A generative framework for creative learning: A tool for planning creative-collaborative tasks in the classroom

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Abstract

In this paper a generative framework for creativity is presented which extends upon Wallas's model of creativity (1926), social learning theories and creativity theories. The framework offered here presents a distillation of learning and creativity theory drawing upon salient roots of both creativity and learning theories in the 21st century. The generative framework can be instantiated for use as a learning support tool to assist with the design of classroom and / or other creative learning experiences. Creativity theories are discussed in relation to their appropriateness of the framework. An explanation of the framework is presented and an example instantiation provided. The development of the generative framework has been influenced by psychological accounts of creativity and socio-constructivist accounts of learning. The framework presented here has a number of implications for creativity theory as well as teaching and learning practice.

Keywords: Learning, Creativity, Collaboration

Introduction

A number of scholars have suggested that there exists a strong relationship between learning and creativity (Guilford, 1950; Karnes *et al,* 1961; Torrance, 1981), indeed, Guilford (1950) states that creativity can be considered as a sub-type of learning. In early approaches towards learning, pedagogy was concerned with pre-packaged lesson materials delivered from the teacher to students. However, more recent learning theories have offered more contextualised approaches to learning, specifically through social learning theories arising from constructivism and constructionism. These perspectives on learning suggest that the act of learning is both an interactive process (Vosniadou, 1996) and a process in which the individual needs to be personally engaged (Harel, 1991; Papert, 1993).

Early research into creativity has focused upon stage-models of creativity as initially proposed in the four stage model by Wallas (1926), namely through the stages of preparation, incubation, illumination and verification.

e-ISSN 2046-4444 | ISSN 2046-4436

Wallas noted that during the creative process an individual could return to earlier stages and this has been supported by subsequent research (Hadamard, 1945; Patrick, 1937; Patrick, 1938; Rossman, 1931). It is important to note that in contrast with historic 'lone' genius notions of creativity, it is now understood both as a potential of every individual and as involving the active construction of new ideas and content within a social context of other members of the field and / or peers.

In light of the suggested link between learning and creativity advocated by Guilford (1950), Karnes *et al,* (1961) and Torrance (1981), this paper discusses various approaches undertaken in the study of learning and creativity. In particular this paper draws upon social-learning theory and historical models of creativity to present a fresh conceptualisation of learning and creativity in the form of a generative framework.

Assertions of the constructivist approach towards learning

According to the constructivist approach, important aspects of learning are as follows: firstly, learning is contextual (Schank, 1995) and, secondly, one needs knowledge to learn. In other words, it is not possible to assimilate new knowledge without having a previous knowledge structure. Thirdly, learning is a self-regulated process (Bandura, 1986) as every individual learns at a different rate depending on their prior knowledge and experience. Finally, according to social constructivist and socio-cultural accounts, learning is viewed as an individual and social activity in which interactions with others and the external environment are conducive to learning (Tapscott *et al,* 2006; Frank, 2005; Sawyer, 2007); students learn by constructing meaning for themselves through active participation within a domain. This approach has a number of strengths. For example, by discussing their experiences with others, shared understandings can be developed (Stager, 2005). This is especially advantageous in collaborative settings. Many have argued that social interaction is paramount to cognitive development as learning occurs through interacting with others. This is thought to enhance the integration of newly acquired concepts into the mental structure of the learner (Derry, 1999; Driscoll, 1994; McMahon, 1997; Vygotsky, 1978) and Vygotsky (1978) suggests that cognitive development is dependent upon social interaction.

Constructionist approaches: learning by building

Constructionist methods have also sought to enhance the learning experience linking creative endeavours to learning. Constructionism can be regarded as an educational method based upon constructivist learning theory (Papert, 1993). Where constructivism advocates that knowledge is constructed in the mind of the individual, constructi*onism* extends upon this,

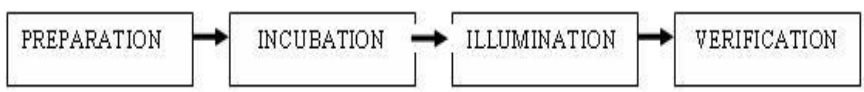
suggesting that an effective way to learn is to build something tangible that exists in the real-world. This is thought to enhance the overall learning experience, making it more meaningful to the student. The emphasis of constructionism is the importance of students' active engagement in personally creating a product which is meaningful to themselves and others (Harel, 1991; Papert, 1993). Constructionist environments are of particular interest to the study reported in this paper as they allow pedagogic concepts to be combined in relevant practical activities, thus making learning tasks more meaningful to students. This is emphasised by Dewey (1989) who suggests that learning is a result of disequilibrium and that students learn most effectively through "work-shop" style scenarios and previous studies have indicated that this approach can lead to a richer learning experience for the student enhancing task motivation (Bruckman, 1997; Bruckman, 1998; Bruckman & Resnick, 1995; Rogers, 1969). This can be facilitated by encouraging students to construct a piece of work based upon their understanding of a pedagogic subject (Papert, 1993), thus, allowing students to explore and participate within a domain for themselves (Laurillard, 1995).

Background motivation: creativity theory

Models of creativity

Creativity research originally focused upon stage models of the creative process starting with the work of Poincare (1913). Poincare describes the creative process as commencing with conscious thought followed by unconscious work, resulting in 'inspiration'. Based on Poincare's account of the creative process, Wallas (1926) formalised the four-stage model of creativity. Wallas defined creativity as a linear four-stage model, progressing through the stages of preparation, incubation, illumination and verification (see figure 1).

Figure 1: Wallas's stage model of creativity



Similarities between learning and creativity

Over the last three decades, theories which emphasise learning as a constructive process have shed light upon creative phenomena (Houtz & Krug, 1995). For example, theoretical underpinnings discussed within this paper suggest that learning and creativity share a number of similarities. Firstly, learning is social in nature as people interact with and are influenced by oth-

ers and their environment constantly (Vygotsky, 1978). Therefore, learning has been described as the outcome of interactions between social agents and their environment (Vosniadou, 1996). Secondly, students construct their own meanings through actively participating within a domain (Forrester & Jantzie, 2001; Honebein *et al*, 1996). Creativity is also social in nature and it is widely acknowledged that any creative idea or artefact arises from the relationship between the individual creator, others and the environment (Fasko, 2001; Hennessey, 2004; Sternberg & Lubart, 1991; Torrance, 1981). Thirdly, creativity is also situated within a context which may concern the culture and domain in which the individual is situated. Therefore, interactions with others and the surrounding environment are keys to both learning and creativity. Two other important aspects shared by learning and creativity are time and previous experience. Learning is not an instantaneous process as significant learning takes time. Time is required to allow students to revisit and reflect upon ideas. By allowing time for reflection students can form different perspectives on a scenario (Gardner, 2007; Sternberg, 2003). This may be assisted partly by analogical and metaphorical thinking. Time is also important to creativity owing to subconscious processing during the incubation stage (Claxton, 1998). Finally, creativity involves forming multiple perspectives of a situation (Guilford, 1967; Runco, 1996), implying, therefore, that creative ideas are inspired by previous situations and experiences. Similarly, learning takes place when the student is able to relate new concepts to previous situations and experiences (Schank, 1995).

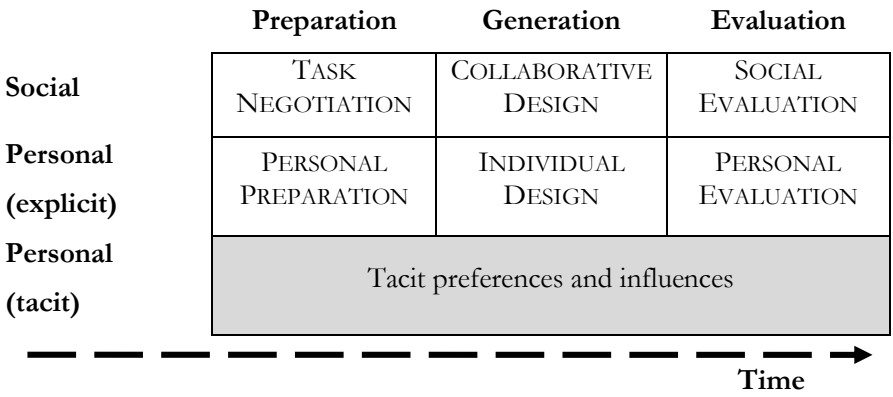
A Generative framework for creativity

Drawing upon these theoretical insights, a framework has been developed which represents a distillation of creativity theory focusing upon education. The framework is presented in the form of a generative framework, which exists as a design support tool to assist with the design of lesson support materials and the design of educational technologies. The framework assists the design of creative educational experiences for the classroom by providing scaffolding for supporting materials in terms of the six white component boxes of the framework (see figure 2).

Wallas's four-stage model has been adapted as the fundamental basis for this generative framework, with the processes of preparation, generation and evaluation represented laterally across the framework. The vertical dimensions reflect individual (denoted here as personal) and social components of creativity. The social level refers to others, peers and society and personal levels reflect explicit and tacit levels of thinking.

With regard to figure 2, the lateral and vertical phases and subcomponents of the generative framework are discussed within the following sub sections.

Figure 2: A generative framework for creative learning



Lateral process: the preparation process

The processes of preparation, generation and evaluation are recognised herein as three integral concepts of the creative process in that, every creative act involves the preparation of ideas, whether in the form of tacit influences drawn from the environment or conscious preparation for the task. Within this process, at the personal level, an individual will develop a curiosity or a desire to create. Once this desire or need has been established, information is consciously accumulated from the external environment and thoughts may be discussed with others on a 'social' level which the individual can reflect upon on a 'personal' level (Getzels, 1964). If working in a collaborative setting, group-wide negotiations of the task will also take place. Inevitably, the way in which an individual prepares for the task will be influenced by their past experiences which may be explicit or tacit (Schank, 1995).

Lateral process: the generation process

The generation process of the framework encompasses social and personal design. Within this process ideas are generated which can involve interactions and negotiations between the individual and peers in their environment. Additionally, idea generation is assisted partly by a continuous interaction occurring between levels of explicit and tacit thinking (Claxton, 1998). The terminology used in the creativity literature refers to these subconscious processes as incubation and illumination, as described above. A number of scholars suggest that influences from the environment at a 'social' level can trigger creative ideas to progress from tacit to more explicit thoughts at a 'personal' level (Claxton, 1998). Thus, the framework presented here acknowledges both the importance of environmental factors upon the creative process and the importance of allowing time for creative ideas

to evolve. This emphasises that, although individuals may at times work alone to produce creative ideas and artefacts, interactions and collaboration with others and the external environment are crucial (Candy & Edmonds, 1999; Csikszentmihalyi & Sawer, 1995; Gardner, 2007; Gero & Maher, 1993). Previous studies concerning the advantages of collaborative learning further support the importance of the environment and interactions with others (Brown *et al,* 1989; Ertmer & Newby, 1993; Fischer, 1991; Vygotsky, 1978; Wilson & Myers, 2000). This implies that individuals are constantly receiving information from the environment which may trigger elements of creative thought at the tacit level which may, then, become conscious explicit realisation. This implies that the environment in which one is situated can stimulate and evoke creativity by igniting a creative idea (Fasko, 2001). Additionally, as creativity involves the formation of multiple perspectives of a domain or scenario (Guilford, 1967, Runco, 1996), influences from the environment may also allow one to shift between differing perspectives leading to the generation of further ideas.

Lateral process: the evaluation process

The evaluation process concerns reviewing early creative ideas through to evaluating the final artefact. The evaluation process may be conducted by the individual at a personal level and by the wider community, fitting in with Boden's notion of P-creativity and H-creativity (Boden, 1992). Whilst the view here is that these are not distinct types of creativity, it is acknowledged that Boden's notion of P and H creativity represent two dimensions of evaluation and a wide body of literature also supports this (Amabile, 1983; Csikszentmihalyi, 1988, 1999; Martindale, 1990; Mumford & Gustafson, 1988). Although not all creative acts culminate in historically significant acts (Briskman, 1980), the creative individual may wish to verify their work with others residing within the community. This may lead to individual and or societal acceptance of the creative artefact and, in some instances, this may lead the individual to return to earlier processes of the framework, for example for the refinement of an idea (Amabile, 1996). This is supported by previous studies which extend upon the work of Wallas (1926) indicating that a second incubation process may occur after initial illumination, depending on the creative idea or artefact produced (Leytham, 1990; Poincare, 1913; Sapp, 1992). Inevitably, what follows the evaluation process will differ between individuals and scenarios.

Additionally, evaluation may also concern the creator's emotional response to the artefact produced in which implicit reactions occur. For example, an individual may feel 'uncomfortable' regarding work produced and return to earlier processes of the framework such as preparation or incubation (Schon, 1983). Similarly, an individual may feel 'satisfied' with their

work and evaluate artefacts at the conscious level. It is suggested that, in terms of personal evaluation, a natural dialogue takes place between explicit and tacit levels of thinking. It is also important to mention that the evaluation process does not necessarily refer to the reviewing of the end product but rather, as one progresses through the framework, ideas may be reviewed and revised where necessary which may result in further preparation and or generation. It is only when this evaluation process has been reached that it is possible to revisit earlier stages of the framework if further generation or preparation is required. This emphasises the cyclical nature of the framework by which processes may be revisited iteratively until a positive evaluation has been attained and the individual is satisfied with their creative idea or artefact produced. Inevitably the number of iterations required will depend upon the scenario and the individuals involved.

Vertical dimensions: the roles of social, personal explicit and personal tacit levels of the framework

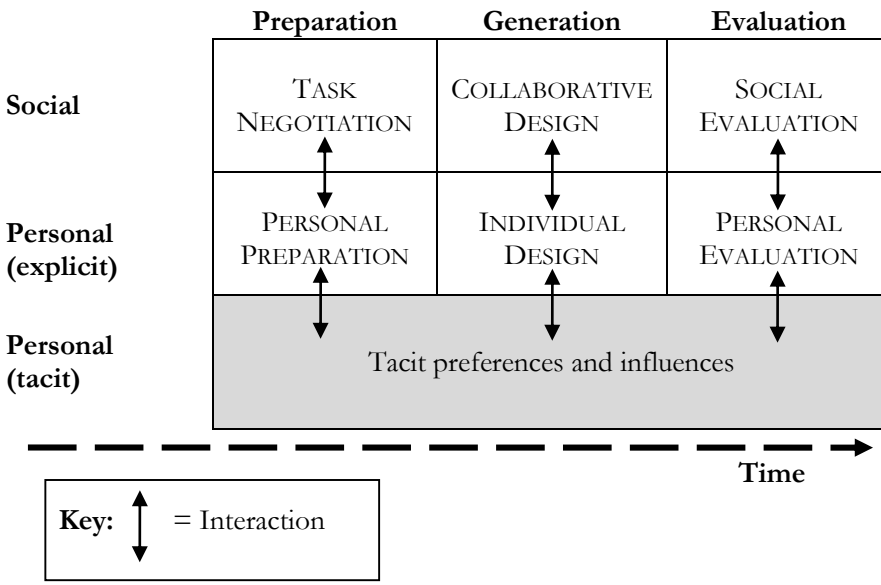
The vertical dimensions of the framework reflect the personal and social components of creativity. These dimensions encompass interactions and discourse with others and influences drawn from the environment. The personal levels - exclusive to the individual - encompass explicit and implicit levels of thinking. On the explicit level, an individual consciously prepares for the task, generates ideas and reviews them. Creativity literature supporting the generative framework states that, at the tacit level, influences received from the environment and conscious thought may influence ideation to occur (Sanders, 2001). 'Ideation' refers to the formation of ideas, in which thoughts initially defy expression in language (Root-Bernstein & Root-Bernstein, 1999). Root-Bernstein and Root-Bernstein (1999) state that creative thinking occurs pre-verbally, manifesting itself via emotions, images and intuition. Furthermore, thoughts can only be translated into formal systems of communication such as language and become explicit when they have sufficiently developed in tacit pre-logical forms (Kaha, 1983) and Claxton (1998) states that time is required to allow for such processing to occur. It is further suggested that the sub-conscious mind can be understood by regarding preparatory materials and information as differing 'rays' impinging on a lens or prism. Given time, appropriate rays might be selected and brought to focus, thus forming a new pattern or characteristic (Leytham, 1990) which then brings new perspectives to the conscious mind. Therefore, thoughts may cross the boundary between implicit and explicit ways of knowing. Thus, illumination occurs and creative ideas can be evaluated.

Through all of the lateral processes, society plays a crucial role in that an individual constantly receives information from the environment and the society in which they are immersed. For example, in the domain of music

one is always influenced by the scales and concepts of tonality shaped by the culture in which they exist. In terms of preparation and generation stages, one continuously draws upon such influences, not only an explicit level but also at a tacit level. The individual may collect information relating to the artefact they wish to create, whether it is in the form of literature, music or conversing with others. Finally, in terms of evaluation, the individual may wish to discuss and evaluate their work with others by allowing those within the wider community to form judgments relating to their creative work. Throughout the component boxes represented on the framework, interaction occurs vertically between social aspects and the individual (see figure 3).

Figure 3 illustrates interactions between social and personal levels. These interactions continuously occur as the individual is influenced by factors relating to the environment or culture in which they are immersed. Interaction also continuously occurs between explicit and tacit levels of thinking throughout the creative process.

Figure 3: Vertical interactions occurring within the framework



Theoretical assumptions of the framework

The generative framework for creativity attempts to explain concepts and processes involved in creativity. As illustrated in the framework (see figure 3), the creative learning process begins with social and individual

preparation, ends with social and individual evaluation and is characterised by three main processes. The framework also acknowledges social and individual elements within the creative process. The framework does not commit to a strict linear route and it is emphasised here that the creative process is cyclical in nature, something which is been supported by aspects reviewed within the theoretical background (Amabile, 1996; Hadamard, 1945; Patrick, 1937; 1938; Rossman, 1931). The review of creative ideas may result in a need to revise ideas which may result in further preparation or evaluation or further generation and so on. The framework exists as a design support tool for facilitating creative learning and can be used to guide the design of lesson materials for the classroom and the design of e-learning environments. The framework can be utilised as a design support tool to facilitate creative thinking in the classroom (Leytham, 1990; Runco & Bahleda, 1986; Sternberg, 1985).

Instantiating the framework

The generative framework proposed here offers many advantages in terms of facilitating creative thinking and learning within the classroom context. Teachers and designers of educational technology can utilise the framework to assist with compiling lesson plans to ensure that all aspects of the creative process are considered and the framework has been designed so that it can be applied to any domain. Here it is instantiated through a music composite on example in which students are set the task of composing music in pairs. This instantiation is illustrated in figure 4.

With regard to figure 4, students will, over the long term, have acquired a great deal of knowledge about music and the kinds of musical styles dominant in their culture to which new ideas will be related, allowing the student to construct their own meanings based on previously acquired knowledge and influences. In the short-term, preparation will also concern students working in pairs negotiating how to carry out the task. Each member of the pair will also bring unique experiences to the task in terms of any musical instrument training and personal musical preferences. Students may then reach a point at which ideas are acted upon in the generation phase leading to the evaluation of ideas. This may result in students returning to earlier phases to refine ideas. Evaluation occurs at the personal level in which the individual student reflects upon the composed work. At the social level, evaluation will involve students evaluating the composition within the pair. This may also lead to students seeking evaluation from the wider community in terms of the larger student group or discussions with their teacher in which others are encouraged to comment on the compositional piece.

Figure 4: Instantiation of the framework - a music composition example

	Preparation	Generation	Evaluation
Social	Short term – discussion with fellow student about task. Long term – social enculturation of music	Pair-wise problem solving and discussion	Feedback from peers and teacher, and pair-wise reflection and judgement of composition
Personal (explicit)	Individual experience (music training etc.) Musical preferences (heavy metal, eminem etc.). Personal ideas about how to carry out the task	Personal construction of ideas	Personal reflection and judgement of the composition
Personal (tacit)	Tacit preferences and influences		

Time

Conclusion

This paper has extended upon Wallas's model of creativity with the presentation of a generative framework. Specifically, the generative framework provides a contemporary perspective on the creative process by incorporating social learning theory, in particular constructivism. The framework exists as a design support tool for educators, teachers and designers of educational technologies alike in the preparation and design of learning materials. This paper has outlined the motivation behind the framework and demonstrated how the framework can be instantiated for use in educational settings.

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