Examples of the Use of Gaps in Students' Perceptions of Creativity to Design Learning Activities and Assessments

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Abstract: Students' perception often determines their actions. Thus, students' perception towards creativity needs to be identified and bridged to help them learn to be creative. This paper first aims to establish that creative design and instructional design share similar concerns. Hence, the design of learning activities and assessment in both frameworks have the potential to complement each other. Subsequently, a survey on students' perceptions towards creativity, factors contributing to creativity and perceived suitable assessment criteria is carried out. Next, examples of learning activities and learning strategies aimed at addressing gaps in students' perceptions towards creativity and creative processes are illustrated. Next, examples of how criteria assessments based on students' perceptions can be negotiated are presented. It is hoped that these suggestions can be expanded within the creative design and instructional design communities.

1. Introduction

Creativity is motivated by the drive to improve. [1] points out that creativity is "a basic human need to make new" (p.37). Furthermore, the inculcation of creativity extends beyond the boundaries of research laboratories as creativity is "… in the personality, the process and the product within a domain in interaction with genetic influences and with optimal environmental influences of home, school, community and culture, gender, and chance. Hence, the creative experience is characterized by an immersive engaging experience or flow [2], which results in the development of novel and useful ideas, crucial in the competitive work place.

In order to inculcate creativity, let us first consider what factors contribute towards creativity. [1] points out that creativity is the outcome of interactions between the individual, the disciplinary domain and a group of peers or experts who evaluate and determine whether an idea is creative and worthy of further exploration. Pedagogically, the multi-dimension, multi-level type of thinking required to produce creative outcomes can draw lessons from cognitive flexibility theory or CFT [3]. Principles underlying CFT are: thinking from multiple dimensions with diverse content representations, authentic and context-dependent content, emphasis on knowledge construction from multiple examples and the formulation of associations among concepts to form a holistic view of the knowledge concerned. CFT is also referenced as the theoretical framework in this paper.

Based on common concerns among the Generic Creativity Framework, a Creative Design Curriculum Reference Model [4] and a Common Instructional Design model [5],

the author argues that creative design and instructional design share similar concerns and can complement each other. Consequently, the findings of this study has the potential of enhancing the design of learning activities and negotiated assessments in both frameworks.

1.1 Research objectives

The objectives of this paper are two-fold:
a)   to provide examples of learning activities and learning strategies within the creative design/instructional design framework based on gaps in students' perceptions towards creativity and creative processes,
b)   to provide examples how criteria assessments based on students' perceptions can be negotiated.

In order to achieve the first objective, a survey is first carried out. The objective of the survey is to investigate students' perception towards what constitutes creative characteristics, their perception towards factors contributing to creativity and their perception of suitable assessment criteria that they perceive can be negotiated with the instructor (assuming that the instructor regards the student as a stakeholder in the design of the creativity curriculum). For the second objective, examples of the design and development of learning strategies aimed at bridging gaps in students' perceptions towards creativity and creative processes are provided. Subsequently, assessment criteria that students and instructors can negotiate with are suggested. These examples add on to [4]'s work, part of an on-going research to questions raised in [6].

2. Related work

2.1 Generic Creative Design Framework

[7]'s creative design framework highlights the generic processes for creative design and reasoning activities. As shown in Figure 1, the creative design framework consists of mainly 4 processes, i.e. collect, relate, create and donate. Corresponding sub-processes are searching for information, visualizing data and processes, consulting with peers and mentors, thinking by free associations, considering what-if scenarios, composing artifacts and performances, reviewing and replaying session histories and disseminating results. There is heavy emphasis on visualization, consideration of alternatives through what-if tools and collaboration but fundamentally, creative design involves thinking processes that facilitate schema construction and the use of schema to produce novel outcomes.
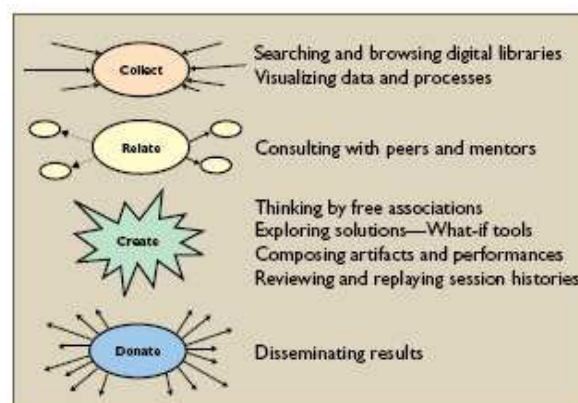

Figure 1. Schneiderman's generic creative framework

Processes supporting creativity are iterative and non-sequential, i.e., students can harness a process as the need arises. However, the iterative process has to be driven by learning goals. As goals change with learning outcomes, instructors need to carefully balance the learning challenge with different student abilities by providing sufficient and appropriate feedback. If mastered effectively, the reframing and refocusing of ideas based on changing goals and learning outcomes at each iteration will enable students to reflect critically and associate ideas to form and to refine the big picture. Learning consequently becomes meaningfully constructive.

2.2 Creative Design Curriculum Reference Model

[4]'s Creative Design Curriculum Reference Model is aimed at enabling classrooms across local and national educational standards (and eventually, across cultures and geographical boundaries) to share and learn from each other how to help students to become more creative designers and problem-solvers. Principles adhered to can easily be mapped to [7]'s generic creativity framework. They are:
a)   designing learning activities and strategies to help students to experience and realize *by themselves* what creative design is about (not just processes or rituals),
b)   contextualize creative design within local communities which students are familiar with; communities which are relevant and which matter to them, The first three processes in [7]'s framework, i.e., collect, consult and subsequently create, provide the rationale. Familiar contexts are crucial because it is easier to tap into and associate if students can fully harness their prior knowledge. Once prior knowledge has been tapped, associated and refined, students are likely to feel more comfortable sharing and learning from not only those they know but also experts from different locales and internationally.
c)   encourage iterations of framing and reframing to refine goals, hypotheses and designs through question-posing/consultations with peers, instructors and experts via pin-up sessions and gallery walks.
     Another principle suggested in this paper is to develop the student's learning/development in a holistic manner, i.e. not only to consider their cognitive development but more importantly, to guide and refine their perception of creativity and creative processes so that students will be able to self-direct their own learning.

2.3 Common Instructional Design Model

As of 1980, there are 40 Instructional Design (ID) models [8]. In view of the diversity of focus and needs that have given rise to these Instructional Design models, [5] have proposed a Common Instructional Design Model; capturing the common attributes in ID models. These common attributes are: to utilize the appropriate learning theory, to cater to individual learning needs by personalizing and promoting meaningful individual and collaborative learning, to motivate learners especially in e-learning/blended learning environments, to empower learners, to foster active learning, to adhere to usability and accessibility guidelines and to conduct formative assessments more frequently in order to review the effectiveness of curricular design and students' progress.
     It is noted that the second, third, fourth and fifth attributes (italicized) share similar concerns as [4]'s principles for promoting creative design in curricula design. They also provide the pedagogical guidelines for translating [7]'s creativity generic framework into curricular design. Hence, these framework/principles and attributes are complementary to each other, across creative design and instructional design disciplines.

3. Research Design

The survey was carried out in a suburban Malaysian secondary school. Snowball and convenience sampling procedures were used to obtain a sample of students. A total of 40 students aged between 15 and 17 participated in the survey.

3.1 Procedures

A questionnaire was distributed to students. There were 4 sections to the questionnaire: Section I profile, Section II perception towards creativity, Section III perceived factors contributing towards creativity, Section IV perceived suitable assessment criteria. Characteristics describing creativity in the questionnaire were derived from benchmark creativity test constructs [9, 10].

The objectives of the study were first explained. Subsequently, queries were answered and clarified on the spot whenever they were raised. The researcher emphasized that for Sections II, III and IV of the questionnaire, there were no right or wrong answers. Furthermore, students were free to choose as many characteristics as they thought represented creativity. In terms of importance, 1 represents least important top 5, and 5, the most important top 5 characteristic. To determine the degree of importance for each characteristic, the rating (1 to 5) is multiplied by the frequency that the characteristic is chosen, i.e., importance x frequency = weight.

3.2 Results and discussion

I. **Profile**: Reasons that students provided for wanting to be creative are to become more interesting (3), more independent (1), improve ability to work (4), think more widely (1), become smarter (1), become successful in all fields (1) and to remember better (1). Five students, however, expressed no interest in becoming creative (5). This suggests that many students are indeed interested in becoming more creative reasoners. It also tells us that early in the unit, teachers will have to help learners to recognize the value of the creative reasoning they are doing.

II. **Students' perceptions of creativity:** Students identified *imaginative, being able to view from different angles, confident, practical, and curious* as the top 5 characteristics reflective of creativity. They viewed *imaginative, confident, curious, practical,* and *can think from different angles* as the five most important characteristics of creative people. Although different in order, these two lists are quite similar and show much agreement in the ways Malaysian high schoolers perceive creativity. Tables 1 and 2 show the top 6 results. These results suggest students are already somewhat aware of what creative thinking is but that their awareness is limited, i.e., that explicit help with becoming creative can be useful.

Table 1. Top six characteristics students perceive as reflecting creativity

Characteristics	Number Poll
imaginative	28
can think from different angles	27
confident	23
practical	22
curious	21
original	20

Table 2. Top six perceived relative importance of creativity characteristics

Characteristics	Weighted score
imaginative	81
confident	52
curious	49
practical	46
can think from different angles	45
original	32

III. **Factors contributing to increase in creativity:** When asked about factors they think might increase creativity (see Table 3), four of the characteristics polled highest in frequency are also polled as part of the top 6 most important characteristics. Furthermore, the characteristics they rate as important in order to be creative are *able to identify goals and sub-goals and able to reason using different perspectives.* Low on learners' list of what is important for creativity, however, are *linking information to the goal/context, reflecting on outcomes, making hypotheses, identifying what they need to know next,* and *willingness to share.* This tells us that it will be particularly important, in helping teachers to know how to carry out the curriculum, to help teachers know how to identify when learners' success is due to these practices, to help learners identify these practices as useful to creative thinking, and to help learners explicitly identify the ways they are carrying out these practices.

Table 3. Top six factors contributing to increased creativity in students (frequency/ importance)

Characteristics (frequency)	Characteristics by weighted score
Willing to change with new information (31)	Able to identify important ideas (85)
Able to identify important ideas (27)	Able to identify goals and sub-goals (69)
Able to propose new solutions (20)	Able to reason using different perspectives (53)
Willing to share (20)	Willing to change with new information (46)
Able to link information with context (19)	Willing to share (40)
Able to identify goals and sub-goals (18)	Able to propose new solutions (40)

IV. **Criteria for assessing creativity:** Learners identified imagination, flexibility, constraints, curiosity and risk as the five most important characteristics to assess in deciding if someone has been creative (see Table 4). The top six perceived criteria for assessing creativity based on weighted scores relative to importance are imagination (64), flexibility (123), constraints (70), curiosity (20), risk (26), and relevant ideas (45). However, they ranked relevance of ideas, practicality, and elaboration of ideas quite low. This suggests that the curriculum will have to help learners understand that creative thinking should be practical thinking, that imagination should be aimed toward relevant and practical ideas, and that a great deal of elaboration might be needed to move from first-imagined ideas to those that might work.

4. Examples of learning strategies to bridge contributing factors among novices and experts and how these can be assessed

Findings from the survey rated *imaginative, confident, curious, practical and able to think from different angles* as the top 5 characteristics reflective of creativity and most important top 5. Furthermore, the characteristics *able to identify goals and sub-goals and able to reason using different perspectives* were deemed among the top 5 in importance but did not score that well in frequency. In addition, the characteristic *linking information to the goal/context* was polled fifth in terms of frequency but rated fourth from the bottom in terms of degree of perceived importance. However, goal orientation is key to ensure all initiatives meet the goal. Since systems thinking is fundamental and key to creative and divergent thinking, a major concentration of strategies need to revolve around scaffolding this skill. The following example shows strategies to address these two skills that require more attention. The case scenario is how to design a green smartphone.

Example 1: Linking goals with sub-goals/context

Strategy: Students can be asked to identify what green means, which parts or functions of the smartphone can be made green and factors external to the smartphone which they can utilize/harness to make the smartphone green.

Assessment: Since this is the initial stage of their design, the criteria perceived by students to be important can be used, i.e., imagination, flexibility, constraints, curiosity, risk, and relevant ideas.

Example 2: Helping students to think from two proposed perspectives.
Strategy: Students use substitution and combination techniques (Table 4).

Assessment: Students are likely to be at a more advanced stage of reasoning here. As such, the assessment criteria used in Example 1 can be reused by the bar is increased. Furthermore, the assessment criteria relevance of ideas, practicality, and elaboration of ideas can be added in incrementally based on students' abilities and progress.

Table 4. Examples of learning strategies to inculcate multi-dimensional thinking

Technique	Generation	Elaboration
Substitute	Substitute material used for the smartphone's cover	Material should be able to regulate and dissipate heat so the phone will not heat up too quickly
Combine	Screen can enable self-sustaining energy use.	Create screen which can capture solar energy or recycle the heat generated by the smartphone into energy.

5. Conclusion

This paper has presented that creative design and instructional design share similar concerns and can complement each other, illustrated how learning strategies can be designed based on students' perception towards creativity, perception towards factors that contribute to creativity and assessment criteria and perception towards assessment criteria. Examples of how learning activities and learning strategies can be designed within the creative design/instructional design framework and how assessment criteria based on students' perception can be negotiated based on students' abilities and progress. It is hoped that more strategies can be developed in wider communities.

Acknowledgement

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