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Fostering Creativity through Educational Video Game Development Projects: A Study of

Contextual and Task Characteristics

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Abstract

The increasing demand for creative individuals in the labor market requires well-prepared professionals, capable of enhancing competitiveness through new ideas and innovative actions. Educational programs should therefore rely on approaches and learning environments that foster creativity. In this study, video game development projects were used as an approach to foster creativity in educational contexts. Conceptual frameworks focused on contextual creativity enablers indicate that specific environment and task characteristics can facilitate the development and expression of creativity. This study explored the extent to which students perceived that educational game development projects mimicking real-world dynamics recreated contextual conditions appropriate to foster creativity, and whether they associated these conditions to their self-perceived creativity improvement. Questionnaires were administered to 38 students enrolled in two educational game development programs. Findings suggest that video game development creates a remarkable setting to promote and facilitate the expression and development of students' creativity, due to characteristics of the task and of the work environment generated by this activity.

Keywords: creativity enablers, contextual characteristics, task characteristics, video game development, undergraduate education

Introduction

As society evolves in an ever more technological and globalized world, the importance of creativity becomes a central issue. Creativity is a key driver of industrial development. From an economics perspective, creativity can be regarded as a process of generation of novel and useful ideas implemented through innovation processes in response to open-ended problems, tasks or opportunities (Amabile, Conti, Coon, Lazenby, & Herron, 1996; Amabile & Mueller, 2008; Mumford, 2000; Oldham & Cummings, 1996). Creativity is important to support industries in their on-going adaption to ever-changing environmental demands, since it allows identifying and responding to emerging demands and opportunities for development (Amabile, 1997; Oldham & Cummings, 1996; UNCTAD, 2010). Creativity is crucial to the competitiveness of both creative and "non-creative" industries: whilst the former need creativity as a prime matter to create innovative products and services of high quality at short notice (Pratt & Jeffcutt, 2009), the latter are normally important consumers of technology, and technological innovation can greatly affect their competitiveness (UNCTAD, 2010).

Creativity is therefore paramount for the labor market in the current economy, being highly sought-after by industries that need to fuel or be fuelled by innovation (Amabile, 1997; Ashton, 2011; Bridgstock, 2011). Furthermore, inventiveness and adaptability allow creative individuals to explore new opportunities of (self)employment, with consequent benefits in earning a living amidst the current economic downturn (Ashton, 2011; Bridgstock, 2011). Thus, creativity development should be a key focus in educational initiatives aiming at developing high-quality professionals (Bridgstock, 2011, Pratt & Jeffcutt, 2009; Shaheen, 2010).

The video game sector is a particularly relevant case to consider concerning the importance of creativity and its development through formal education. In spite of the current economic downturn, in 2010 the video game industry was worth around $56 billion, doubling the size of the recorded music industry and exceeding by nearly 25% the magazine business, and equating to about 60% the size of the film industry (Cross, 2011), with over 450 million next-generation gaming consoles sold worldwide to date (VGChartz, 2013).

One of the main factors that have influenced the enormous growth of this industry has been the great amount of creative ideas that underpin successful products (Walfisz, Zackariasson & Wilson, 2006). As game development requires high levels of creativity and large numbers of creative people (Tschang & Szczypula, 2006), the game industry is a giant that feeds on creativity. To address this need, contemporary formal education is actively engaged in the challenging process of enhancing existing curricula and/or creating entirely new, specialized ones to foster game development domain-specific skills and creativity (IGDA, 2008; McGill, 2009; Rajagopalan & Schwartz, 2005). This scenario motivated us to investigate creativity development in the context of game development education.

Fostering Creativity through Video Game Development

The scope of most creativity research has traditionally pivoted around four key facets of creativity: person, process, product, and place (Kozbelt, Beghetto & Runco, 2010; Runco, 2004). The 'person' perspective investigates personal characteristics influencing creative behaviors, such as personality traits and motivation (Csikszentmihalyi, 1988; Feist, 2010; Runco, 2004). The 'process' approach studies stages of processing or particular mechanisms key to the creative thought and activity (Lubart, 2001; Petty, 1997; Runco, 1995, 2004). The 'product' approach

focuses on the objective appreciation of the concrete outcomes of creative processes (Cropley & Cropley, 2010; Runco, 2004). The 'place' approach focuses on the setting in which individuals operate, studying contextual characteristics which may generally foster or inhibit creativity (Amabile, 1996; Amabile et al., 1996; Harrington, 2011; Kozbelt, et al., 2010; Runco, 2004).

Most of the studies and conceptual frameworks regarding the 'place' come from the field of organizational behavior (e.g. Amabile, 1996; Mumford, 2000; McLean, 2005; Shalley & Gilson, 2004), and it has been acknowledged that further research is needed to achieve a better understanding of contextual factors affecting creativity at individual and collective levels, within and outside organizations (Harrington, 2011; McLean, 2005; Shalley & Gilson, 2004). Research studying creativity in relation to education apparently corroborates this notion. The literature has frequently explored creativity development with a lesser emphasis on environmental conditions, usually considering it in relation to specific pedagogic practices and learning theories (Craft, 2001; Fasko, 2001; Ferrari, Cachia & Punie, 2009; Loveless, 2002). In the specific case of educational video game development, some research focused on 'person' and 'process', demonstrating that developing games can be leveraged as a motivational tool in conjunction with an appreciative learning pedagogic approach to enhance students' perceived individual creative characteristics (Eow, Wan Zah, Rosnaini & Roselan, 2010a) and processes (Eow, Wan Zah, Rosnaini & Roselan, 2010b).

The lack of 'place-oriented' research specifically focused on contextual creativity enablers in relation to game development activities represents an important gap. Research on contextual creativity enablers suggests that there are specific task and work environment characteristics that can foster creativity expression and development independent of personal

factors (e.g. Amabile et al., 1996; Hunter, Bedell & Mumford, 2007; Mumford, 2003, Oldham & Cummings, 1996; Stokols, Clitheroe & Zmuidzinas, 2002). In light of these elements, research investigating creativity within game development (e.g. Tschang, 2003, 2007; Tschang & Szczypula, 2006; Walfisz et al. 2006; Zackariasson, Styhre, & Wilson, 2006) seems to support the idea that intrinsic characteristics of game development activities and the related climate may originate contextual conditions conducive of creativity through educational projects mirroring real-world scenarios.

Amabile (1988, 1996) and Amabile et al. (1996) demonstrated that the production of creative (novel and useful) ideas by employees depends not only on their individual characteristics, but also on the perception of the environment where they work. In their studies, the concept of 'climate' is used to describe the social microenvironment influencing creativity of workgroups. They identify six climate factors that highly potentiate creativity:

1. Challenge involves matching people and assignment so that the stretch of the employee ability is not so little that they feel bored but not so much that they feel overwhelmed.

2. Freedom implies giving employees autonomy throughout processes, but only to the extent that there are clear and consistent goals.

3. Resources refers to allocating appropriate time and budget legitimately needed to fulfill the aims of a project.

4. Work-Group features refers to building teams composed of people with diversity of perspectives and backgrounds to promote the interplay and integration of different ideas.

5. Supervisory encouragement considers management recognition and acknowledgement of creative work before its impact is known.

6. Organizational support emphasizes the need for managers to support and acknowledge creative efforts, not just achievements.

Further research demonstrated the validity of these environmental factors in supporting creativity in the workplace (e.g. Shalley & Gilson, 2004). Other studies contributed to the contextual factors literature by identifying further environmental elements supporting creativity. For instance, Shalley and Perry-Smith (2001) found that exposure to a creative model enhanced individuals' creative performance on subsequent tasks. Ekvall (1996) identified playfulness as an important contextual characteristic promoting creativity in teams. Special attention has also been given to the relationship between task characteristics and creativity. Key task properties (e.g. whether the work is short or long-term, simple or complex, routine or novel) have implications on the individual and group motivation, and creative output at work. Research reviewed by Shalley and Gilson (2004) indicated that highly complex and challenging tasks make workers more persistent and more likely to explore alternative approaches, which should result in more creative outcomes. Mumford (2000) posited that creative work can occur when the tasks presented involve complex, ill-defined problems requiring the generation of novel, useful solutions. Oldham and Cummings (1996) suggested that complex tasks encourage creativity by requiring simultaneous focus on multiple dimensions of the work being tackled.

Game development presents several characteristics closely related to key contextual conditions enabling creativity. The high expectations and demands of modern players require game developers to work in interdisciplinary teams, creating and integrating large amounts of graphic and sound assets, storylines, interactive mechanics and complex programming code to "give life" to sophisticated gaming worlds (Cohen & Bustamante II, 2009; Tschang & Szczypula,

2006). Coordinated collaborative work and exchanges of ideas among differently-minded people are therefore crucial to engage in complex scenarios requiring simultaneous work on interdependent tasks (Walfisz et al., 2006; Cohen & Bustamante II, 2009; Keith, 2010; Tschang, 2003). Game development is a complex, often ill-structured process (Keith, 2010), requiring teams to solve open-ended, interlocked problems through juggling many alternative ideas, for each one of which there are many possible implementations (Tschang & Szczypula, 2006; Walfisz et al.2006). Committing to ideas and transforming them into concrete innovations are decision-making and problem-solving challenges that teams have to face constantly (Walfisz et al., 2006). A continuous and recursive cycle of idea creation, implementation and evaluation is the heart of the video game development process (Walfisz et al., 2006; Cohen & Bustamante II, 2009; Keith, 2010; Tschang & Sczcypula, 2006). Within this cycle, as new problems are discovered and new ideas and solutions are subsequently developed, further problems and new opportunities arise, thus potentially fostering creativity through the dynamic, iterative interaction of problem finding and problem solving stages (Petty, 1997; Runco, 1995). Walfisz et al. (2006) stress the importance of using a "loose-tight" management discipline to organize game development project in accordance to this cycle, to assure that tasks are done on time while at the same time allowing some freedom to facilitate the emergence of creative contributions.

Educational game development projects mimicking authentic scenarios would demand learners to collaborate in interdisciplinary teams in order to deal with complex problem-solving and decision-making challenges requiring the integration of diverse skills, individual and group creativity to define, implement and test emergent ideas through creative processes (Walfisz et al., 2006). At the same time, this would require tutors to support creative expressions through

managing the "inherently chaotic or idea-infused nature of game development" (Tschang & Sczcypula, 2006, p. 275), based on the cyclic nature of video game development.

An examination of the nature of game development in light of research on contextual creativity enablers led to identifying environmental and task characteristics which are acknowledged to promote the expression and development of creativity, and could be 'naturally' generated by video game processes (Figure 1).
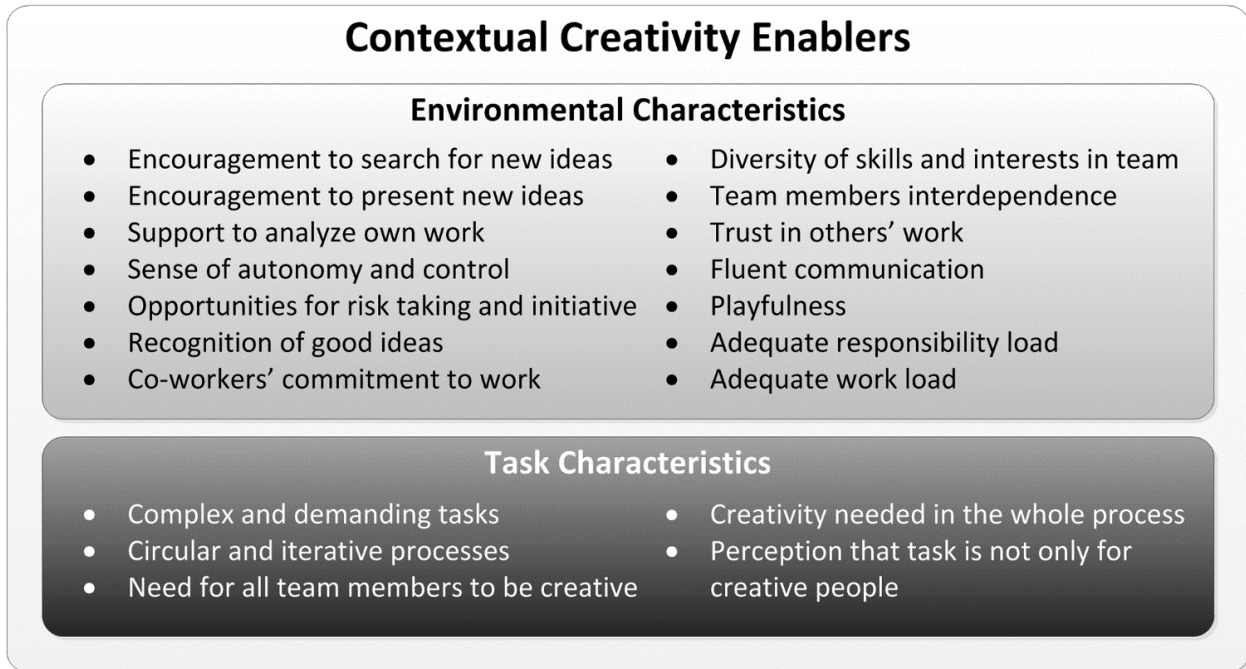
Contextual Creativity Enablers

Environmental Characteristics

- Encouragement to search for new ideas
- Encouragement to present new ideas
- Support to analyze own work
- Sense of autonomy and control
- Opportunities for risk taking and initiative
- Recognition of good ideas
- Co-workers' commitment to work

- Diversity of skills and interests in team
- Team members interdependence
- Trust in others' work
- Fluent communication
- Playfulness
- Adequate responsibility load
- Adequate work load

Task Characteristics

- Complex and demanding tasks
- Circular and iterative processes
- Need for all team members to be creative

- Creativity needed in the whole process
- Perception that task is not only for creative people

Figure 1. Contextual creativity enablers

If reproduced in an educational environment, these elements could foster creativity independent of learners' individual characteristics and specific pedagogic strategies. Consequently, this study explored whether learners perceive that educational game development projects mimicking real-world dynamics recreate these environmental and task characteristics,

and whether students associate them to their self-perceived creativity improvement. The study aimed at answering the following research questions:

- Do students perceive that educational video game development generate conditions identified by the literature as enablers of creativity expression and development?

- Are these conditions related to students' perceptions of development of their own creativity?

Method

Participants

A total of 38 white Italian male students participated in this study, with ages ranging between 19 and 32 (M = 21.7, SD = 3.7). Participants were students of two Italian vocational study programs in multimedia software design and development. Students had no previous experience in video game development. Although open to male and female participants, only male students were enrolled in these programs.

Description of the Educational Programs

The study programs adopted an authentic learning approach, thus providing to students a learning context reflecting the way knowledge and skills are used in a real work environment. The programs lasted seven to ten months, with an average of four weekly sessions of five hours. In the first three months students attended courses in game design, programming, graphic arts, sound design and multimedia design, and were involved in practical workshops to consolidate and enrich their learning through experiential activities. In the remaining months students were involved in a game production internship, in which they had to design and implement a video game through a team project. The internships lasted four to six months. Five teams were formed

with six to eight students per team. Each team was articulated in interdependent sub-teams of game designers, graphic artists, sound designers and game programmers, with students often covering more than a single role. A multidisciplinary team of seven tutors supported the students throughout the game development process, which was articulated through stages mimicking a real-world game project lifecycle (Cohen & Bustamante II, 2009) (Figure 2).
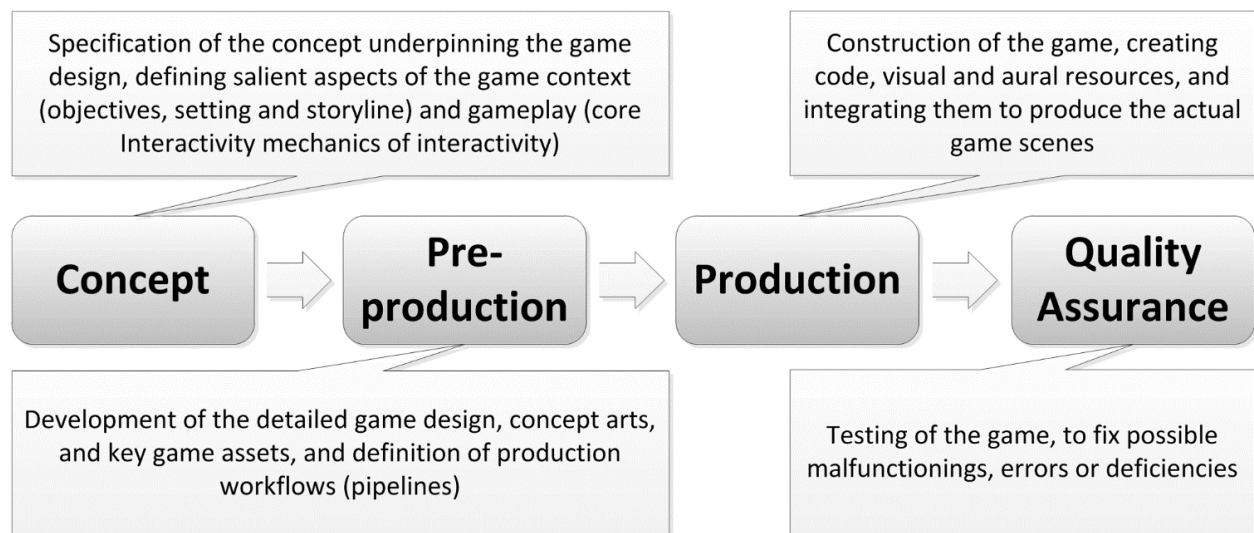

Figure 2. Game development lifecycle

Mirroring real-world dynamics, after the completion of the pre-production each project progressed through iterations between production and quality assurance activities. Games were typically subdivided in stages (scenes), and for each scene sub-teams were driven by cycles of idea creation, implementation and evaluation, starting with an initial game design specification, and ending with a playable game scene (Walfisz et al., 2006; Cohen & Bustamante II, 2009; Tschang & Sczcypula, 2006) (Figure 3).
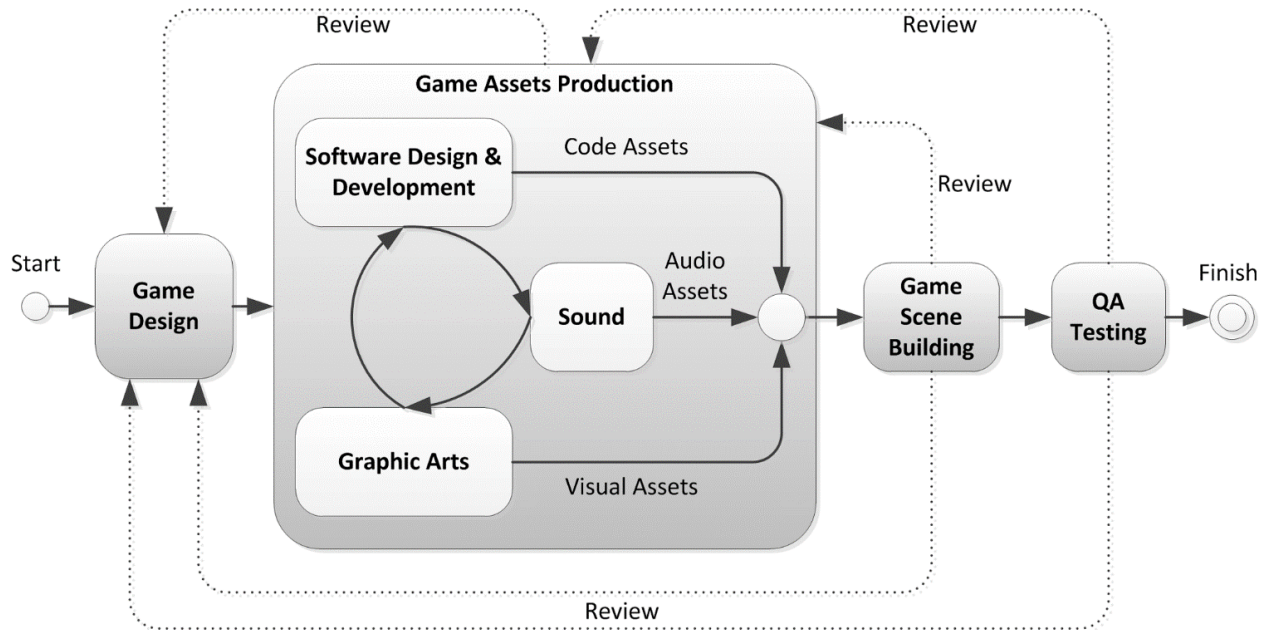
Figure 3. Game scene production pipeline

Instrument

A 33 item questionnaire was created (in Italian) to collect students' perceptions regarding environmental and task characteristics of the learning experience. Item contents were defined based on the literature previously discussed (see Figure 1), and were organized in three areas:

1. Characteristics of the task (e.g. "There was a constant reformulation of ideas based on the results emerged in the development process".)

2. Environmental factors (e.g. "Students contributed to the game design and development process with different abilities and interests")

3. Perception of creativity improvement (e.g. "I think I developed my creativity thanks to participating in the game development internship".)

Students were asked to rate the items on a 5-point Likert scale (1 = Strongly disagree, 5 = Strongly agree). Cronbach's alpha of the questionnaire was 0.77.

An electronic copy of the questionnaire was sent by e-mail to all the students during the last week of their study programs. Participation to the study was anonymous, voluntary and no incentives were offered to recruit participants. The researchers made sure that respondents understood that there were no right or wrong answers and that the purpose of this exercise was to capture their perceptions of the educational process they participated in. Questionnaires were returned by 85% of students.

Results

A descriptive analysis of the items regarding environmental factors fostering creativity was carried out to determine to what extent student perceived their presence during the game development internships. Table 1 shows the percentage of students agreeing or strongly agreeing with item statements regarding environmental characteristics. Eight characteristics described by the literature were perceived by more than 75% of participants as being a part of their working/learning environment during the game development process. Only two environmental characteristics, adequate workload and responsibility load, were scarcely perceived by students.

As to the perception of task characteristics (Table 2), the cyclical and recursive nature of the video game development process, as well as its complex and demanding nature, were particularly evident to students.

Most students (84.2%) believed that they had developed their creativity thanks to the game development experience. Students also considered that the creative skills developed will be important for both their professional and personal activities in the future (78.9% and 81.6% respectively).

Spearman's correlation test was used to analyze if student perception of environmental and task factors was related to the perception about their own creativity development. Results show a positive correlation between the student perception of the characteristics of a creative environment (as a scale) during their game development experience and the evaluation of the impact of game development activity on their creativity ($\rho = 0.76$, $p = 0.000$). There was no significant correlation with the tasks characteristics taken as a scale.

Discussion

Although the sample size of this study was small and the conclusions cannot be generalized, the results provide some valuable insights into the potential that video game development has to create environmental conditions fostering student creativity. Our findings suggest that developing video games in an educational context recreates a work climate that supports creativity. A large number of students identified in their game development learning activities most of the aspects which, according to the literature, characterize environments and tasks that enhance creativity. It appears that the main characteristics perceived by students were the encouragement to critically analyze their own work, and to search, generate and present new ideas, all of which have been identified as creativity enablers by past research (Amabile et al., 1996; Shalley & Gilson, 2004). Furthermore, the learning environment fostered the acknowledgement of new ideas that were good, which parallels research focusing on the importance of recognition and credit to promote creative motions (Shalley & Gilson, 2004).

Interestingly, while students agreed that encouragement to create and present new ideas was part of the game development context, there was less agreement in saying that those ideas were really welcomed by their teammates. Proposition and acceptance of new ideas are certainly

two different things. Some environments may well foster the proposition of new ideas. However, when it comes to accepting ideas, other factors can change the situation. Above all, personal tastes and ego issues may well lead to the rejection of others' ideas even though the act of proposing ideas was, by itself, very welcome.

Other context features identified by students were the team's commitment to work, the diversity of skills and interests of team members and trust in others' work. This is consistent with previous studies (e.g. Amabile et al., 1996; Shalley & Gilson, 2004; Tschang, 2003) showing that creativity is fostered by diversity in team members' backgrounds, challenging of ideas, and shared commitment to the work being carried out. Diversity and challenging of ideas increase the probability of producing a greater variety of unusual ideas. At the same time, shared commitment to a project is likely to influence motivation through a sense of challenge perceived as constructive.

Of all the environmental creativity enablers mentioned by students, adequateness of workload and responsibility were scarcely perceived. Student responses revealed that there was an overload of work and responsibility. Both educational programs involved in this study were highly demanding as to productivity, efficiency and quality of student work. Students had to follow explicit rules and schedules to organize production processes and meet set deadlines, all of which was explained at the beginning of the programs, and reviewed throughout the development process. Timing, budget and outputs commitment make game development a highly demanding process (Walfiscz, Zachariasson & Wilson, 2006), and this was also present in our educational projects. Excessive workload and responsibility are said to undermine creativity (Basadur, 2004; Oldham & Cummings, 1996; Shalley & Gilson, 2004). Thus, educators who

plan to leverage authentic video game development in their educational programs should consider its complex and demanding nature, consequently tuning expectations regarding process and outcomes to avoid overloading students and hindering their creative processes.

A high correlation was found between students' perception of contextual characteristics and their evaluation of their own creativity development, which is consistent with previous research indicating that creativity also depends on how people perceive their work environment (Shalley & Gilson, 2006). This finding is especially important in educational contexts in which students may not initially perceive themselves as creative individuals, and thus believe that they are less prepared for the creativity-driven industries. By providing the conditions that promote creative processes, educational initiatives based on authentic video game development may increase student employability not only by enhancing their creativity but also by fostering their self-confidence as creative persons.

In relation to the task characteristics, it was expected that the way the game development process is structured would foster creativity. When jobs are complex and challenging, individuals are more likely to focus all their attention and efforts on their work. This makes people more persistent and more likely to consider different alternatives, which should lead to the production of creative results (Mumford, 2000; Oldham & Cummings, 1996; Shalley & Gilson, 2004). Furthermore, game development is a cyclical and iterative process (Tschang & Sczcypula, 2006; Walfisz et al., 2006) mirroring recursive and non-linear dynamics associated with the creative process (Runco, 1995). In our research, these characteristics were perceived by most of the involved students. More specifically, almost all the students perceived the video game development process as an iterative and complex task that required all the team members to be

creative throughout the whole production cycle. This is consistent with the literature on creativity and video game development indicating that the circular nature of game development is intrinsically conducive to creative ideas production (Tschang, 2003; Walfisz et al., 2006), suggesting that participation in game development processes would naturally engage individuals in a context fostering creativity.

Enhancing student creativity in post-secondary educational settings is of paramount importance, since creative skills are valuable to all industries which need employees capable of thinking creatively, to leverage innovation, foster competitiveness and adapt to the rapid changes of today's world (Basadur, 2004). Although due to the sample size firm conclusions cannot be drawn, this research highlighted the potential that game development activities have to generate contextual conditions promoting creativity expression and development. Further practice and research is needed to better unravel the complex relationships among task characteristics, environmental factors, creativity and other creativity-related competences (e.g. problem-solving and teamwork) in game development. As this unraveling occurs, educational programs may be better suited to leverage game development to generate learning environments fostering student creativity.

References

Amabile, T. M. (1988). A Model of Creativity and Innovation in Organizations. In B. Staw & L. Cummings (Eds.), Research in Organizational Behavior (Vol. 10, pp. 123-167). Greenwich, CT: J.A.I. Press.

Amabile, T. M. (1996). Creativity In Context. Boulder, CO: Westview Press.

Amabile, T. M. (1997). Motivating Creativity in Organizations: On Doing What you Love and Loving What you Do. California Management Review, 40(1), 39-58.

Amabile, T. M., & Mueller, J. S. (2008). Studying creativity, its processes, and its antecedents: An exploration of the componential theory of creativity. In J. Zhou & C. E. Shalley (Eds.), Handbook of Organizational Creativity (pp. 33-64). New York, NY: Lawrence Erlbaum.

Amabile, T. M., Conti, R., Coon, H., Lazenby, J., & Herron, M. (1996). Assessing the Work Environment for Creativity. Academy of Management Journal, 39(5), 1154-1184.

Ashton, D. (2011). Media work and the creative industries: Identity work, professionalism and employability. Education & Training, 53(6), 546-560.

Bridgstock, R. (2011). Skills for creative industries graduate success. Education & Training, 53(1), 9-26.

Cohen, D. S., & Bustamante II, S. A. (2009). Producing Games: From Business and Budgets to Creativity and Design. San Diego, CA: Focal Press.

Craft, A. (2001). An analysis of research and literature on creativity in education. Report prepared for the Qualifications and Curriculum Authority. London: QCA.

Cross, T. (2011). All the world's a game. The Economist, 401(8763), 1-11.

Cropley, D. H., & Cropley, A. J. (2010). Functional Creativity: Products and the generation of effective novelty. In J. C. Kaufman & R. J. Sternberg (Eds.), The Cambridge handbook of creativity (pp. 301–317). New York, NY: Cambridge University Press.

Csikszentmihalyi, M. (1988). Motivation and creativity: Toward a synthesis of structural and energistic approaches to cognition. New Ideas in Psychology, 6(2), 159–176.

Ekvall, G. (1996). Organizational climate for creativity and innovation. European Journal of Work and Organizational Psychology, 5(1), 105–123.

Eow, Y. L., Wan Zah, B. W. A., Rosnaini, B. M., & Roselan, B. B. (2010a). Computer games development and appreciative learning approach in enhancing students' creative perception. Computers & Education, 54(1), 141–161.

Eow, Y. L., Wan Zah, B. W. A., Rosnaini, B. M., & Roselan, B. B. (2010b). Computer games development experience and appreciative learning approach for creative process enhancement. Computers & Education, 55(3), 1131–1144.

Fasko, D. Jr. (2001). Education and Creativity. Creativity Research Journal, 13(3-4), 317–327.

Feist, G. J. (2010). The Function of Personality in Creativity. In J. C. Kaufman & R. J. Sternberg (Eds.), The Cambridge handbook of creativity (pp. 113–130). New York, NY: Cambridge University Press.

Ferrari, A., Cachia, R., & Punie, Y. (2009). Innovation and Creativity in Education and Training in the EU Member States: Fostering Creative Learning and Supporting Innovative Teaching: Literature review on Innovation and Creativity in E&T in the EU Member States (ICEAC). JRC Technical Note, 52374.

Harrington, D. M. (2011). Creative Environments, Conditions, and Settings. In M. A. Runco & S. R. Pritzker (Eds.), Encyclopedia of Creativity, vol. 1 (2nd ed., pp. 264–272). Burlington, MA: Elsevier.

Hunter, S. T., Bedell, K. E., & Mumford, M. D. (2007). Climate for Creativity: A Quantitative Review. Creativity Research Journal, 19(1), 69–90.

IGDA. (2008). Curriculum Framework - The Studies of Games and Game Development - version 3.2 beta. IGDA. Retrieved from http://www.igda.org/wiki/images/e/ee/Igda2008cf.pdf

Keith, C. (2010). Agile game development with Scrum. Upper Saddle River, N.J.: Addison-Wesley.

Kozbelt, A., Beghetto, R. A., & Runco, M. A. (2010). Theories of creativity. In J. C. Kaufman & R. J. Sternberg (Eds.), The Cambridge handbook of creativity (pp. 22–47). New York, NY: Cambridge University Press.

Loveless, A. M. (2002). Literature Review in Creativity, New Technologies and Learning. Bristol, UK: NESTA Futurelab.

Lubart, T. I. (2001). Models of the Creative Process: Past, Present and Future. Creativity Research Journal, 13(3-4), 295–308.

McGill, M. M. (2009). Defining the expectation gap: A Comparison of Industry Needs and Existing Game Development Curriculum. Proceedings of the 4th International Conference on Foundations of Digital Games - FDG '09 (pp. 129–136). New York, NY: ACM Press.

McLean, L. D. (2005). Organizational culture's influence on creativity and innovation: A review of the literature and implications for human resource development. Advances in Developing Human Resources, 7(2), 226–246.

Mumford, M. D. (2000). Managing Creative People: Strategies and Tactics for Innovation. Human Resource Management Review, 10(3), 313-351.

Mumford, M. (2003). Where Have We Been, Where Are We Going? Taking Stock in Creativity Research. Creativity Research Journal, 15(2), 107–120.

Oldham, G. R., & Cummings, A. (1996). Employee Creativity: Personal and Contextual Factors at Work. (P. J. Edwards, R. M. May, & N. R. Webb, Eds.) Academy of Management Journal, 39(3), 607-634.

Petty, G. (1997). How to be better at creativity. London: Kogan Page Limited.

Pratt, A. C., & Jeffcutt, P. (2009). Creativity, Innovation and the Cultural Economy: Snake oil for the twenty-first Century? In A. C. Pratt & P. Jeffcutt (Eds.), Creativity, Innovation and the Cultural Economy (pp. 1-20). London: Routledge.

Rajagopalan, M., & Schwartz, D. I. (2005). Game Design and Game-Development Education. Phi Kappa Phi Forum. Summer2005, 85(2), 29–32.

Runco, M. A. (1995). Cognition and creativity. Educational Psychology Review, 7(3), 243–267.

Runco, M. A. (2004). Creativity. Annual review of psychology, 55(1), 657–687.

Shaheen, R. (2010). Creativity and Education. Creative Education, 1(3), 166–169.

Shalley, C. E., & Gilson, L. L. (2004). What leaders need to know: A review of social and contextual factors that can foster or hinder creativity. The Leadership Quarterly, 15(1), 33-53.

Shalley, C. E., & Perry-Smith, J.E. (2001). Effects of social-psychological factors on creative performance: the role of informational and controlling expected evaluation and modeling experience. Organizational Behavior and Human Decision Processes, 84(1), 1-22.

Stokols, D., Clitheroe, C., & Zmuidzinas, M. (2002). Qualities of Work Environments That Promote Perceived Support for Creativity. Creativity Research Journal, 14(2), 137–147.

Tschang, F. T. (2003). When Does An Idea Become an Innovation? The Role of Individual and Group Creativity in Video game Design. Proceedings of the DRUID Summer Conference. Copenhagen: Copenhagen Business School. Retrieved from http://www.druid.dk/uploads/tx_picturedb/ds2003-871.pdf

Tschang, F. T. (2007). Balancing the Tensions Between Rationalization and Creativity in the Video Games Industry. Organization Science, 18(6), 989–1005.

Tschang, F. T., & Szczypula, J. (2006). Idea Creation, Constructivism and Evolution as Key Characteristics in the Videogame Artifact Design Process. European Management Journal, 24(4), 270-287.

UNCTAD. (2010). Creative Economy Report 2010. United Nations. Geneva: United Nations. Retrieved from http://archive.unctad.org/templates/WebFlyer.asp?intItemID=5765&lang=1

VGChartz. (2013). Platform totals. Total worldwide sales (in millions of units) per platform. VGChartz. Retrieved from http://www.vgchartz.com/hardware_totals.php

Walfisz, M., Zackariasson, P., & Wilson, T. (2006). Real-time strategy: Evolutionary game development. Business Horizons, 49(6), 487-498.

Zackariasson, P., Styhre, A., & Wilson, T. L. (2006). Phronesis and Creativity: Knowledge Work in Video Game Development. Creativity and Innovation Management, 15(4), 419–429.

Table 1: Percentage of students perceiving environmental factors conducive of creativity

Environmental characteristics	% students
Encouragement to analyze own work	97.4
Participants' commitment to work	92.1
Encouragement to present ideas	86.8
Encouragement to search for new ideas	86.8
Participants with different skills and interests	81.6
Opportunities for initiative	81.6
Trust in others' work	78.9
Acknowledgement of good ideas	78.9
Team interdependence	68.4
Fluent communication tutors-students	65.8
Encouragement for autonomy	65.8
Absence of favoritism	63.2
Tutors as creative models	60.5
Motivating/ stimulating work climate	57.9
Possibility of assuming risks	57.9
New ideas welcomed by participants	55.3
Playful work climate	52.6
Adequate responsibility load	15.8
Adequate work load	7.9

Table 2: Percentage of students perceiving task characteristics associated with creativity

Task characteristics	% students
Video game development as circular and iterative process	94.7
Video game development as complex and demanding	92.1
Importance of creativity for all team members	68.4
Need for creativity during the whole process	68.4
Video game development not only for the creative people	57.9