Computers in Human Behavior 41 (2014) 454–463

Contents lists available at ScienceDirect

Computers in Human Behavior

journal homepage: www.elsevier.com/locate/comphumbeh

# Students' perceptions of creativity in learning Information Technology (IT) in project groups ☆

Chunfang Zhou [a,*], Hongbing Chen [b], Lingling Luo [b]

[a] Department of Learning and Philosophy, Aalborg University, Denmark
[b] Research Center of Science, Technology and Society (STS), Northeastern University, China

ARTICLE INFO

*Article history:*
Available online 20 November 2014

*Keywords:*
Creativity
Project group
Information Technology (IT)
Problem-based learning (PBL)
IT education

ABSTRACT

This paper explores students' perceptions of creativity in learning Information Technology (IT) in project groups and the implications of better educating creative IT students for the future. Theoretically, the extension of social psychology research into creativity lays the basis of bringing creativity, learning and IT education into one framework. Empirically, qualitative interviews were carried out with 48 students from three disciplines, including Computer Science ($n = 16$), Electronic Systems ($n = 15$) and Medialogy ($n = 17$) at Aalborg University (AAU) in Denmark, which has a tradition of using problem-based learning (PBL) in student project groups. According to the findings, the students' perceptions of creativity reflect their domain-related conceptualization and tacit learning experience, with different levels of confidence of being creative persons. As IT plays multiple roles in developing students' creativity, it can be regarded as a 'learning partner'. This implies that in the future creativity should be taught more explicitly, helping students to become creative IT talents as a part of their professional identity. It also requires teaching efforts to build a learning environment that stimulates creativity more effectively through more interactions between learners, learning tasks and learning tools.



## 1. Introduction

In general, the term creativity means to generate new and useful ideas (Amabile, 1996; Kaufman & Baer, 2005; Robinson, 2013). The field of creativity was practically somnolent when Guilford (1950) woke it up more than half a century ago with a presidential address to the American Psychological Association (Sternberg, 2005). Today the field has seen an explosion of interest: creativity has been discussed much by such theories as psychology (Martinsen & Kaufmann, 1999), social psychology (Amabile, 1996), cultural psychology (Glaveanu, 2010), social culture (Craft, 1995), and even philosophy (Singer, 2011). However, recent studies indicate increasing interests in a systematic approach to creativity (Miell & Littleton, 2004). As the *Handbook of Creativity* (Sternberg, 1999) indicates, the development of scientific thinking about creativity has followed a particular trajectory: going from an early emphasis on isolated individuals and their internal traits and capabilities, followed by a developing focus on the interaction between individuals and the environment. In other words, the focuses of creativity research have changed from 'what creativity is' to 'where/how creativity happens' (Sternberg, 1999).

The emerging research on creativity in relation to Information Technology (IT) education has been driven by the rapid development of Computer Science and digital technologies since the 1950s (Gauntlett, 2011). In the 1960s, computer-based teaching sparked enthusiasm for individualized teaching (Sun, Lin, & Yu, 2008). Then the subsequent availability of microcomputers enabled the application of computers to education and changed the learning culture (Scardamalia & Bereiter, 1993). IT has brought the potential to fundamentally transform how and what people learn throughout their lives. Just as advances in biotechnologies make possible the 'green revolution' in agriculture, new digital technologies make possible a 'learning revolution' (Resnick, 2002). As Gauntlett (2011) suggested, since the historical point at which education became institutionalized in a system of schools, learning has become a process directed by a teacher, whose task it is to transfer nuggets of knowledge into young people's minds. However, we can see a growing engagement with a new learning culture mediated by IT.

☆ This publication was supported by two national-level research projects: one is in China and one is in Denmark. The earlier stage of this research was supported by Research on Critical Thoughts of Technology Culture of Neo-Luddism (with project ID of 13BZX022, China). The later stage work was supported by Fostering Creativity in Higher Education: A Comparative Study on Pedagogical Strategies of Learning by Projects between Denmark and China (with project ID of DFF 1321-000117, Denmark).

* Corresponding author.
*E-mail address:* chunfang@learning.aau.dk (C. Zhou).

http://dx.doi.org/10.1016/j.chb.2014.09.058
0747-5632/

This orientation rejects the passivity of learning, and seeks opportunities for creativity, social connections, and personal growth.

Accordingly, IT is sparking a new entrepreneurial spirit, the creation of innovative products and services, and increased productivity. The importance of well-educated, creative citizenry is greater than ever before (Resnick, 2002). This has produced a growing number of scholars who devote themselves to calling for creativity in IT education (Gauntlett, 2011). This subject has presented various issues including how to understand technology adoption in informal learning (Straub, 2009), how computers can be partners in the creative process (Lubart, 2005), and how to foster motivation and creativity for computer users (Burleson, 2005), etc. Combining the literature on computer models of creativity (Boden, 1998), e-learning (Garrison, 2003), mobile learning (Cavus & Uzunboylu, 2009) and usage of Web 2.0 (Glaveanu, 2010), etc., another point has also been underpinned, that IT and creativity have a symbiotic relationship: on the one hand, IT supports and mediates learners with diverse creative learning environments; on the other hand, in order to handle problems required by learning tasks in IT-supported educational contexts, learners need creativity to move on in the learning process. This means the educational role of IT-related disciplines is not only to prepare students with the ability of using IT well, but also to provide a positive attitude towards IT systems and a confident, responsible and creative use of IT in the information society (Romeike, 2007).

Along with education development supported by IT, another stream of teaching for creativity has been formed by the emerging new educational philosophies that are rooted in social theories of communities (Wenger, 1998a, 1998b), constructivism (Von Glasersfeld, 1982) and social constructivism (Duit & Treagust, 1998), etc. and emphasize strategies such as learning by doing, interdisciplinary learning, peer learning, group work, student-centred learning, and the shift from teaching to facilitation (Craft, 1995). This has also led to the growing exploration and application of new educational models. For example, Problem-Based Learning (PBL) has been widely used in diverse disciplines and cultures throughout the world (Tan, 2009). In PBL, students' learning centres on complex problems that do not have a single answer, or solving real-life projects. Students work in collaborative groups to identify what they need to learn in order to solve the problems. The teacher acts to facilitate the learning process rather than to provide knowledge (Hmelo-Silver, 2004). This can be achieved through the application of constructive learning principles that emphasize learning should be an active process in which students actively construct or reconstruct their knowledge networks. Learning should also be a process of creating meaning and building personal interpretations of the world, based on individual experiences and interactions (Gauntlett, 2011). This also indicates the need for research that can build on the responses of learners in relation to particular topics with the aim of improving future teaching strategies.

Following the above lines, this paper considers PBL as the research context and proposes two research questions: (1) how do students perceive creativity in their learning experience of IT knowledge in project groups? And (2) what are the implications of students' perceptions of creativity for better IT education in the future? In order to answer these questions, this paper takes a departure from the social psychology perspective on creativity by theoretically combining creativity, learning, and IT education in one framework. Empirically, qualitative interviews were carried out with 48 students from three IT-related disciplines, including Computer Science ($n = 16$), Electronic Systems ($n = 15$) and Medialogy ($n = 17$) at Aalborg University (AAU) in Denmark, which has a tradition of using problem-based learning (PBL) in student project groups. As the findings and discussions demonstrate, this paper has important significance for linking creativity, learning and IT education for future studies.

## 2. Education for creativity and learning IT

### 2.1. A social psychology perspective to creativity

Creativity is a complex and multifaceted phenomenon. As such, it is appropriate to adopt a variety of methods to investigate it from a multitude of perspectives (Ward, 2007). According to Jeffrey and Craft (2001), creativity research in the 1950s firstly focused on the psychological determinants of the individual's giftedness, based on the individuality, outstanding ability and fertility of the genius, and then focused on personality, cognition and how to stimulate creativity. The latter focus was supported by a philosophical debate in the 1970s that saw creativity as moving away from product outcomes and as being connected with imaginativeness. During the 1980s, a new line that of a social psychology and system theory, was developed that took environmental conditions into account. Within these four lines of development (i.e., personality, cognition, stimulating creativity and social theories), there were specific foci: the person who creates; the creative process; environmental factors; and the outcome. During the 1990s, due to the development of social psychology, research into creativity became more comprehensive, integrating these specific foci, and began to concentrate more on the creativity of ordinary people within the educational system.

This paper takes a departure from the social psychology perspective to creativity that recognizes that social structures affect individual creativity (Jeffrey & Craft, 2001). It focuses on personality variables, motivational variables, and the social-cultural environment as sources of creativity (Miell & Littleton, 2004). It includes the roles of co-creation or collaboration in the process of reaching 'great discoveries' among ordinary persons (Glaveanu, 2010). For example, Csikszentmihalyi (1988) has taken a 'system' approach that emphasizes the role of the individual (via cognitive process, personality traits, and motivation), the field (consisting of people who influence a domain and evaluate new ideas), and the domain (the culturally defined symbol system that transmits creative products to others and to future generations). Amabile (1996) defined three components: domain-relevant skills that provide the fundamental basis for any creative performance to occur; creativity-relevant skills that include knowledge of heuristics for generating novel ideas as well as appropriate cognitive styles and working styles; and task motivation that accounts for motivational variables determining an individual's approach to a given task, including one's attitude toward the task and self-perceived motivation for undertaking the task. Sternberg and Lubart (1995) also link specific aspects of intelligence, knowledge, thinking styles, personality, motivation and the environment to creativity. Furthermore, there is recent increasing interest in also considering creative acts in an interactive framework, including self, other, new and existing artefacts, and in promoting ecological studies of creativity and emic definitions that rely on how people themselves define creativity within different contexts (Csikszentmihalyi, 1988; Glaveanu, 2010).

### 2.2. Creativity as domain-general and domain-specific

In general, creativity is the ability to come up with new ideas that are surprising yet intelligible, and also valuable in some way (Boden, 1990). This is true for all cases of creativity, whether within science, art, politics, cookery, whatever. Such a domain-general view is implicit in the classic psychometric studies of creativity in which the goal is to measure the level of creativity in people by tests (Sternberg, 1999). However, defining 'a new idea' is ambiguous, because it may be new with respect to the whole of