An International Study on Learning and Process Choices in the Global Game Jam

Ali Arya	**Jeff Chastine**	**Allan Fowler**	**Jon Preston**
Carlton University, Canada	*Southern Polytechnic State University, USA*	*Waiariki Institute of Technology, New Zealand*	*Southern Polytechnic State University, USA*

Abstract

This paper reports the results of an online survey done by Global Game Jam (GGJ) participants in January 2012. This is an expansion of an earlier survey of a local game jam event and seeks to validate and extend previous studies. The objectives of this survey were collecting demographic information about the GGJ participants, understanding their motivations, studying the effectiveness of GGJ as a learning and community-building experience, and understanding the process used by GGJ participants to make a computer game in extremely limited time. The survey was done in two phases: pre-jam and post-jam. Collectively, the information in this survey can be used to (1) plan different learning experiences, (2) revise the development process for professional and academic projects, and (3) provide additional elements to game jams or change their structures based on the participants' comments to make them more fruitful.

Keywords: Global Game Jam, Collaboration, Community, Design, Game Development, Learning, Game Development Process

Introduction

The Global Game Jam (GGJ) is the world's largest game development event (a.k.a. "game jam"). GGJs are organized by a central organizing committee and local organizers in more than 40 countries and 200 sites (Global Game Jam Sets Guinness World Record™ for being the Largest Game Jam in the World, 2012). Taking place at various sites (mainly educational institutions) throughout the world, this event is a 48-hour period (the last weekend of January) that brings together thousands of game enthusiasts (students, industry employees, and others interested in game development) with different skills to make games with a common theme and some optional diversifiers (GGJ Wiki, 2009). As spectators, participants and organizers we have long been interested in the learning opportunity that the GGJ represents, a corollary of a pedagogic awareness of the considerable benefit of applied and practical learning experiences. Piaget (1970) in particular advocated the importance of learning through experience. Through applied learning experiences there are opportunities for learners to develop through the practice of their skills and understandings, either learn in both tangible and intangible environments. While the focus of Piaget's (1970) work was primarily focused on the four different stages of cognitive development of young learners, a later proponent, Csikszentmihalyi, (1990) has concentrated on "stage independent" aspects of Piaget's theory, which appear to be relevant to all learners.

Csikszentmihalyi (1990) developed the flow theory of optimal experience, which derives its name from the experience that people feel when they act with total involvement. This has close links to the learning process by suggesting an optimal, enjoyable, and immersive learning environment as Chan & Ahern (1999, p. 152) say: "At its most basic, flow is simply a description of people enjoying themselves. They are in a state of enjoyment because they have situated themselves in an optimal environment. This should strike a resonate chord for any instructional designer. The goal of any instruction is to help students acquire the requisite knowledge or skill under optimal conditions."

Through being involved in the GGJ as a highly engaging process, participants may learn applied and potentially transferable skills that may be similar, comparable or possibly better than the skills learnt in a formal education environment. This is particularly noteworthy considering the unique circumstance at which GGJ runs, i.e. extreme timing constraints that require an exceptionally efficient development process. This means that participants not only can learn and practice game development skills but also they need to discover and potentially invent development processes suitable for their extreme timing constraints (an outcome of their participation that can even be helpful and educational for observers in order to find more efficient methods for time-constrained development projects).

While GGJ has been around since 2009 (History and Contributors, 2012), there has not been much research on different aspects of this global event. Some recent examples include Musil et al., (2010) and Shin et al., (2012). It is our belief that the GGJ represents a significant learning opportunity and studying this event and the participants not only provides insight on the educational aspects but also can reveal valuable information on participants as the next generation of game developers, and their skills and interests. The study presented in this paper is based on a survey of the GGJ 2012 participants. The survey included a broad range of questions - from general demographic to learning and development aspects. For the learning process, we considered general skills and practices involved in game development, such as programming and artistic content development, and also the skills, methods and approaches unique to the GGJ. On the other hand, the participants go through the design and development process within a strictly-limited time and theme constraints that are not common to typical educational tasks in formal institutions where most GGJ participants are trained. The time constraints mean that participants not only need to learn and use specific skills, but also they have to learn how to apply their skills in a timely manner - a particular “learning” task which may not happen in typical educational experiences but can have a clear effect on their performance once in industry. The specific research questions are:

- Research Question 1: What learning occurs as a result of the Global Game Jam? This includes learning specific skills and also understanding the process and can be broken down into the following sub-questions:
    - 1-1: What skills (if any at all) are or can be learned during the GGJ?
    - 1-2: How much learning takes place during the GGJ?
- Research Question 2: How do the time and theme constraints affect the design and development process? This includes the way teams are formed, the process models, management tools, etc. The following sub-questions are considered in this group:
    - 2-1: What are the process-related decisions made by the GGJ participants?

- 2-2: How do these decisions affect the participants' satisfaction with the results?

Considering what was possible for the research team, this study is currently limited to a survey and so to the perception of participants of the above issues. An objective study would be extremely beneficial and complementary but out of the scope of the current paper. As described later, our study shows that the GGJ has been perceived as a successful learning experience and similar activities can potentially be used effectively for game education. The study also shows a clear relationship between process choices and metrics such as satisfaction with the outcome. Potential outcomes of our research on GGJ participants include but are not limited to:

- Evaluating the appropriateness of the GGJ as a component in formal education contexts
- Improving the development process of extremely time-constrained projects
- Providing better educational/vocational experiences based on understanding of the young game developers
- Enhancing the GGJ experience based on participants' feedback

The following three sections are dedicated to a review of related work, description of our research methodology, and discussion of survey results. Some concluding remarks are provided at the end.

Related Work

There is a rich history of game jamming; Chris Hecker and a group of 13 other game developers/designers captured the philosophy of open, independent game innovation when establishing one of the first game jams a decade ago in Independent (Indie) Jam 2002; he states, "Participants can work on their own game, team up with others, do multiple games, do a new game every hour […], or any combination of thereof" (Hecker, 2001). The modern Global Game Jam (GGJ) was inspired by and modeled itself after the Nordic Game Jam and has roots going back to the Indie Jam in 2002 (Shin et al., 2012).

While game jamming as an activity has been around for quite some time and is certainly growing in worldwide acceptance, the idea of using game jam weekends to systematically improve community and learning and explore the research questions asked as part of this paper are fairly new. This work leverages cognitive motivation theory and related concepts of positive psychology. In this section, we explore the background research of cognitive and positive psychology, how creativity can be inspired by intentional constraint, and why the game community is an ideal group to utilize in exploring creativity within the confines of a game jam weekend.

Musil et al. (2010) suggest that game jams provide an effective and focused experience and that participants gain valuable skills in prototyping and collaboration. There has been considerable academic interest in the benefits of applied and practical learning experiences. Piaget (1970) in particular advocated the importance of learning through experience while Csikszentmihalyi (1990) discussed the optimal experience and total involvement in the context of the flow theory. Through applied learning experiences, there are opportunities for learners to develop through practicing their skills and understandings. Students could either learn in both tangible and intangible environments. Preston et al., (2012) advocate the use of game jams to nurture innovation, computational and rule-based thinking. The question is then posed: what

characteristics exist in game jams that encourage learning and participant growth? We answer this next.

The game jams are communitarian events that support creativity and learning and establish spaces that support the indie game development ecosystem (Guevara-Villalobos, 2011). Game jams encourage prototyping of ideas and support the creative experimentation in a rapid, cyclic process. There is an immediacy effect in the culture of sharing ideas, play testing, and collaboration in an immediate setting. This rapid prototype model has been adopted elsewhere with success in allowing the best ideas to effervesce to the top by embracing the possibility of failure to encourage risk taking and by inducing creativity through constraint (Shodhan et al., 2005).

Game jams embody the process of learning by using (Rosenberg, 1982); this process of using a hands-on, learning-by-doing approach is a way for participants to explore new technology and refine their current knowledge of tools. Since jam events are intentionally rapid and short-lived, there is little "cost" associated with doing something wrong. This environment can be liberating through allowing participants to dedicate a weekend dedicated to developing something new. This potentially leads to more risk taking, exploration, and innovation in a "safe" environment.

Sherry et al., (2003) identify six gratifications that motivate players: competition, challenge, social interaction, diversion, arousal, and fantasy. All of these are also evident at game jam events. The competition element raises a fascinating point of contention among organizers of game jam events. Some organizers have argued that the jams should be free explorations of creativity without competition among teams, whereas other organizers have actively introduced competitive elements into the Global Game Jam at their sites (GGJ Site, 2011). For our part, we have discovered that "best of" prizes at the closing ceremony do inspire participants, but we also provide random "door prizes" that all are eligible for to ensure those who do not compete will not feel excluded.

While one could argue that the element of competition could diminish the element of exploration, we must remember that the negativism philosophy of "there is no wrong way to do a jam" trumps all and ensures that each participant can choose to do what they would like during the game jam weekend. Interestingly enough, the first game jams (Indie Game Jams in 2002 and 2003) focused on a common constraint (technology) to help induce the challenge element (Adams, 2002). This element of constraint is carried forward in the more recent Global Game Jam events, though it is certainly possible that participants "go their own way" and deviate from the organized elements of the jam.

Beyond the structure of the event supporting creativity and growth, the characteristics of the participants themselves encourage these activities. Because "the creative involvement of the player is a fundamental feature of any game" (Sotamaa, 2005, p. 106), game players have a high propensity for creativity and a strong desire to influence the media that they consume. This leads to areas such as use-generated content, mods, and indie and novice game developers. The integrated nature of the aesthetic and social aspects is a fundamental underpinning of game play (Aarseth, 2001); as a result, players are by definition participatory in shaping their experiences within the game world and are often interested in expanding these game worlds and building game systems of their own. Game players are motivated by creativity as evidenced in the longstanding (such as "Adventure Construction Set" and others from computer gaming antiquity)

and newly-expanded "user creation toolkits" (such as "Little Big Planet" and mod kits in the modern game industry) (Van den Bosch, 2011).

Having answered the question of the nature and structure of game jams; next we focus on the specific educational benefits of game jams. While "players are typically motivated by the quality of experience that playing affords, not by the expectation of some future utility" (Rodriguez, 2006), this does not preclude the benefit of play experiences to future utility. In fact, the large body of work in the field of serious games indicates a broader utility of game experiences (Sawyer, 2008). Game jam experiences are not only fun and pleasurable for the participants, the experience advances the skills and professional network of the participants. Each participant has skills that contribute to the whole team, and it is necessary to allow participants to see this in action (Gestwicki et al., 2008). Shin et al. (2012) review the potentials of the GGJ as a collaborative learning process and suggest some design ideas within the context of a local Jam site. Although valuable, their study is limited to a particular site and does not include a global survey. We note that there has been limited number of studies addressing the learning benefits of game jam events, thus our contribution in this paper is unique in expanding our previous, limited work to a global scale. On the other hand, while many literature have studies software and game development process, the effect of team formation and process-related choices on the overall success of game development projects, especially those with strict time constraints, have not been studied. Our research tries to address this by identifying process decision and linking them to satisfaction levels as a measure of success.

Further, it is possible to utilize games and game jam events to foster creative thinking and innovation and expand computational thinking among participants. Not only do participants brainstorm many game designs during the initial hours of a game jam, there has been research done that shows creativity can be enhanced through idea generation games such as GameSpace (Kultima et al., 2008). In fact, this technique of idea generation has been used specifically at the Finish GGJ venues in 2010 and 2011 (Kultima, 2011), and we used a similar approach for ideation at our GGJ events in 2011 and 2012 to spur teams' creative process. Beyond expanding idea generation, digital and non-digital games can enhance computational thinking in a rule-based context (Berland, 2011) such as in the game design context of game jam weekends.

Finally, our previous work (Preston et al., 2012) demonstrated that there was a positive correlation between game jam participation and formal academic performance in courses within the first two years of students' studies. Students who do not attend game jams have a lower GPA than the average GPA of their peers (Preston et al., 2012).

Methodology

The authors have years of professional and academic experience with game development process in general. They have also been organizing the GGJ event from the beginning and as a result have been observing the participants and developed some initial ideas of what happens during the Jam, how participants work, and what are the potential benefits. This, together with some exploratory interviews in 2011, allowed the authors to establish a methodology that could match the complex nature of this study, including what to ask and in what format.

Our research is based on a mix of quantitative and qualitative data collected through two online surveys of the GGJ participants: pre-Jam and post-Jam. Participants are required to register at the GGJ website prior to the Jam. They may also be required to do a registration at

their local Jam site. The GGJ organizers approved this survey and forwarded the information to all participants. Each online survey was open for a week before and after the Jam. The participants were asked to (optionally) enter their email address so the research team could link the pre-Jam and post-Jam answers. This was needed for some questions, for example, the perceived skill levels before and after the Jam.

The pre-Jam survey included 20 questions while the post-Jam had 19 (some with multiple parts). Not all of the questions have been used in the current study. Table 1 shows the questions most relevant to our initial research questions. The full list of survey questions can be found in Appendix A. They can be grouped into three categories:

1. General information such as age, gender, education, country, social network usage, etc
2. Numeric (including multiple-choice) data related to issues of interest such as skill levels, perceived project success, satisfaction rating, etc
3. Open-ended opinions and descriptions such as the development process, team formation methods, etc

Table 1. Survey questions directly related to the research questions

Survey Question	**Type**	**Related Research Question**
Pre-Event Survey		
Skill level in different positions (2D Artist, 3D Artist, Programmer, Project Manager, Audio Specialist (Sound), Audio Specialist (Music), Game Designer, UI Designer, Play Tester, Other)	Numeric rating	1-1 and 1-2
Reason for coming to the GGJ	Text	1-1
Did you think about possible game ideas/features before coming to the 2012 Global Game Jam site?	Yes/No	2-1
Did you consider possible team members before coming to GGJ?	Yes/No	2-1
Post-Event Survey		
Skill level in different positions (2D Artist, 3D Artist, Programmer, Project Manager, Audio Specialist (Sound), Audio Specialist (Music), Game Designer, UI Designer, Play Tester, Other)	Numeric rating	1-1 and 1-2
Rate the following: • How successful was the initial brainstorming in choosing teammates and game ideas? • What was the level of collaboration among team members? • How democratic/egalitarian was the design and development process in your group? • How satisfied are you with your final outcome? • How satisfied are you with your overall experience? • How would you rate the Global Game Jam as a place	Numeric	2-1 and 2-2

to learn? • How would you rate the place you studied game design or development as a place to learn?		
How did you end up with your team? What attracted you to it?	Text	2-1
Describe your team process for concept, design, and development. What were the main challenges and how did you overcome them?	Text	2-1
Attending the GGJ again? Why?	Text	1-1

The general information was collected as background data with no immediate intention of analysis. Future studies on this data are possible for establishing correlations or dependencies.

Our methodology consisted of three main steps:

- Collection and analysis of quantitative data related to skill, learning and satisfaction levels.
- Collection and analysis of qualitative data related to motivations, team formation and process choices
- Associating quantitative and qualitative data, and potentially establishing hypotheses related to success of process choices

Research questions 1-1 and 1-2 (type and amount of learning during the GGJ) were structured into the step 1, quantitative survey questions. This was due to the fact that we categorized learning into typical game development roles and skill levels, to be numerically rated before and after the Jam. To verify these ratings, and to discover other potential benefits of the GGJ (other than potential learning), we included an open-ended question for motivation where we could count various motivating items (potential benefits) mentioned by the participants and see how learning compares to others such as fun or social networking.

We analyzed the quantitative data (numeric answers) using typical statistical methods. The answers are generally ratings based on a 5-point Likert scale. We calculate mean and variance of different variables and their correlation in order to answer our research questions related to learning.

For research question 2-1 (team formation and process choices) we did not use any pre-assumptions on what possible choices could be. We analyzed the qualitative data (open-ended answers) using emergent coding (Corbin & Strauss, 2008) supported by the qualitative data analysis software Dedoose. This approach involves extracting codes (significant concepts mentioned in the text) from the qualitative data through an iterative process of finding key information and patterns, refining the codes, and forming categories of related codes. For example, coding the process-related question could result in defining categories such as development cycle and idea development which in turn include codes such as iterative development and brainstorming. We would then create tables displaying the data and codes (Miles & Huberman, 1994) in order to identify relationships and patterns that will provide insights into the team formation and development process. The codes and categories developed in this step provide an initial answer to the research question 2-1.

To measure the success of process choices for the research question 2-2, we used the levels of satisfaction with the final results and the overall experience, which could also be measured numerically. We then established relations between the identified codes (or concepts/categories mentioned in the responses, such as brainstorming) and the numeric success measures (satisfaction levels) in order to develop hypotheses about the success of process choices that can suggest best practices for time-constrained game development projects.

Since our methodology is based on responses to a survey and not objective evaluations, the results can only be used as a measure of perceived levels and relations. This cannot necessarily provide a definitive answer to the research questions, but can be used as an indication of what participants themselves think, which in turn can be the basis for hypothesizing and further evaluation.

Results

The GGJ 2012 was held on January 27-29 in 242 sites globally. The research team asked all game jam site organizers to invite their respective participants to answer the survey. In accordance to the ethics approval process, all respondents were informed at the beginning of the survey that:

1) There are no known risks associated with this activity.
2) The participants had the right to withdraw at any time during the data collection and for any reason.
3) The information collected would be stored securely and used for research purposes. The identity of participants would not be revealed in publication of research results.
4) This research had been reviewed and cleared by the Research Ethics Board (REB) at Waiariki Institute of Technology.

The numbers of participants who took part in the pre-Jam and post-Jam surveys were 551 and 532, respectively. 303 pair of responses could be linked in two surveys (i.e. they provided the same email address). Table 2 shows the general information collected through the pre-Jam survey.

Table 2. General Information (total 551 participants)

Gender		**Age**		**Country**		**Education**		**University Level**	
Female	96	18-20	105	Argentina	9	Below high-school	22	Not Student	237
Male	445	21-30	358	Australia	42	High-school	109	Y1	43
NA	10	31-40	65	Brazil	88	Some college	178	Y2	51
		41-50	16	Canada	29	Associate	35	Y3	77
		51-60	3	England	5	Bachelor	152	Y4	73
		60+	4	Finland	124	Graduate	55	Grad Student	70
				France	2				
				Germany	3				
				Iran	1				
				New Zealand	1				
				Northern Ireland	1				
				Norway	16				
				Peru	1				
				Sweden	20				
				UK	4				

		USA 192 Venezuela 10		

Out of 532 participants in the post-Jam survey, 385 responded that they planned to attend another Game Jam, for reasons such as having a fun experience, learning, networking and challenge. 22 responded as “Maybe”, 2 as “No”, and 119 participants did not respond to this question. Table 3 shows the distribution of motivation for attending another Game Jam.

Table 3. Reasons for Attending another Game Jam (total 385 participants)

Reason to Attend	**Number of Participants**
Fun	138
Learning (including improving skills)	89
Networking	38
Challenge	30
Other (including responses like “great experience” without explanation, getting new ideas, making a portfolio item, and no answer at all)	90

Learning in the GGJ

In order to investigate the learning effects of the GGJ, we asked participants to rate their skill level in a series of roles as listed in Table 4, before and after the Jam. This was calculated for 265 participants who entered matching email addresses and also entered valid responses for the skill levels.

Table 4. Skill Level Changes (total 265 participants)

Role	**Skill Level Difference From Pre-Jam to Post-Jam**	
	Mean	**STD DEV**
2D Artist	0.113	0.707
3D Artist	-0.030	0.689
Programmer	0	0.614
Project Manager	0.234	0.868
Audio Specialist (Sound)	0.181	0.818
Audio Specialist (Music)	0.192	0.735
Game Designer	0.094	0.729
UI Designer	0.057	0.834
Play Tester	0.019	0.835
Average	*0.096*	*0.759*

Although Table 4 shows almost no change in the skills in question, the participants clearly rated the GGJ as a "great place" to learn. This is illustrated in Table 5 which shows the participants' rating on how the GGJ affected their skills and abilities, and in Table 6, which lists what participants expressed as what they learned at the Global Game Jam that they did not learn in their formal study.

Table 5. Perceived Effect on Skills and Abilities (total 532 participants)

Skill	**Perceived Positive Effect**

	Mean	STD DEV
Art/design/programming skills	4.005	0.718
Social networking skills	3.874	0.747
Ability to work in team environments	4.085	0.753
Understanding or appreciating the different roles in game development process	4.177	0.770
Sense of community and connectedness to your peers and/or instructors	4.078	0.770
Level of engagement with your university/major/professors	3.441	0.755
Confidence on developing games	4.290	0.727

Table 6. Expressed Learning Items
(total 158 responses to the question)

Learning Item	Number of Participants
Game Development Process	39
Technical and/or Art Skills	31
Teamwork (communication, collaboration, etc)	28
Attitude	13
Time Management	12
Nothing New	17
Other (including More Experience, etc)	18

The responses to the question about what participants learned during the game jam could be categorized into: technical skills, game design process and collaboration. Examples from technical responses include "Creating usable sprite sheets from Flash content", "A new way to apply texture to simple models" and "Began to learn XNA". Responses related to the game design process included "How to work under tight deadlines, knowing what to cut from a project", "How the industry works and massive, fast prototyping", and "How a full game development team actually works". One participant commented "It really enforced a scrum like development cycle, due to the limited time and need to have a finished game. [We were] working on the main features first. We also worked on everything at once, sound, menus, gameplay all at the same time and the end result made them all feel like they belonged and weren't just tacked on at the end."

Participants also indicated they were able to use a variety of collaborative/group skills. One participant stated "How fantastic it is to bounce ideas off of group members, what we initially conceptualized was very different from the final product, but I love where we ended up." Another wrote "It's a challenge to present ideas diplomatically and encourage people to collaborate but not let anyone run you over or do that to others."

The data clearly shows that the GGJ is perceived to be a highly effective place to learn by the participants. While Tables 5 and 6 show that participants believed in significant learning during the GGJ, Table 4 shows relatively small differences in skill levels before and after the event. This can be explained in two possible ways:

1. The learning was not necessarily in general technical skills. It was about things such as process and teamwork and also possibly new technical tools.
2. The participants had an unrealistically high perception of their skills before the Jam. During the Jam the learned about those subjects and increased their skill levels to the values they used to think they were at.

Table 7. More Numeric Questions (total 532 participants)

Question	Answer	
	Mean	**STD DEV**
How successful was the initial brainstorming in choosing teammates and ideas?	3.685	1.242
What was the level of collaboration among team members?	4.007	1.137
How democratic/egalitarian was the design and development process in group?	3.948	1.203
How satisfied are you with your final outcome?	3.800	1.074
How satisfied are you with your overall experience?	4.407	0.852
How would you rate the Global Game Jam as a place to learn?	4.481	0.836
How would you rate the place you studied game design/dev as a place to learn?	2.899	1.836

Development Process in the GGJ

Since we predicted that a major part of learning in the GGJ would be related to the development process, and the unique ways in which a game jam differs from academic and even professional projects, the survey included some open-ended question where participants could describe how they formed a team and the what process-related choices their team made. We also added numeric questions where participants could rate their satisfaction with the final outcome and the whole experience, in order to link the team and process-related choices to the satisfaction levels, as a measure of success for those choices.

All the qualitative responses were read by the researchers and through an iterative process, a series of codes were generated and assigned to the responses. The codes represent concepts present in the responses which in turn specify the significant aspects of the responses (Lieber, 2009). The coding process resulted in highlighting key phrases from the responses such as “we started by sharing our ideas” or “we stated whatever was on our minds”. At a second round of coding, these excerpts were turned into more unified codes such as Brainstorming and Sketching. Next iterations modified the list of codes by removing insignificant ones or combining some codes, and finally the codes where categorized into groups like Idea Development and Cycle for process, and Who and When for team formation.

Table 8 shows the list of codes generated for two main qualitative responses related to the development process. The questions were:

- Please describe your team process for concept, design, and development.
- How did you end up with your team? What attracted you to it?

We used the online qualitative and mixed-method research tool Dedoose.com which is designed for mixed data analysis. Dedoose allows defining excerpts within qualitative data and assigning codes to them. It also allows inclusion of numeric data (referred to as "descriptors"). The analysis tool then provides various charts for codes and descriptors such as Codes by Descriptor (distribution of codes over one descriptor), Descriptors by Code (distribution of descriptors over one code), etc. Tables 9 to 12 show the distribution of Process and Team Formation codes over SatisfiedWithOutcome and SatisfiedWithExperinece descriptors (see

Table 7). The sum of percentage values in some rows of these tables do not add up to 100 due to the fact that there were participants who used the code related to those rows but did not have answers to the satisfaction level questions so would not be in any of the satisfaction levels 1-5.

Table 8. Codes Generated for Process Post-Jam Question (total 150 responses)

Question	Codes	Occurrence	Question	Code	Occurrence
Process	*Idea Development*		Team	*How*	
	Brainstorming	87		Based on Idea	29
	Criteria/score	17		Based on People	85 *
	Evolving	11		Based on Skills	7 **
	ExistingIdea	3			
	IndividualIdea	15		*When*	
	Sketch	9		Before the Jam	61
	SkillAssessment	6		At the Jam	56
	Technology-driven	3		New Members Added	4
	Cycle			N/A	33
	Iterative/Incremental	5			
	Waterfall	13		*Who*	
	Other			Have Known Before	85
	FrequentReview	11		Have Worked with Before	10 ***
	Leader	8			
	Milestones	4		New Jammers	39
	NewTechnology	10			
	PipelineTools	3			
	PriorityList/Scope	9			
	Prototype	13			
	TaskList	10			

* "Based on People" code was assumed equal to "Have Known Before"

** This number was too low to include in the analysis and compare with others

*** "Have Worked with Before" numbers were included in "Have Known Before"

Table 9. Percentage of Process Codes at each Level of Satisfaction with Outcome

Code	Percentage at Level of Satisfaction with Outcome				
	1	**2**	**3**	**4**	**5**
All Process Codes	*12.5*	*16.9*	*18.9*	*18.6*	*18.9*
Idea Development					
Brainstorming	13.6	14.9	22.5	31.9	17.1
Criteria/score	0	40.5	18.4	26.1	15
Evolving	0	0	18	38.2	43.9
ExistingIdea	85.7	0	0	6.7	7.7
IndividualIdea	55.5	0	12.2	17.3	14.9
Sketch	0	0	27.9	49.4	22.7
SkillAssessment	0	0	0	77.7	22.3
Technology-driven	0	0	71.1	0	28.9
Cycle					
Iterative/Incremental	0	58.6	0	12.6	28.9

Waterfall	0	0	17.6	25	57.4
Others					
FrequentReview	0	0	24.4	25.9	49.7
Leader	0	0	31	43.8	25.2
Milestones	0	0	39.7	28.1	32.3
NewTechnology	0	0	44.4	31.5	24.1
PipelineTools	0	0	0	30.3	69.7
PriorityList/Reduction/Scope	58.8	0	6.5	13.7	21
Prototype	0	0	30	21.2	48.8
TaskList	0	0	15.7	33.3	51

Table 10. Percentage of Process Codes at each Level of Satisfaction with Experience

Code	**Percentage at Level of Satisfaction with Outcome**				
	1	**2**	**3**	**4**	**5**
All Process Codes	*20.8*	*16.3*	*16.5*	*17.6*	*18.4*
Idea Development					
Brainstorming	0	0	16.4	36.9	46.7
Criteria/score	0	0	32.5	24.4	43.1
Evolving	0	0	0	43	57
ExistingIdea	0	86.4	0	8.9	4.7
IndividualIdea	0	50.2	20.7	15.5	13.7
Sketch	0	0	0	48.6	51.4
SkillAssessment	0	0	0	55.7	44.3
Technology-driven	0	0	79.1	0	20.9
Cycle					
Iterative/Incremental	0	0	0	65.4	34.6
Waterfall	0	0	72	9	19
Others					
FrequentReview	0	0	0	44.7	55.3
Leader	0	0	0	38.6	61.4
Milestones	0	0	0	48.6	51.4
NewTechnology	0	0	46.3	23.1	30.6
PipelineTools	0	0	0	48.6	51.4
PriorityList/Reduction/Scope	0	63.2	0	19.5	17.2
Prototype	0	0	0	21.3	78.7
TaskList	0	0	0	53.1	46.9

Table 11. Percentage of Team Codes at each Level of Satisfaction with Outcome

Code	**Percentage at Level of Satisfaction with Outcome**				
	1	**2**	**3**	**4**	**5**
All Team Codes	*16.2*	*16.5*	*17.4*	*18.8*	*18.2*

How					
Based on Idea	22.8	24.8	15.0	8.9	28.5
When					
Before the Jam	12.5	27.2	17.9	22.4	20.1
At the Jam	9.3	10.1	13.3	10.1	20.0
New Members	0	0	0	72.3	27.7
N/A	35.1	19.2	11.6	13.7	20.4
Who					
Have Known Before	24.5	20.8	12.6	17.8	24.2
Have Worked with Before	49.0	17.8	5.4	19.1	8.8
New Jammers	0	17.6	29.3	20.7	32.5

Table 12. Percentage of Team Codes at each Level of Satisfaction with Experience

Code	**Percentage at Level of Satisfaction with Outcome**				
	1	**2**	**3**	**4**	**5**
All Team Codes	*20.8*	*16.3*	*16.5*	*17.6*	*18.4*
How					
Based on Idea	0	0	30.2	33.9	35.9
When					
Before the Jam	44.5	12.7	18.3	14.4	10.0
At the Jam	0	0	42.1	24.5	33.4
New Members	0	0	0	65.4	34.6
N/A	0	24.1	19.9	32.3	23.7
Who					
Have Known Before	37.3	16.0	19.7	13.1	13.9
Have Worked with Before	0	46.8	19.3	28.9	5.1
New Jammers	0	0	46.3	25.5	28.2

The average Satisfaction with Outcome for all participants was 3.8 as shown in Table 7. For Overall Experience it was 4.4.

Some of the key observations we can make from the relation between codes and satisfaction with outcome are:

- While brainstorming was almost evenly distributed among satisfaction levels, using an existing or an individual's idea had clear negative effect while use of design sketches and prior skill assessment had positive effects.
- Waterfall cycles seemed to work better possibly due to the short period of development that did not allow for formal iteration cycles.
- Prototyping, frequent reviews and having a formal task list resulted in higher satisfaction with the outcome

- Those who formed a team before the Jam, were more likely to be happy with the outcome (Almost 40% of those who formed their team at the Jam were at 0 level of satisfaction). This can be attributed to a better prepared and matched group which will generally result in a more satisfactory product at the end.

Some of the key observations we can make from the relation between codes and satisfaction with the whole experience are:

- Brainstorming and prior skill assessment resulted in higher satisfaction while use of existing or individual ideas had a negative effect.
- Iterative cycles resulted in higher satisfaction with the experience than waterfall cycles.
- Other codes (except Priority List) were associated with higher satisfaction.
- Those who formed their group at the Jam were more likely to have a positive feeling about the whole experience. This is in contrast to their satisfaction with the outcome and can be attributed to what they learn in term of teamwork and also networking (meeting new people) and general fun/attraction of the experience.

Satisfaction with experience is less indicative as participants were, in general, satisfied with experience regardless of their process methods, although they may not be satisfied with the outcome (final products).

Discussion

Game jam participants (and those who organize them) cut across a wide variety of demographic groups and have unique experiences that can be difficult to quantify. After organizing numerous game jams, the authors understood that "good things" were generally occurring during the jams and were interested in trying to solidify these experiences into concrete data. Not only could this information provide for a deeper understanding of what occurs at these events, but it could help improve the events by encouraging broader participation, and in the case of academic institutions, increase student learning and engagement. The large, internationally-diverse participant base in both the pre- and post-jam survey provides confidence that these findings are universally applicable and can serve as a foundation for future studies (see Table 2).

To begin the discussion, we first examine the question of what draws participants to game jams. According to Table 3, many of the post-jam participants that responded indicated that the event was *fun*. To educators and organizers alike, this is exciting because the event usually occurs under conditions that would *not* normally be considered fun: lack of sleep, time-constrained environments, questionable eating habits, and so on; other aspects of the event must overcome those elements in some way. It also requires us to examine why participants who have no prior game jam experience choose to participate in the first place; we hypothesize that, at a minimum, future participants at least *perceive* the event as being fun. Either way, organizers may be able to leverage that perception to help encourage participation. Table 3 also suggests that participants attend game jams to learn. While this may seem obvious, organizers should understand that learning is an expectation and could leverage this to include events such as pre-jam workshops, mentoring, and other ideas.

While the data suggests that technical skills (art, audio, design, programming, etc.) did not increase within the 48-hour period, Table 5 shows that the game jams have a positive perceived effect on their skills. This is most pronounced in the participants' confidence in developing video games, which is likely the result of having just developed one. It is also clear that participants believe the jams positively affect their group skills, which can be seen in the high ratings to "Understanding or appreciating the different roles in game development process" and "Ability to work in team environments". This is reinforced by Table 6, which rates the "Game Development Process" high as a major learning item. To educators, this means that even though game jams may not be the best place/method to teach particular skills, they can be a great way of introducing learners to the "process", providing them with more practical experience, and allowing them to expand their personal network and networking skills.

From an academic viewpoint, Table 7 draws strong attention. In comparing the learning environment of game jams with where participants learned game design and development, the data suggests that game jams provide a stronger learning environment. Part of this may be explained from that fact that not all participants had formal training – perhaps learning game design and development informally or in isolation. Alternatively, it may be because game jams enable students to collaborate with those who have different skill sets (e.g. art schools can collaborate with technical schools). Regardless, *the argument can be made that game jams provide a strong educational supplement to those who design and develop games*.

Though many game jams are open to the public – yet hosted at universities – the authors were also interested in understanding at what level the jams impacted the local gaming community. Because game development requires a heterogeneous set of skills, GGJs are naturally cross-disciplinary and can enable designers and developers to interact with those of different backgrounds (as they would in industry). For example, the last GGJ at one of the author's home institutions brought together participants from a variety of universities and industry – each with a different area of specialization. While the representation from these groups was mostly local, one group was geographically distant. However, to create a sense of community, a video connection was maintained through most of the jam. The sense of connectedness is also reinforced by the responses found in Table 7 – in which participants claim that the level of participation among team members was high.

In examining the data found in Tables 8-12, we see (with a nearly identical response) that groups form both before and at the jam. However, many group members knew other members before the jam, but likely had not worked with them. Further, the data suggests that while some groups formed around an idea, many formed around the people they would be working with, and not just the skills that member possessed. To help those who are forming groups on-site, some of the authors borrowed exercises from the Nordic jam – requiring participants to form small groups with those they do not know and practice example design problems; after short periods of time, the process repeats. Though it will take more investigation, it is an interesting question to see how the pre-jam activities of the organizers may influence how groups are formed. As mentioned in the key observations of the previous section, having a pre-formed group could result in a higher satisfaction with the outcome (final product) due to the team members skills and familiarity, but it could potentially reduce the satisfaction with the overall experience as it may take away the chances of meeting new people, learning new skills, and taking full advantage of the Jam experience. While the presented data suggests certain relations between development

cycle/decisions and the satisfaction levels, more research is needed to further understand and verify such relations.

Conclusion

The results of a research survey done by the participants of the Global Game Jam, 2012, have been reported and analyzed in this paper. In addition to demographic information on these participants, the survey provides an insight into participants' opinion of the type and amount of learning that happens during the Jam and also the relationship between various process related decisions and the satisfaction levels (as a subjective measure of success for those process choices). Based on our findings, we can suggest that the GGJ proposes a strong venue/method for learning, especially regarding the whole process rather than special skills. It also proposes that particular practices such as brainstorming can have strong positive impact on the satisfaction with the results.

The methodology is mixed qualitative and quantitative, and based on participants' opinion as opposed to objective measures. As a result, it may not be a strong evidence of a particular relationship or learning aspect, but does offer a valuable insight which among other purposes can be used as reasonable hypothesis for further objective studies.

Potential outcomes of our research on GGJ participants include but are not limited to:

- *Evaluating the appropriateness of the GGJ as a component in formal education contexts*: Several educational institutions around the world include a formal industry project or work experience as part of an undergraduate degree. Given the depth and breadth of the local game development industry, it is often difficult to find suitable industry projects and/or work experience opportunities for our students. The GGJ has the potential to provide these. However, we need both qualitative and quantitative data to convince our stakeholders of this potential.
- *Improving the development process of extremely time-constrained projects*: Since many of game jammers are familiar with development methodologies, and are in a situation that closely resembles professional production, the specific methods they use and the outcomes can provide insight to how suitable the methods are. Without a proper evaluation system, the observations may not be adequate, but they be used as initial hypotheses and starting points for further studies.
- *Providing better educational/vocational experiences based on understanding of the young game developers*: As one of the objectives of such study is to measure the learning that takes place during the GGJ, and as the GGJ has been proven as a motivator of increasing participation, there is obvious potential application for a formal educational environment. The learning experience may also be significant within the workspaces as industry can benefit from similar learning methods, or even design and development approaches in GGJ can be transferable to other projects.

Acknowledgements

This research was conducted under the auspices of the Waiariki Institute of Technology Research Committee ethical standards. We would like to acknowledge the support and assistance of The International Game Developers Association (IGDA).

References

Aarseth, E. (2001). Computer game studies, year one. *Game Studies, 1*(1). Retrieved November 17, 2011, from http://www.gamestudies.org/0101/editorial.html.

Adams, E. (2002). Technology inspires creativity: Indie game jam inverts dogma 2001! *Gamasutra* Retrieved August 7, 2012 from http://www.gamasutra.com/view/feature/2989/technology_inspires_creativity_.php

Berland, M., & Lee, V. R. (2011). Collaborative strategic board games as a site for distributed computational thinking. *International Journal of Game-Based Learning, 1*(2), 65-81.

Chan T. S., & Ahern, T. C. (1999). Targeting Motivation--Adapting Flow Theory to Instructional Design, *Journal of Educational Computing Research, 21*(2), 151-163.

Corbin, J., & Strauss, A. (2008). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Los Angeles, CA: Sage Publications.

Csikszentmihalyi, M. (1990). *Flow: The Psychology of Optimal Experience*. New York, NY: Harper & Row.

Entertainment Software Association (2011). 2011 Sales and Demographic Usage Data: Essential facts about the computer and video game industry, Retrieved August 3, 2012, from http://www.theesa.com/facts/pdfs/ESA_EF_2011.pdf

Gallagher, S. & Park, S.H. (2002). Innovation and competition in standard-based industries: A historical analysis of the U.S. Home Video Game Market, *IEEE Transactions on Engineering Management, 49*(1), 67-82.

Gestwicki P, Sun F.S., & Dean B. (2008). Teaching game design and game programming through interdisciplinary courses. *Journal of Computing Sciences in Colleges, 24*(1), 110–115.

Global Game Jam Wiki, (2009). *Global Game Jam 2012*. Retrieved July 2, 2012, from http://globalgamejam.org/wiki/ggj-wiki

Global Game Jam Sets Guinness World Record™ for being the Largest Game Jam in the World (2012). Retrieved July 3, 2012 from http://globalgamejam.org/news/2012/03/01/global-game-jam-sets-guinness-world-record%E2%84%A2-being-largest-game-jam-world

Guevara-Villalobos, O. (2011). *Cultures of independent game production: Examining the relationship between community and labour*. Paper presented at the Digital Research Association (DIGRA) conference: Think Design Play: The fifth international conference of the Digital Research Association, Hilversum, the Netherlands: Utrecht School of the Arts, Retrieved August 12, 2012 from http://www.digra.org/dl/db/11307.08157.pdf.

Hecker, C. (2001). *Indie Game Jam*. Retrieved January 31, 2012, from http://www.indiegamejam.com/igj0/index.html

History and Contributors (2012). Retrieved July 2, 2012, from http://globalgamejam.org/history

Kultima, A. & Alha, K. (2011, September). *Using the VNA ideation game at global game jam*. Paper presented at the Digital Research Association (DIGRA) conference: Think Design Play: The fifth international conference of the Digital Research Association, Hilversum, the Netherlands: Utrecht School of the Arts, Retrieved August 12, 2012 from, http://www.digra.org/dl/db/11301.19044.pdf

Kultima, A., Niemel, J., Paavilainen, J., & Saarenp, H. (2008). User Experiences of Game Idea Generation Games. In *Proceedings of the 2008 conference on Meaningful Play 2008*. Retrieved January 13, 2012, from http://meaningfulplay.msu.edu/proceedings2008/

Lieber, E. (2009). Mixing qualitative and quantitative methods: Insights into design and analysis issues. *Journal of Ethnographic and Qualitative Research*, *3*(4), 218–227.

Miles, M.B., & Huberman, A.M. (1994). *Qualitative Data Analysis: An Expanded Sourcebook*, Thousand Oaks, CA: SAGE Publications.

Musil, J., Schweda, A., Winkler, D., & Biffl, S. (2010). Synthesized essence: What game jams teach about prototyping of new software products, In *Proceedings of the 32nd International Conference on Software Engineering (ICSE'10)*, Cape Town, South Africa, 2010. ACM: NY. 183-186

Novak, J. (2012). Game Development Essentials: An Introduction (3rd Ed.). Clifton Park, NY: Delmar Cengage Learning.

Piaget, J. (1970). *Science of education and the psychology of the child*, New York, NY: Orion Press.

Prensky, M. (2001). *Digital game-based learning*, New York, NY: McGraw-Hill.

Preston, J., Chastine, J., O'Donnell, C., Tseng, T., and MacIntyre, B., (2012). Game Jams: Community, Motivations, and Learning among Jammers, *International Journal of Games-Based Learning*, 51-70.

Rodriguez, H. (2006). The playful and the serious: An approximation to Huizinga's Homo Ludens. *Game Studies*, *6*(1), Retrieved December 12, 2011, from http://gamestudies.org/0601/articles/rodriges

Rosenberg, N. (1982). *Inside the black box: Technology and economics*. Cambridge: Cambridge University Press.

Sawyer, B. & Smith, P. (2008). Serious Games Taxonomy. Presented at the Serious Games Summit at Game Developers Conference 2008. Retrieved 10 October, 2010, http://www.seriousgames.org/presentations/serious-games-taxonomy-2008_web.pdf

Sherry, J. L., Lucas, K., Greenberg, B. S., & Lachlan, K. (2006). Video game uses and gratifications as predictors of use and game preference. In P. Vorderer & J. Bryant (Eds.), *Playing computer games: Motives, responses, and consequences* (pp. 213-224). Mahwah, NJ: Lawrence Erlbaum.

Shin, K., Kaneko, K., Matsui, Y., Mikami, K., Nagaku, M., Nakabayashi, T., Ono, K., & Yamane, S. R. (2012). Localizing Global Game Jam: Designing game development for collaborative learning in the social context. In A. Nijholt, T., Romão, & D. Reidsma, (Eds.) *Lecture Notes in Computer Science* (pp. 117-132), 7624, Berlin: Springer

Shodhan, S., Kucic, M., Gray, K. & Gabler K. (2005). How to Prototype a Game in Under 7 Days. Gamasutra. Retrieved August, 12, 2010, from http://www.gamasutra.com/features/20051026/gabler_01.shtml

Sotamaa, O. (2005). Creative user-centred design practices: Lessons from game cultures. In L. Haddon, et al. (Eds.) *Everyday Innovators: Researching the Role of Users in Shaping ICTs*. (pp. 104-116), London: Springer Verlag.

Van den Bosch, F., Ribbens, W., & Van Looy, J. (2011, September), *Doing it themselves! A mixed-method study into the motivations of players to 'create' in the context of gaming*. Paper presented at the Digital Research Association (DIGRA) conference: Think Design Play: The fifth international conference of the Digital Research Association, Hilversum, the Netherlands: Utrecht School of the Arts, Retrieved August, 12, 2012 from http://www.digra.org/dl/db/11312.36121.pdf

Zyda, M. (2006). Educating the next generation of game developers, *IEEE Computer*, June, 30-34.