS and CAT for assessment of the solution (Product) and has the option to choose which criteria in the CSDS instrument are relevant at the task granularity level. The instructor can then select which assessment technique is best for the creative process for that particular task.
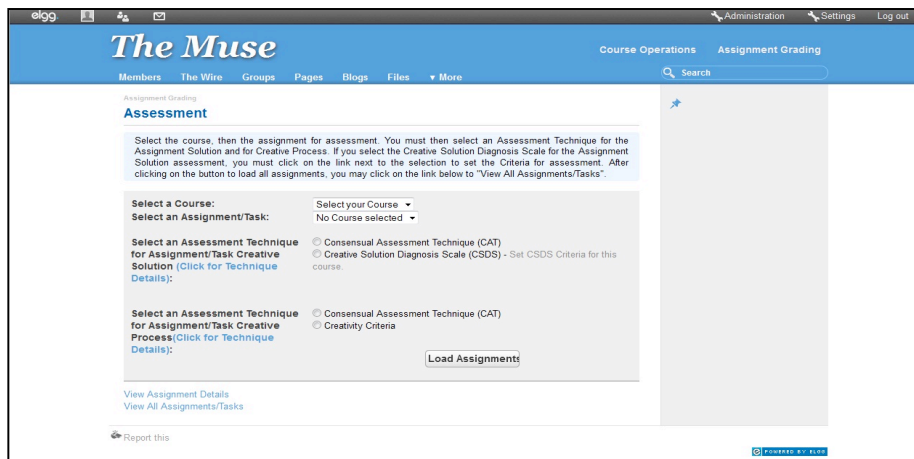

Fig. 15. Assessment Screenshot of The Muse

A creativity tool with an assessment component should provide the following:

✓ Learning of creativity techniques in a hands-on practical manner by simultaneously supporting students in some aspect of a course, for example, coursework tasks.
✓ Creative pedagogies in a range of complexity to match various levels of tasks.
✓ Both individual and group support, through instructions and the activities and tools provided.
✓ Ability to record offline creative activities, for example, in-class activities.
✓ Creation of pre-test activities by the instructor.
✓ Fine granularity of grading tasks.
✓ Creation of levels of subtasks.
✓ Options for selection of assessment technique by the instructor.
✓ Options for creation and modification of assessment criteria at the task level within an assessment technique.
✓ Option to set weights of the chosen criteria.

Fig. 16. Summary of Design Principles

Figure 16 provides a summary of the design principles derived from this context of use study of The Muse. These principles can be used as a basis for further development of creativity tools with an assessment component for education.

6 Future Research and Conclusion

This paper detailed one iteration of user input into the design and implementation of The Muse. Further user input through questionnaires and detailed interviews will be used to continue developing future versions of the software. The Muse is currently being used in a Computer Science project course at The University of the West Indies and further trials are planned with Computer Science and Chemistry courses.

It is expected that after several iterations of the same course, with similar coursework tasks and creativity assessment choices, comparisons and analysis of data on students' creativity can be made. The Muse can track and store all of the data on students' creative processes as students and instructors use the system for supporting and teaching creativity skills. The ability to track and store such data using The Muse provides a unique and valuable stepping stone for further research on creativity in education. Future work is planned for using a known standard, the TinCanAPI [12], for representing and storing students' creative processes, which can then be shared and read automatically by any system that follows this standard.

In conclusion, this paper discussed the assessment component of The Muse, a system for teaching and supporting tertiary students in the sciences in their creative

processes while undertaking coursework tasks. The assessment component focused on the assessment of creativity by instructors of their respective courses. The initial design of The Muse was informed by creativity and education literature. A questionnaire was then designed and conducted with instructors in the sciences. The data gathered was used as input into the current version of The Muse. Analysis of the data, as well as the changes made to The Muse based on this analysis was discussed. Without the data from user input, the system would not have been usable by instructors, thus, the methodology outlined in this paper led to an improved creativity assessment component of The Muse. Finally, several design principles for the development of creativity tools with an assessment component have been derived from this context of use study.

References

1. Barbot, B., Besancon M., and Lubart T. "Assessing Creativity in the Classroom." *The Open Education Journal*, no. 4 (2011): 58-66.
2. Robert W. *Creativity: Beyond the Myth of Genius*. New York: W.H. Freeman, 1993.
3. Smith J. K. and Smith L. F. "Educational Creativity." In *The Cambridge Handbook of Creativity*, edited by J. C. Kaufman and R. J. Sternberg, pp. 250-264. Cambridge: Cambridge University Press, 2010.
4. Kozbelt A., Beghetto R. A., and Runco M. A. "Theories of Creativity." In *The Cambridge Handbook of Creativity*, edited by J C. Kaufman and R. J. Sternberg, pp. 20--47. Cambridge: Cambridge University Press, 2010.
5. Beghetto R. A. and Kaufman J. C. "Broadening Conceptions of Creativity in the Classroom." In *Nurturing Creativity in the Classroom*, edited by R. A. Beghetto and J. C. Kaufman. Kindle ed. Cambridge: Cambridge University Press, 2010.
6. Carroll E. A, Latulipe C., Fung R., Terry M. 2009. Creativity factor evaluation: towards a standardized survey metric for creativity support. In *Proceedings of the seventh ACM conference on Creativity and cognition* (C&C '09). ACM, New York, NY, USA, 127-136.
7. Amabile, T. M. *The social psychology of creativity*. New York: Springer-Verlag, 1983.
8. Cropley, D. H., and J. C. Kaufman. "Measuring Functional Creativity: Non-Expert Raters and the Creative Solution Diagnosis Scale." *The Journal of Creative Behavior* 46: 2 (2012): 119-37.
9. Ellis, S. and Lawrence, B. (2009). The influence of the Creative Learning Assessment (CLA) on children's learning and teachers' teaching. *Literacy*, 43: 3–10. doi: 10.1111/j.1741-4369.2009.00509.x
10. Torrance, E. P. (1998). The Torrance Tests of Creative Thinking Norms-Technical Manual Figural (Streamlined) Forms A & B. Bensenville, IL: Scholastic Testing Service, Inc.
11. Horn D., and Salvendy G. "Product creativity: conceptual model, measurement and characteristics". Theoretical Issues in Ergonomics Science 7: 4, (2006): 395-412.
12. "Tin Can API." Tin Can API. Accessed December 10, 2014. http://tincanapi.com/.
13. Kersting, K. "What Exactly Is Creativity?" *American Psychology Association: Monitor on Psychology*, November 1, 2003, 40. http://www.apa.org/monitor/nov03/creativity.aspx
14. Houtz, J C., and Damon K. "Assessment of Creativity: Resolving a Mid-life Crisis." *Educational Psychology Review* 7: 3 (1995): 269-300.

15. Simonton, D. K. "Creativity in Highly Eminent Individuals." *The Cambridge Handbook of Creativity*. Cambridge: Cambridge UP, 2010. pp. 174-188.