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AN ANALYSIS OF CREATIVE PROCESS LEARNING IN COMPUTER GAME ACTIVITIES THROUGH PLAYER EXPERIENCES

โดย

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ABSTRACT

This research investigates the extent to which creative processes can be fostered through computer gaming. For investigating creative processes in this domain is proposed. This research tends to focus on games that have been specifically designed for educational purposes: Digital Game Based Learning in terms of creativity. This paper describes a behavior analysis for measuring the creative potential of computer game activities and learning outcomes. Creative components are measured by examining task motivation and domain-relevant and creativity-relevant skills factors. The research approach applies heuristic checklists in the field of the gameplay to analyze the factors that the stage of player activities involved in the performance of the task and to examine player experiences with the Player Experience of Need Satisfaction (PENS) survey. The player experiences are influenced with the most complex of game play interactions through player experiences; competency, autonomy, intuitive controls, relatedness and presence. It examines the impact of these activities on the player experience for evaluating learning outcomes through school record. The study forms designed to better understand the creative potential that people engage for knowledge and skills being learned during the course of playing. The findings show the creative potential that occurred to yield levels of creative performance within game play activities to support learning. The anticipated outcome is knowledge on how video games foster creative thinking as an overview of the Creative Potential of Learning Model (CPLN). CPLN clearly understand the interrelationships between principles of learning and creative potential, the interpretation of the results is indispensible.

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Wilawan Inchamnan
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CHAPTER 1

1.1 INTRODUCTION

A digital game involves role-play characters, clever and complex problems to solve, and compelling music and graphics (Shute, 2011), knowledge and skills being learned influence during the course of playing. While there has been significant growth in game-based learning research in the past two decades (Habgood and Ainsworth, 2011), among those studies, this research focuses on the games that have been specifically designed for educational purposes and facilitate problem solving skills.

Games, in general, support the development of critical thinking through visualization, experimentation, and creativity (Amory, 2007). Game elements normally provide problem solving experiences as players try to break down the tasks, engage meta-cognitive skills, and think critically(Turcsányi-Szabó et al., 2006). Games also offer an opportunity to explore new ideas and actions through the diversity of game play opportunities generated by communities of players. As a consequence, the anticipated outcome is knowledge on how video games foster creative problem and learning processes.

1.2 OBJECTIVE

An objective of this study is to analyze the relationship of creative factors and learning outcome. In order to examine the creative process

potential of games by using the comprehensive assessment technique, we have adapted the existing behavior and verbal protocol developed by Ruscio et al. (Ruscio et al., 1998). This technique has been previously used to assess a range of creative game activities (Inchamnan et al., 2012).

The finding examine the previous measurement method is designed to explore the relationship between task motivation, domain relevant skills, creativity relevant skills, and player experiences within a game activity that adapted from our previous findings (Inchamnan W., 2013). Thus, the aim of this study is to examine the relationships between game enormous potential for helping people to learn more effectively, and also, investigate what extent does gaming impact on the learning outcomes.

1.3 RESEARCH HYPOTHESIS

The hypothesis of this study is that the elements of the game environments will influence the components of creative performance in terms of learning experiences. As a result, the research problem addressed in this project is to develop an investigation of creative learning processes in the game context. The specific hypothesises in this study are following as follows:

(H1): Player experiences have an influence on people's creative process skills.

(H2): Game activities encourage people to learn more effectively.

(H3): Game activities facilitate the creative process during the game play experiences.

1.4 SCOPE & LIMITATIONS

The popular games are usually different in genre, game narrative, and game mechanism. This study will focus on two genres of games, that is, puzzle elements games and online action games. The fifteen pilot students for examining the school record in this case study depends on the timeline of research.

1.5 CONTRIBUTION AND SIGNIFICANCE

Digital simulations and games play a significant role in facilitating exploration and creative problem solving. This study aims to gain insight of the potential benefits of game activities for promoting creative processes, and aims to assist the game industrial developers to create his/her games to support such processes. This current study is significant in that it will assist game designer in adding new and helpful educational dimensions to either educational or traditional commercial games. It enables mapping between the elements of developed games and the components of the creative process. This finding will provide the guideline of the creative component activities for helping people to learn more effectively.

1.6 DEFINITIONS

- **Game:** A competitive activity or sport in which players contend with each other according to a set of rules.
- **Creativity:** The process of finding appropriate solutions through the exploration of multiple paths; motivations of curiosity, discrepancies and gaps in knowledge to drive the creative problem solving process;

The process of evaluating solutions and settling on the most appropriate for the given problem space.

- **Creative Process:** An internal process through which ideas are generated.
- **Game-Based Learning:** The use of video games to support teaching and learning.
- **Learning Process:** An activity sequence followed as a set of learning steps

CHAPTER 2
Backgrounds and Related Works

2.1 CREATIVE POTENTIAL

To identify the potential of games to engage the players in creative processes, criteria related to activity undertaken need to be clearly defined. As mentioned in the works of Paras and Bizzocchi (2005) , games had great potential to support creative processes (Paras and Bizzocchi, 2005). Furthermore, creative ideas resulted from the novel combination of ideas (Spearman, 1930), this creativity involves a process of divergent and convergent thinking (Amabile, 1996), and that problem solving plays an important role (Clark et al., 1965).

Divergent and convergent thinking are the core elements of the creative process. Divergent thinking is important for idea generation (Amabile, 1996), and is necessary to produce many alternative solutions to the problem (gordon1961). Convergent thinking, as a creative process, occurs in the idea validation stage (Amabile, 1996). It allows an individual to select the correct way to approach the task at hand (Sviderskaya, 2011), with the ability to select a single response from a series of alternatives (Clark et al., 1965). To develop interactive experiences that incorporate these valuable and educative learning processes, it firstly needs a clear understanding of how different game elements are combined to produce the creative potential.

Based on the review of the literature, the creative process in this context is defined in terms of:

- Sensitivity to the problems, or the processes of deconstruction and planning. This term includes rearranging the elements of problems, identifying the important elements in the problem, structuring the elements of a problem, and looking for ways to move closer to the goal.
- The process of finding appropriate solutions through the exploration of multiple paths. This term includes considering intermediate impossibilities: not being concerned with the validity of an idea, but looking for its value in producing new ideas;
- Motivations of curiosity, discrepancies and gaps in knowledge to drive the creative problem solving process, extended problem-solving effort: engaging concentrated "work" sessions.
- The process of evaluating solutions, settling on the most appropriation for a given problem space, and playing with ideas: trying something counterintuitive, exploring possibilities (Amabile, 1996).

2.2 CREATIVE POTENTIAL PROCESSES MEASURMENT METHOD

The measurement method of creativity describes the ways how we enter into stages of the creative activity. The componential framework of creativity consists of problem solving at its core and includes three major components, that is, domain-relevant skills, creativity-relevant skills, and task motivation (Amabile, 1983). As people are solving the problems, they generate responsive possibilities from an array of available pathways and explore the environment to determine the best solution.

Domain knowledge plays an important role in the generation of an acceptable solution. Engaging in playful activities or fantasy possibly result to a positive effect that influences the active engagement of creativity-relevant processes (Amabile, 1996). Creative-relevant skills influence the quality of the ideas produced as well as task motivation influences the quantity of ideas (Amabile, 1983, Amabile, 1989, Amabile, 1996).

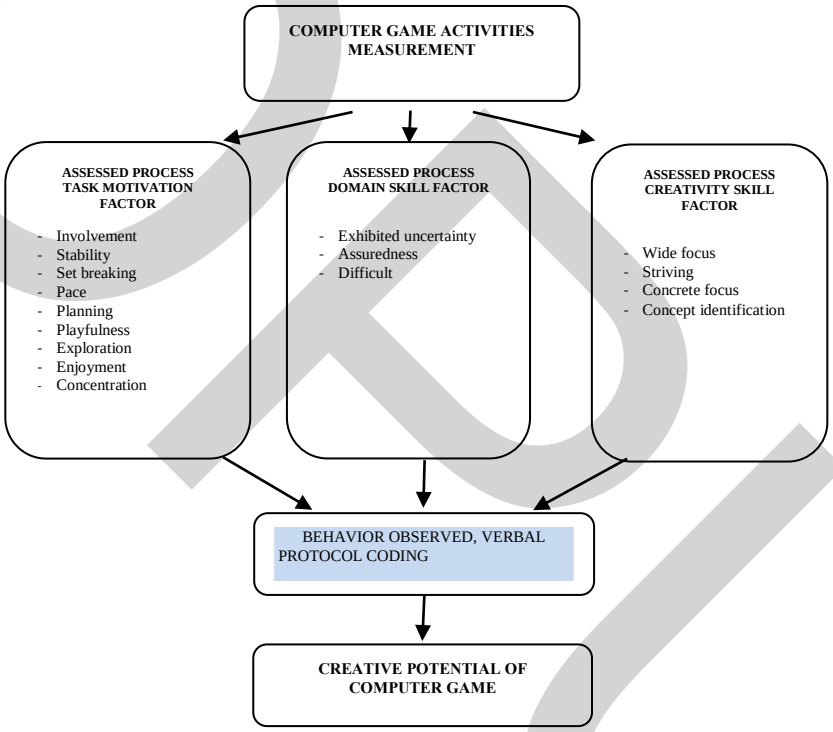

Figure 1 Game Creative Process Measurement Method (Based on (Inchamnan et al., 2012))

The three components (Task Motivation, Domain Skill, and Creative Skill) are crucial characteristics of a creative process. In order to make understanding in the creativity, El-Murad and West (El-Murad and West, 2004) adopted a similar approach to Amabile's work(1989). Amabile emphasizes the aspects of managerial practice that affect to the creativity. In terms of gameplay (See Figure 1) some studies adapted an approach for

measuring a creative potential of puzzle-based games (Inchamnan and Wyeth, 2013, Inchamnan et al., 2012, Inchamnan W., 2013).

2.2.1 Task motivation

In this context, task motivation accounts for the motivation variables that encourage an individual's approach to a given task. This component is responsible for initiating and sustaining the creative process (Amabile, 1989). Task motivation includes two elements, first, the individual's baseline attitude toward the task, and second, the individual's reasons for undertaking a given activity.

Task motivation is specific to a particular task. It represents a baseline attitude toward the task and also typically matches to the person's interest (Brown, 1989). It is an important component within the problem presentation stage and during the response generation. Task motivation refers to the difference between what an individual can do and what he/she will do (Amabile, 1996).

2.2.2 Domain-relevant skills

Domain-relevant skills form the basis from which any performance must proceed. This component incorporates factual knowledge, technical skills, and special talents in a particular domain. The information, skills, and talents that an individual brings to a task influence the preparation within a creative problem solving process. Domain-relevant skills define the set of possible responses available to an individual (Amabile, 1996). Any problem domain consists of a unique set of rules and practices (Wang, 2008). And this knowledge allows individual to identify various strategies for conducting information analysis. Domain-relevant skills provide the material

drawn on during operations that determine problem solving pathways. The skills also provide the criteria that will be used to assess the response possibilities (Amabile, 1983). Knowledge of a particular domain influences the evaluation process (Brown, 1989).

2.2.3 Creative-relevant skill

Creativity-relevant skills include cognitive style, application of heuristics for the exploration of new problem paths, and working style (Amabile, 1983). This factor influences the response generation process. Heuristic thinking is a skill that relies on a person's intellectual and emotional comfort with a situation. Differences in cognitive style result in different behaviors that individuals apply when they gather and evaluate information (Gutierrez and Greenberg, 1993).

Creativity-relevant skills act as an executive controller that influences the way where the search for responses will proceed (Amabile, 1983). Brown (1989) stated that creativity-relevant skills include the ability to concentrate for long periods of time (Brown, 1989). The relevant characteristics are commonly reported as the correlates of creative people, including self-discipline, ability to delay gratification, perseverance, and absence of conformity (Brown, 1989). Problem solvers automatically activate the areas of knowledge that are associated with the past problem solving experience and the relevant knowledge (Santanen et al., 2002). This component includes a cognitive style characterized by the ability to break set of tasks during people's problem solving. This involves the ability to break away for standard thinking, approaches, and solutions during problem solving. Individuals can gain experience from idea generation that may inform their own strategies for creative thinking (Amabile, 1996).

2.3 GAME ACTIVITY COMPONENTS FOR CREATIVE GAMEPLAY

Table 1: Creative Gameplay (Inchamnan et al., 2014)

Game Activity	Creative Gameplay
Open-ended goals	Wide focus Playful exploration
Narrative mechanisms	Clear pathways to complete tasks
Challenges	Complexity, planning, refining
Variety challenges	Wide focus, complexity, striving, playful exploration, object use and manipulation, planning
An appropriate pace and match a player's skill level	Striving
Freedom of choice	Wide focus, object use and manipulation, planning
Player actions have an impact on and shape the game world	Wide focus, object use and manipulation, playful exploration
Actions relate to the overarching story/setting of the game and that feedback makes sense within this context	Clear pathways to complete tasks
Manage player errors and ensuring that the impact is minimal	Striving
Player has a sense of control	Environments that instill confidence
Provide mechanisms that allow players to receive immediate and continuous feedback on their actions	Environments that instill confidence, clear pathways to complete tasks, refining
Feedback provided to the player positively reinforces good choices and allows for free choice and self-awareness	Striving, understand what is required, refining

Some studies yielded a specification of particular task behaviors that are strongly possible to predict creativity the creative game potential measures identified by analyzing game activities. Table 1 shows the game play activities and the creative process components that facilitate creative processes (Inchamnan and Wyeth, 2013). From Table 1, the game activities related to the creative potential during playing game. Thus, these activities are able to support learning of individuals.

Playing games has a significant role to help people to learn to solve their problem (Myers et al., 2010). Game activities have influences on the creative potential through creative gameplay. For example, game activity facilitates creative-relevant skill and provides greater opportunities for players to take a wide focus when engaging in gameplay with open-end goals. The feedback activities provides positive reinforcement which enhances free-choice and self-awareness (Inchamnan and Wyeth, 2013).

2.4 SELF MOTIVATION REPORTS

The game environment is the medium that allows players to achieve such experiences. Games significantly extend the range of experiences available to an individual. Enjoyable game experiences result from players being able to work through the game interface to become immersed in playful activity. Within this study project measurement of player experience is based on self-determination theory (SDT) (Ryan, 2000). SDT has been successfully applied in many study discipline such as sports, education, and leisure domains. Przybylski, Rigby and Ryan (2010) applied SDT to the video game player motivations. Based on SDT and other relevant theories (e.g. presence), Przybylski and his colleagues developed the Player

Experience of Need Satisfaction (PENS) measure, which assesses the game play experiences in terms of competence, autonomy, relatedness, intuitive controls, and presence/immersion (Przybylski et al., 2010).

In this study, to assess game play experiences, the 21-item PENS survey was adopted. It evaluates game play experience from five dimensions: competency, autonomy, relatedness, presence, and intuitive controls. Each item consists of a statement on a seven-point scale, ranging from 1 to 7. The interactive experience with the game environment allows players to express their creativity and intentions (Sweetser and Johnson, 2004). This learning experience allows players greater freedom in term of decision-making.

2.5 ENGAGEMENT

When a player is engaged, it means that the player is interested in the game and wants to keep playing (Brown and Cairns, 2004). According to Loveless's work (Loveless, 2002), engagement means the having of the ability to acknowledge risk and uncertainty. Video games are claimed to be an effective learning environment that are maintained through engagement. The engagement during game play continually delivers optional, achievable, new challenges, and experiences in a temporary world (McGinnis et al., 2008).

According to Scoresby and Shelton (Scoresby and Shelton, 2011), in the computer game environment, a player links the content, has an emotional experience, and is motivated to play simultaneously. In addition, Mcginnis et al. (2008) stated that a classic structure of a game is driven by the interactive feedback loop. This feedback loop helps players balance the challenges.

Hunicke in Mcginnis et al (McGinnis et al., 2008) supported the idea that the interactive feedback loop provides players with instantaneous feedback. The feedback supports the process of trial and error. Through this task the players can learn without significant fear of repercussions, effective learning provided without any consequences (McGinnis et al., 2008). The trail and error skills can be used to access the responsive possibilities that generate more ideas to solve the problems.

Figure 2 illustrates the main aspect of a formal closed loop game system. In the magic circle (see Figure 2), a game is governed by rules that describe the boundary of the game and affect the limitations in the circle. Players can understand the rules which are embedded in the underlying of game mechanics. The rules delineate goals. These rules sit at the heart of the circle that forms the core of the formal game structure.

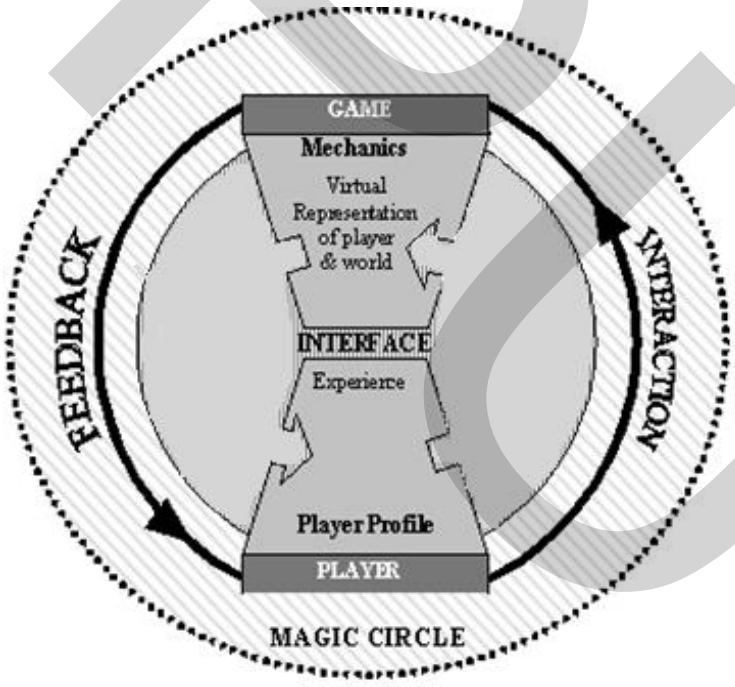

Figure 2 Player and game closed loop system within a magic circle (McGinnis et al., 2008).

Goals help maintain engagement. The engagement provides motivation for players to gradually progress through a game. This could be related to their progression towards the overall goal to win the game. However, Mcginnis et al. (2008) stated that the structure of games could be designed to provide players with tasks that are interconnected and are related to the overall goal. The structure chain provides the player with a series of short-term goals. This structure is a chain of convexities and it allows players to balance challenges that encourage continued play. The number of choices to spend can generate the number of ideas to solve a problem. Players will create their own ways through their curiosity. Engagement is the label for curiosity behaviors that influence task motivation which, in turn, fosters the creative processes.

2.6 GAME BASED LEARNING

There are many new approaches toward the education, teaching and learning. Challenge and engage all young people are influenced to identify rewarding learning experiences that will inspire in the 21st Century (Perrotta et al., 2013). The use of video games in education is focused the emergence of new trends like ‘Game Based Learning’ that supports teaching and learning. Game-based learning refers to the use of video games to support teaching and learning (Perrotta et al., 2013). Game environment have influence on the learners to foster their skills. Games and play are an essential part of child development (Prensky, 2005a). Digital Game-Based Learning is exactly about fun and engagement (Prensky, 2002). This study focuses on the relationships between computer game enormous potential for helping people to learn more effectively.

2.6.1 Games for Learning

Learning experiences allow players greater freedom in terms of decision-making. Games offer an opportunity to explore new creative uses through the diverse ideas generated by communities of players. Learners gain meta-cognitive skills and group identity that could influence experiences for life through motivating game play (Turcsányi-Szabó et al., 2006). Game is keeping learners motivated (Prensky, 2005b). The main reason that people play games is the process of game playing is engaging.

Table 2: Principals and Mechanics of Learning (Perrotta et al., 2013)

Principals	Mechanics
– Intrinsic Motivation – Enjoyment and fun – Authenticity – Autonomy – Experiential Learning by doing	– Rules: simple and binary – Clear and challenging goals – Fantasy and difficulty – Self-control and feedback – Social element

Fig. 1.

Table 2 shows the principals of learning based on game activity. The principles refer to the underlying assumptions and concepts. The mechanisms refer to processes and dynamics involved in game-based learning are interdependent (Paras and Bizzocchi, 2005).

The principals and mechanisms involved in game-based learning are spitted based on the extent that video games can impact overall academic achievement. The majority of the studies examine the impact of video games on student motivation and their school record: programming, math and art subject. Video games allow learners to engage with topics and ideas through

interaction and simulation, rather than through the conventional materials and formats of schooling: textbooks, lessons, assignments and so forth (Perrotta et al., 2013). This study focuses on the engagement in creative activity that is the result of individuals being intrinsically motivated to interact, and the learning that occurs through positive experiences. To understand what extent did gaming impact on learning outcomes, we examine the relationships between participant's self-report and academic learning outcomes.

2.7 BEHAVIOR ANALYSIS

Behavior is the activities of living organism that everything people do, including how they move, what they say, what they think, or how they feel. The experimental analysis of behavior has discovered a number of basic principles-statements about how behavior works as a function of environmental variable (Cooper et al., 2007).

2.7.1 Behavior Measurement

Behavioral assessment involves a variety of methods including direct observations, interviews, checklists, and tests to identify (Cooper et al., 2007). Direct measurement is concerned with measurement of the specific behavior to be taught. For example, direct measurement must provide data on student response to the actual materials used during the instructional setting (Cooper, 1982). Applied behavioral analysis is concerned with the manipulation of environmental stimuli (Cooper, 1982), games create environments where each atomic challenge is stand-alone and is addressed that way by a player.

This study focuses on the game environments that foster creative processes by using behavior analysis. Behavioral assessment allows analysis of creativity from a divergent thinking and convergent thinking perspective. The measurement can be used in the identification and development of creative potential (Schaefer, 1969).

2.8 FACTOR ANALYSIS

Factor analysis is one of the most commonly used procedures in the development and evaluation of psychological measures (Floyd and Widaman, 1995). The factor analysis method is used to divide criteria into groups (Tzeng et al., 2007). Factor analysis is particularly useful with multi-item inventories designed to measure behavioral styles, cognitive schema, and other multifaceted constructs of interest to clinical psychologists (Floyd and Widaman, 1995). Assessing creative potential requires a focus on how and why an individual responds to activities (Kaufman et al., 2011). The behaviors that related to the creative activity must be clearly stated and readily translated into the assessment (Amabile, 1983).

This study used the three main factors. Firstly, the model proposed by Ruscio et al. (Ruscio et al., 1998) to identify task motivation as a measure of involvement in tasks. Behaviors such as set breaking, task pace, exploration, enjoyment, and concentration are identified as the ways in which intrinsic motivation manifests itself within the creative process. Secondly, domain-relevant factors determine the initial set of pathways to search for a solution and the ability to verify an acceptable solution (Amabile, 1983) through assuredness, difficulty and exhibited uncertainty activities within gameplay. Thirdly, the creative-relevant factors are the component of creative thinking

including the ability to break away for standard thinking, approaches, and solutions during problem solving. Individuals can gain experiences from ideas generation that may inform their own strategies for creative thinking processes (Amabile, 1996). Creativity-relevant skills are measured through the specific process factors of concrete focus, concept identification, wide focus and striving (Ruscio et al., 1998). This leads to the following questions to be answered in this study.

CHAPTER 3

3.1. THE PROPOSED METHODOLOGY

The proposed methodology is broadly divided into two stages. The first stage involves a game study which adapted from existed a creative potential method (Inchamnan et al., 2012). This creative potential method examines players by using established creativity criteria in order to determine the levels of creative activity. The process focuses on the reliability of the factors used for measurement determining those factors that are more strongly related to creativity. The second stage involves the determination of relationships of game play elements. The objective of this stage is to investigate and establish related elements that support creative performance and learning outcome.

3.2. CREATIVE POTENTIAL CRITERIA EVALUATING (STAGE 1)

The measurement of creative potential uses an existing assessment through an analysis of domain-relevant skills, task motivation, and creativity-relevant skills. Assessing creative potential of a computer game can facilitate creative processes that refer to how and why an individual responds to game activities (Inchamnan et al., 2012). The main procedure of principal component analysis can be described in the following steps when it is applied to factor analysis through the creative potential within gameplay activities:

- **Step 1:** Find the correlation matrix (*R*) or variance–covariance matrix for the objects to be assessed.
- **Step 2:** According to the work of Kaiser (1958), use varimax criteria to find the rotated factor loading matrix, which provides the additional insight for the rotation of factor-axis.
- **Step 3:** Name the factors referring to the combination of manifest variables.

3.2.1 Study Procedure

To explore the relationships between the uses of creative processes during game play and the player experiences, this study decided to adopt four games, that is, Portal 2, I-Fluid, Gunz 2: The second Duel, and Braid. While these games have different mechanics, goals and settings, they all require the players to solve problems in the game tasks to keep progress thorough the game play. Evaluation method involved examining in relation of the creative process as measured by task motivation, domain-relevant skills and creativity-relevant skills. Game task behaviors and verbalizations were coded to obtain the empirical indices of the creative processes in which game players were engaged. Participations in the study involved were observed during playing the four selected games. To examine the creative process, participants were video recorded while playing the games. A video coding scheme was used to capture the type and the frequency of the observable behaviors and verbalizations. This coding scheme was implemented based on the measures criteria below that developed for analyzing creative process (Inchamnan et al., 2012). The results from stage 1 will be used to establish the extent which the games facilitate creativity and how the components of creativity are involved.

3.2.1 Measures

A video coding scheme will be used to capture the type and the frequency of the observable behaviors and verbalizations in which participants engaged. The coding uses items that are identified as the significance in the creative process (Ruscio et al., 1998) and the coding is performed using both 7-point Likert scales and frequency counts. Item's details are outlined in Table 3.

Table 3: The coding items identified in the creative process

Item	Creativity Component	Category
Involvement: Work on solving the problem (L)	Intrinsic motivation	Behavioral
Work on achieving a good result: Amount of work committed to completing a particular task/ challenge (L)		
Set breaking: Manipulates game elements; uses them in new ways (L)		
Pace: Speed at which particular task/ challenge; a slow to fast gradient of playing rate (L)		
Planning: Organizes game elements; establishes an idea, order to build in, steps to take (L)		
Playfulness: Engaging in task in curious manner; trying out ideas in a carefree way (L)		
Exploration: Curious, or playful testing out of ideas (L)	Intrinsic motivation	Verbal
Enjoyment: Having a good time, finding pleasure in the task / challenge (L)		
Concentration: Focused on the task; not distracted (L)		
Exhibited uncertainty (-): Self-initiated backtracks:Intentionally		

moves to previous locations or revisits a particular task / challenge (F)	Domain relevant	Behavioral
Assuredness: Confidence: Certainty of ability to complete task; assuredness in going about the task; not doubtful, timid, or anxious (L) **Pace:** Speed at which particular task / challenge; a slow to fast gradient of playing rate (L) **Difficulty (-):** Problems encountered, trouble playing with game elements (L)	Domain relevant	Behavioral
Difficulty (-): Problem with self (-): Uncertainty, self-doubt, negative statements about ability or mood (F) Negative exclamations (-): Usually one word, can be two or three; curses or otherwise sharply negative (F)	Domain relevant	Verbal
Wide focus: Goal statements: Something that cannot be done in one step, future oriented; restatement of problem given, self-imposed goal, statement dealing with a desired final goal, etc. (F) Irrelevant to task: Anything not related to performing the task / challenge (F)	Creativity relevant	Verbal
Striving: Difficulty: Encountering problems or obstacles to completing some or all of the task/ challenge (L) Transitions: Statement or fragment of movement to new area of action; includes place holding fragments if utterance stands alone and is separated from others by 1 sec or more (F) Question how: Questioning how or what to do; what is currently being done, present tense only (F) Repeat something: Repeats instructions, the word summer, entire poem, or word(s) (F) Exclamation: One word, can be two or three; positive or negative outcome (F)	Creativity relevant	Verbal
Concrete focus (-): Talks about task (-): statement of like or dislike about the task (F) Describes game elements: statement about texture, color, or other	Creativity relevant	Verbal

attributes of elements naming game elements (F)		
Concept identification: Analogies: Description or statement containing an analogy or metaphor (F) Aha: Eureka-type statements; abrupt change in activity (F) Transitions: Statement or fragment of movement to new action; includes place holding fragments if utterance stands alone and is separated from others by 1 sec or more (F)	Creativity relevant	Verbal

L = Measure: Seven point Likert scale , F = Measure: Frequency counts

3.3. ANALYSIS CREATIVE POTENTIAL AND LEARNING (STAGE 2)

To examine the creative process, participants were video recorded while playing the games and a video coding scheme was used to capture the type and frequency of observable behaviors and participant verbalizations. To assess the game experiences, this study used the 21-item PENS survey that consists of five dimensions: competency, autonomy, relatedness, presence, and intuitive controls. Each item consists of statements on a seven-point scale ranging from 1 to 7. Specifically, the research reported in this paper examines the relationship between creative game play processes and game play experience as measured by the Player Experience of Need Satisfaction (PENS) survey:

- **In game Competence.** This scale measures participants' perception that the game provides a competency.

- **In game Autonomy.** This scale assesses the degree to which participants felt free, and perceived opportunities to do activities that are interested in them.

- **In game Presence.** This scale measures the sense of immersion in the gaming environment. Three items considered are: physical presence, emotional presence and narrative presence.

- **In game Intuitive Control (IC).** This scale assesses the degree which participants control their character's actions in the game environment.

- **In game relatedness.** This scale assesses the desire to connect with others in a way that they feel authentic and supportive.

In summary, the main procedure of principal component analysis can be described in the two following steps.

- **Step 1:** Find the mechanics of learning through Self-Motivation Report (PENS) and participants' school record.
- **Step 2:** Find the relationship between creative components occurring during the game play and the academic record for pilot study.

CHAPTER 4

4.1. FACTOR ANALYSIS OF CREATIVE POTENTIAL GAME ACTIVITIES

The levels of creative problem solving that occur during game play and the determination of the game design elements are necessary to facilitate creative game play. Objects and resources manipulation within the games are a source of behavior variation across all components. Table 5 shows the actual factors that were extracted from all 16 variables. In the table 5, all factors account for 72.51 percent of the variability in all 16 variables.

The pilot testing of items should be performed to ensure that items that designed to measure a common construct are moderately correlated with one another and are correlated with the total scale score. If one item does not satisfy the moderate correlation constraint (e.g., $r \geq .20$) to other items in the construction process, that item tend to perform poorly in a factor analysis.

4.1.1. Factor Analysis

Table 4: Behavioral factor Total Variance Explained

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.789
Bartlett's Test of Sphericity	Approx. Chi-Square	1050.959
	df	120
	Sig.	.000

According to the table 4, Kaiser-Meyer > .5 (.789) is acceptable confident to use this data for factor analysis technique.

Table 5: Behavioral factor Total Variance Explained

Factor	Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	6.231	38.947	38.947
2	2.470	15.439	54.386
3	1.618	10.110	64.495
4	1.282	8.012	72.508

According to the table 5, Factor 1 accounts for 38.95% of the variability value of all 16 variables. Ten variables that are loaded strongly on this factor are Involvement (Task), Set breaking (Task), Pace (Task), Planning (Task), Playfulness (Task), Exploration (Task), Enjoyment(Task), Concentration (Task), Assuredness (Domain), Difficulty (Domain) and Wide focus (Creative).

Factor 2 accounts for 15.44% of the variability value of all 16 variables, five variables that are loaded strongly on this factor are Stability (Task), Exhibited uncertainty (Domain), Striving (Creative) and Concept identification (Creative).

Next, Factor 3 accounts for 10.11% of the variability value of all 16 variables. Stability in task motivation factor loaded the most strongly on this factor. Finally, Factor 4 accounts for 8.01% of the variability value in all 16 variables, Concrete focus in creative-relevant skill factor loaded the most strongly on this factor.

4.1.2. Strong Factor Component

This issue regarding to measured variables concerns the scale on which scores fall. Factor 1 finding refers to the player can work on solving the problem (Involvement game activity). The game play provides players to

manipulate materials; uses or attaches them in new combinations (Set breaking game activity). Speed during play game at which the participant works on tasks/challenges (Pace game activity) allows players to organize material; establishes an idea, order to build in (Planning game activity). Playfulness (Playfulness game activity) activities engage the player in tasks in the curious manner; trying out ideas in a carefree way and exploration (Exploration game activity) as curious, or playful testing out of ideas. The enjoyment (Enjoyment game activity) refers to the player has a good time experience, finding pleasure in the task / challenge and focusing on the task; not distracted (Concentration game activity). The task motivation game activities relates to the learning domain-relevant skills during play game. The results in the domain-relevant skills categories might be expected. Players are confidence: certainty of ability to complete task; assuredness in going about the task; not doubtful, timid, or anxious (Assuredness game activity). Player faces the problems within the game activities and reflexes the game tasks by making a negative statement (Difficulty game activity). The creative-relevant skill has a relationship between the effect of intrinsic motivation and domain-relevant skill required in game play activities. The creative-relevant skill allows the player to have a future oriented; restatement of problem given, self-imposed goal, and statement dealing with a desired final goal (Wide focus).

Factor 2 finding refers to that the player can work on refining the integrity or stability of a problem solution within the game (Stability game activity). The findings showed that the creative potential , in term of domain-relevant skill required, is self-initiated backtracked by using intentionally moves to previous locations or by revisiting a particular game task/challenge within the gameplay activity (Exhibited uncertainty game

activity). The factor related to the creative-relevant skills as a player can encounter the problems or obstacles so as to complete some or all of the tasks/challenges (Striving game activity) and can abrupt the changes in activities and transitions: movements to new action; includes place holding utterances (Concept identification game activity).

Table 6: Components Matrix of Creative Components

Component Matrix[a]				
	Factor			
Creative Component	**1**	**2**	**3**	**4**
Involvement (Task)	.753	-.257		-.131
Stability (Task)	.232	.705	.314	
Set breaking (Task)	.863			
Pace (Task)	.787	-.246		
Planning (Task)	.888	.149		.127
Playfulness (Task)	.830	.361	-.111	
Exploration (Task)	.843	.317		.111
Enjoyment (Task)	.804	.384		
Concentration (Task)	.790		.118	
Exhibited uncertainty (Domain)		.605	.569	
Assuredness(Domain)	.748	-.506		.185
Difficulty(Domain)	.298	-.461	.574	-.157
Wide focus(Creative)	.329		-.556	-.321
Striving(Creative)	-.257	.834		-.215
Concrete focus(Creative)		.131	-.328	.860
Concept identification(Creative)	.248	.295	-.515	-.328

4.2. CREATIVE PROTENTIAL TO DIGITAL GAME-BASED LEARNING

According to the timeline and data gathering, the pilot test adopted only 15 students. The unit outcomes of participants during study period were observed in order to evaluate logical skills (Math and Programming subjects)

and creative art skills (i.e. Animation Drawing subject). The principals and mechanisms involved in the game-based learning were splitted on the extent to which video games can impact upon overall academic achievement. The majority of the studies examine the impact of video games on student's motivation and their school records: programming, math and art subject. Participants played the game Gun Z 2: The second Duel online between their friends and Bots. In the experiments, gameplay finished in approximately 15 minutes in total and completed a Player Experience Needs Satisfaction (PENS) questionnaire (Przybylski et al., 2012) after playing.

4.2.1. Methodology

Fifteen pilot participants were involved in the study; one female and fourteen males. They were senior Interactive design and game development, Information Technology Faculty student that only few female enrolled in this course. Their ages were around 21 to 24. Most participants have played games more than 7 years and have enough games experiences to conduct the test. The participants were tested by playing game GunZ 2 mentioned before.

To examine the creative process, all participants were recorded by video while playing the game and a video coding scheme was then used to capture the type and frequency of observed behaviors and verbalizations. To ensure that all variables contributed equally, all frequency tally scores were standardized (Myers et al., 2010). It examines the impact of these activities on the player experience by evaluating school record outcomes during their study almost 4 years.

4.2.2. Data Analysis

4.2.2.1. Player experiences have an influence on people's creative process skills (H1).

The significant mean differences of PENS scores (Player experience) across creative components shown in Table 7 point out that players felt competence during involvement in the game. The autonomy scale assesses the degree to which participants felt free, and perceived opportunities to do activities that interest them with striving. In game relatedness, the scale assesses the desire to connect with the others in a way that feels authentic and supportive. These results show significant ($\alpha < .05$) player experiences that are significant to the concept identification within the game play. The intuitive control scale aims to assess the degree which participants control their character's actions in the game environment. These results show significant ($\alpha < .05$) player experiences that were significant to the concept identification and striving within the game play activities. These findings show that player experiences have an influence on people's creative process skills.

Table 7:The significant mean differences of PENS scores across creative components

ANOVA Between Group	Df.	F	Sig.
Involvement and Competence	9	7.698	.018
Striving and Autonomy	9	5.301	.040
Concept identification and Relatedness	7	5.003	.025
Striving and Intuitive Control	10	6.587	.042
Concept identification and Intuitive Control	10	6.305	.045

4.2.2.2. Game activities encourage people to learn more effectively (H2).

The significant mean differences of school record scores across creative components shown in Table 8 point out that players faced speed at the particular task which play a slow to fast gradient of task rate. The logical skills as programming subjects related how students organize game elements; establishes an idea, order to build in, and steps to take with in game activities.

Table 8:The significant mean differences of school record and creative components

ANOVA Between Group	Df.	F	Sig.
Programming and Pace	5	4.104	.032
Programming and Planning	4	5.649	.012
Art and Concept Identification	8	4.406	.044

These results show significant ($\alpha < .05$) the relationships between Art subject and creative-relevant skill as concept identification within the game play activities. These findings show that game activities encourage people to learn more effectively.

4.2.2.3. Game activities facilitate the creative process during the game play experiences (H3).

The finding identifies (in Table 9) a significant ($\alpha < .05$) player experience of playing game that were significantly with involvement (Task motivation), Exhibited uncertainly (Domain-relevant skill) and Concept identification (Creative-relevant skill) within the game play. The programming and mathematics results aim to assess the degree that a player has a logical thinking of learning. These results show a significant ($\alpha < .05$)

player learning that was significantly with exploration, wide focus, and concept identification within the game play.

Table 9:The significant mean differences of PENS scores across creative components Creative Potential and Learning Outcome

ANOVA Between Group	Df.	F	Sig.
Involvement and Year of Game Experience	3	8.103	.004
Exploration and Programming	5	7.784	.004
Exhibited uncertainly and Year of Game Experience	3	5.721	.013
Concept identification and Year of Game Experience	3	14.707	.000
Wide focus and Math	4	6.424	.008
Concept identification and Programming	5	9.068	.003

The creative-relevant skill encourages learning activity through the degree to which player has a logical thinking of learning (Involvement, Concept identification and Year of Game Experience). It appears that the ideal conditions for creativity are achieved within self-initiated backtracks by using intentionally moves to previous locations or revisits a particular game task/ challenge (Exhibited uncertainly and Year of Game Experience).

Table 10:The significant mean differences of PENS scores across creative components Creative Potential and Learning Outcome

ANOVA Between Group	Df.	F	Sig.
GPA and Competence	9	8.361	.015
GPA and Intuitive Control	10	5.977	.050

Table 10 shows the significant difference of learning outcome (GPA) within players' feeling competence and intuitive control during play games. These findings refer to game activities can facilitate individual's learning outcomes by using the creative process skills.

CHAPTER 5

5.1. DISCUSSION

The current study demonstrates that the existing measures and techniques can be effectively adapted to assess the creative processes occurring in the gameplay experiences.

In this study, creativity can be measured by examining domain-relevant and creativity-relevant skills, as well as task motivation during game play. As a result, this understanding will be able to apply to create a general method for designing new learning experiences. The method will identify crucial characteristics of the creative process that emerges during the process of playing games and mapping elements of games to the components of the creative process.

However, this study has focused on the puzzle games and action games, thus it could be questionable if the results are used to extrapolate beyond these genres. In the future works, the author will explore creativity in the gameplay process more generally. The design method produced will guide game designers in term of the game creation to facilitate people's creative thinking skills. It's seemed that 72.5 percent of all creative components within the game play activities can assess the creative processes behavior.

5.1.1. Guidelines for Digital Game Based Learning

As aforementioned, the guidelines presented herein are used to assist game developers to produce games that facilitate creative problem solving. In the guideline, firstly, learning outcomes have to be mapped to the mechanisms of learning that are identified for facilitating creative potential.

These conceptual guidelines are shown in the figure 3 as an overview of the Creative Potential of Learning Model (CPLN). In the figure, one can see that all principle concepts are linked into the circular module. In order to clearly understand the interrelationships between principles of learning and creative potential, the interpretation of the results is indispensible.

A game's ability to facilitate task motivation centers on the creating an environment that instils confidence to complete tasks and ensures that players have a logical skill to exploration their experiences.

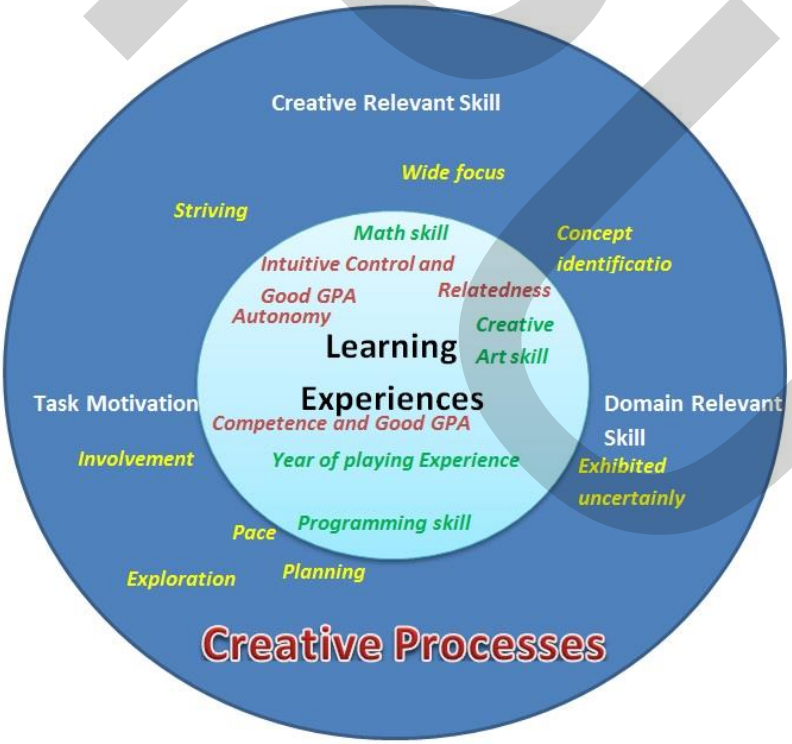

Figure 3 The Creative Potential of Learning Principles Model (CPLN).

From a creativity-relevant skills perspective included providing greater opportunities for players to take a striving while engaging in gameplay. This can be achieved by allowing activity that is the learning mechanisms (Striving and Autonomy; Striving and Intuitive Control). The results refer to the game activity experiences as intuitive control affects the learning outcome.

This can also may be achieved by allowing activity that is the future-oriented, to let players work through the problems that require facilitating interactions with others, and require feeling of intuitive control (Concept identification and Relatedness; Concept identification and Intuitive Control). The creative-relevant skills encourages learning activity through the degree to which player has a logical thought of learning (Concept identification and Creative Art skill; Wide focus and Math; Concept identification and Programming)

The tension parameter has been identified between providing an experience that encourages striving (creativity-relevant skills) and producing gameplay where the player finds it straight-forward to understand what they are required to do and how they might go about doing it (domain-relevant skills). In identifying process, it appears that the ideal conditions for creativity are achieved within self-initiated backtracks by using intentionally moves to previous locations or revisits a particular game task/challenge (Exhibited uncertainly and Year of Game Experience).

Task motivation activities results found that the game challenges effectively allowed for cognitive and logical thinking and strategic planning. There were multiple types of challenges available that players could approach in their own way and at players' own pace, the level of challenge was well matched to player skill level.

The subsequent step of the producing guideline is to map the game activity components to the mechanisms identified(Inchamnan et al., 2014), and learning skills in Figure 3. These guidelines are outlined below, notice that the creative component facilitated included in brackets.

- Ensure that the class includes clearly goals that allow students to develop their own sub-goals and problem solving skills (Wide focus, Math skill).
- Create challenges in the class that require logical thinking involvement and strategic planning in the class (complexity in problem solving, planning, refining problem solutions)
- Implement challenges that develop at an appropriate pace and match a student's skill level (facilitate striving activity, environments that instill feeling Autonomy)
- Implement rules that offer freedom of choices, where students have the options about what actions to use to solve a problem in the class lesson (wide focus, object use and manipulation, planning)
- Manage student errors by allowing supports for the recovery from errors, and by ensuring that the impact is minimal (facilitate striving activity, environments that instill confidence)
- Allow students to receive immediate and continuous feedback on their actions (environments that instill competence, understand what is required, clear pathways to complete lesson)

5.2 CONCLUSION

This study examines the activity of game potential for helping people to learn more effectively. The study maps the results of the analysis of

players engaging in creative problem solving during on line game play. The analysed data have been used to gain better understanding of how in-game activities influence a player's engagement in creative activity and learning. Furthermore, this study developed preliminary guidelines are proposed. The guidelines consider the specific ways that game developer can align learning mechanisms to support creative problem solving processes. The lesson activities should provide the involvement, exploration and planning during study. The class should be engaged the problem solving skills of striving, wide focus, concept identification and exhibited uncertainly.

Future works will investigate the applicability of the Creative Potential of Learning Model to other different game genres. More participants can enable the established models more optimized. Furthermore, the guidelines proposed will be applied and evaluated in the game development to support creative activity for educational purposes. Finally, the future work will focus on larger samples in order to find the factor analysis of how the game have potential to help people to learn more effectively in terms of creative processes.

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APPENDIX

ข้อมูลนักศึกษา

1. เพศ ☐ชาย ☐หญิง
2. อายุ ☐17-20ปี ☐21-24ปี ☐25-28ปี ☐29-32ปี ☐33-36ปี ☐37-40ปี ☐มากกว่า 41 ปี
3. ปัจจุบันเป็นนักศึกษาชั้นปีที่ ☐ปีที่ 1 ☐ปีที่ 2 ☐ปีที่ 3 ☐ปีที่ 4 ☐อื่นๆระบุ_____
4. ภูมิลำเนา_____
5. เกรดเฉลี่สะสม_____
6. วิชาที่ชอเรียน_____
7. นักศึกษามีประสบการณ์เล่นเกมมานานเท่าไหร

   ☐น้อยกว่า 1 ปี ☐1-3 ปี

   ☐3-5 ปี ☐5-7 ปี

   ☐มากกว่า 7 ปี ☐อื่นๆระบุ _____
8. นักศึกษาเล่มเกมคอมพิวเตอร์ช่วงเวลาใด

   ☐เช้าก่อนมาเรียน ☐ช่วงเวลาว่างในระหว่างเวลาเรียน

   ☐ช่วงเย็นหลังเลิกเรียน ☐ก่อนนอน

   ☐อื่นๆระบุ _____
9. นักศึกษาใช้เวลาเท่าไหรในการเล่นแต่ละครั้ง

   ☐น้อยกว่า 30 นาที☐30 นาที – 1 ชม.

   ☐1-3 ชม. ☐3-5 ชม.

   ☐5-7 ชม. ☐7-9 ชม.

   ☐9-11 ชม. ☐มากกว่า 10 ชม.
10. นักศึกษาเล่นเกมแนวไหน (ตอบได้มากกว่า 1 ข้อ)

    ☐RTS (Real-Time Strategy)

    ☐FPS (First Person Shooter)

    ☐TPS (Third Person Shooter)

    ☐Adventure Game

    ☐RPG (Role Playing Game)

☐MMORPG (Massive Multiplayer Online Role Playing Games)

☐ Sport

☐Puzzle Game

☐Arcade Game

☐Racing

☐Simulation

☐Fighting Game

☐Party Game

☐Rhythm Game

☐อื่นๆระบุ _____

11. นักศึกษาเล่นเกมบน Platform ไหน (ตอบได้มากกว่า 1 ข้อ)

☐ เกมเครื่องพื้นฐาน(Console)ระบุ_____

☐ เกมเครื่องพกพา (Handheld)

☐ เกมบนมือถือ รุ่น_____

☐ เกมบนเครื่อง PC

☐ อื่นๆระบุ _____

12. ให้นักศึกษาระบุเกมที่ชอบเล่นมาทั้งหมด 3 เกม

- _____
- _____
- _____

ข้อมูลความพึงพอใจ

ID_____

PENS	**1= Do Not Agree(ไม่เห็นด้วย), 7=Strongly Agree(เห็นด้วย)** 1 2 3 4 5 6 7						
PENS: Competence C1. I feel competent at the game. ผู้เล่นรู้สึกเชื่อมั่นว่าสามารถเล่นเกมได้							
C2. I feel very capable and effective when playing. ผู้เล่นรู้สึกว่าสามารถเล่นเกมได้ดีและมีประสิทธิภาพ							
C3. My ability to play the game is well matched with the game's challenges ความสามารถของผู้เล่นเหมาะสมกับด่านต่างๆในเกม							
PENS: Autonomy A1. The game provides me with interesting options and choices ในเกมเตรียมทางเลือกต่างๆ ให้ผู้เล่นอย่างน่าสนใจ							
A2. The game lets you do interesting things เกมให้ผู้เล่นรู้สึกสนใจที่จะเล่นเกม							
A3. I experienced a lot of freedom in the game ประสบการณ์ในเกมรู้สึกผู้เล่นมีอิสระในการเล่น							
PENS: Relatedness R1. I find the relationships I form in this game fulfilling. ผู้เล่นรู้สึกมีความสัมพันธ์กับเกม							
R2. I find the relationships I form in this game important. ผู้เล่นรู้สึกมีความสัมพันธ์กับเกมมีความสำคัญ							
R3. I don't feel close to other players. (-) ผู้เล่นรู้สึกไม่รู้สึกใกล้ชิดกับผู้เล่นคนอื่น							
Presence/Immersion P1. When playing the game, I feel transported to another time and place. ขณะเล่นเกมผู้เล่นรู้สึกปิติยินดีในช่วงเวลาและสถานที่นั้นๆในเกม							
P2. Exploring the game world feels like taking an actual trip to a new place. การท่องและค้นหาในเกมผู้เล่นรู้สึกเหมือนได้ไปในสถานที่ใหม่ๆ							
P3. When moving through the game world I feel as if I am actually there. ในขณะที่ผู้เล่นท่องไปในโลกของเกมผู้เล่นรู้สึกเหมือนอยู่ ณ ที่นั้นๆ จริงๆ							
P4. I am not impacted emotionally by events in the game (-). เหตุการณ์ในเกมไม่มีผลกระทบต่อจิดใจของผู้เล่น							
P5. The game was emotionally engaging. เกมโน้มน้าวใจผู้เล่น							
P6. I experience feelings as deeply in the game as I have in real life. ผู้เล่นรู้สึกว่าเกมเหมือนในชีวิต							

อย่างมาก							
P7. When playing the game I feel as if I was part of the story. ผู้เล่นรู้สึกว่าเป็นส่วนหนึ่งของเนื้อเรื่องในเกม							
P8. When I accomplished something in the game I experienced genuine pride. ประสบการณ์ในการเล่นเกมทำให้ผู้เล่นมีความภาคภูมิใจที่สามารถเล่นและแก้ปัญหาภายในเกมได้							
P9. I had reactions to events and characters in the game as if they were real. ผู้เล่นตอบสนองเหตุการณ์และตัวละครภายในเกมเหมือนในชีวิตจริง							
PENS: Intuitive Controls: I1. Learning the game controls was easy. สามารถเรียนรู้การควบคุมเกมได้ง่าย							
I2. The game controls are intuitive. การจัดการในเกมสร้างความคิดริเริ่มให้กับผู้เล่น							
I3. When I wanted to do something in the game, it was easy to remember the corresponding control. เมื่อผู้เล่นต้องการจะทำอะไรบ้างอย่างในเกมสามารถทำได้สะดวกเนื่องจากอุปกรณ์ควบคุมในเกมสอดคล้องกัน							

SPSS OUTPUT

```
MEANS TABLES=MeanA MeanA2 MeanA3 MeanA4 MeanA5 MeanA6 MeanA7 MeanA8 MeanA9 MeanB1 MeanB2 MeanB3 MeanC1
MeanC2 MeanC3 MeanC4 BY MC MA MR MP MI
  /CELLS=MEAN COUNT STDDEV
  /STATISTICS ANOVA.
```

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
MeanA * MC	Between Groups	(Combined)	13.058	9	1.451	7.698	.018
	Within Groups		.942	5	.188		
	Total		14.000	14			
MeanA2 * MC	Between Groups	(Combined)	3.773	9	.419	.675	.714
	Within Groups		3.106	5	.621		
	Total		6.879	14			
MeanA3 * MC	Between Groups	(Combined)	11.667	9	1.296	2.778	.137
	Within Groups		2.333	5	.467		
	Total		14.000	14			
MeanA4 * MC	Between Groups	(Combined)	11.699	9	1.300	3.826	.077
	Within Groups		1.699	5	.340		
	Total		13.397	14			
MeanA5 * MC	Between Groups	(Combined)	10.403	9	1.156	1.607	.313
	Within Groups		3.597	5	.719		
	Total		14.000	14			
MeanA6 * MC	Between Groups	(Combined)	4.128	9	.459	1.111	.480
	Within Groups		2.065	5	.413		
	Total		6.193	14			

MeanA7 * MC	Between Groups	(Combined)	7.312	9	.812	1.295	.407
	Within Groups		3.137	5	.627		
	Total		10.449	14			
MeanA8 * MC	Between Groups	(Combined)	10.805	9	1.201	2.776	.137
	Within Groups		2.163	5	.433		
	Total		12.967	14			
MeanA9 * MC	Between Groups	(Combined)	9.483	9	1.054	1.923	.244
	Within Groups		2.740	5	.548		
	Total		12.222	14			
MeanB1 * MC	Between Groups	(Combined)	4.173	9	.464	2.438	.169
	Within Groups		.951	5	.190		
	Total		5.123	14			
MeanB2 * MC	Between Groups	(Combined)	11.753	9	1.306	2.906	.126
	Within Groups		2.247	5	.449		
	Total		14.000	14			
MeanB3 * MC	Between Groups	(Combined)	2.181	9	.242	.530	.808
	Within Groups		2.285	5	.457		
	Total		4.466	14			
MeanC1 * MC	Between Groups	(Combined)	2.439	9	.271	4.572	.054
	Within Groups		.296	5	.059		
	Total		2.735	14			
MeanC2 * MC	Between Groups	(Combined)	2.742	9	.305	.898	.583
	Within Groups		1.696	5	.339		
	Total		4.438	14			

MeanC3 * MC	Between Groups	(Combined)	1.392	9	.155	.396	.892
	Within Groups		1.953	5	.391		
	Total		3.344	14			
MeanC4 * MC	Between Groups	(Combined)	7.885	9	.876	1.001	.530
	Within Groups		4.375	5	.875		
	Total		12.260	14			

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
MeanA * MR	Between Groups	(Combined)	6.865	7	.981	.962	.520
	Within Groups		7.135	7	1.019		
	Total		14.000	14			
MeanA2 * MR	Between Groups	(Combined)	.778	7	.111	.128	.993
	Within Groups		6.101	7	.872		
	Total		6.879	14			
MeanA3 * MR	Between Groups	(Combined)	7.292	7	1.042	1.087	.458
	Within Groups		6.708	7	.958		
	Total		14.000	14			
MeanA4 * MR	Between Groups	(Combined)	7.992	7	1.142	1.479	.309
	Within Groups		5.405	7	.772		
	Total		13.397	14			
MeanA5 * MR	Between Groups	(Combined)	5.492	7	.785	.646	.711
	Within Groups		8.508	7	1.215		
	Total		14.000	14			
MeanA6 * MR	Between Groups	(Combined)	2.488	7	.355	.671	.694

	Within Groups		3.706	7	.529		
	Total		6.193	14			
MeanA7 * MR	Between Groups	(Combined)	4.886	7	.698	.878	.566
	Within Groups		5.562	7	.795		
	Total		10.449	14			
MeanA8 * MR	Between Groups	(Combined)	5.757	7	.822	.798	.613
	Within Groups		7.210	7	1.030		
	Total		12.967	14			
MeanA9 * MR	Between Groups	(Combined)	7.179	7	1.026	1.424	.326
	Within Groups		5.043	7	.720		
	Total		12.222	14			
MeanB1 * MR	Between Groups	(Combined)	3.544	7	.506	2.243	.154
	Within Groups		1.580	7	.226		
	Total		5.123	14			
MeanB2 * MR	Between Groups	(Combined)	5.250	7	.750	.600	.742
	Within Groups		8.750	7	1.250		
	Total		14.000	14			
MeanB3 * MR	Between Groups	(Combined)	2.063	7	.295	.858	.577
	Within Groups		2.404	7	.343		
	Total		4.466	14			
MeanC1 * MR	Between Groups	(Combined)	.778	7	.111	.397	.877
	Within Groups		1.957	7	.280		
	Total		2.735	14			
MeanC2 * MR	Between Groups	(Combined)	1.063	7	.152	.315	.925
	Within Groups		3.376	7	.482		

	Total		4.438	14			
MeanC3 * MR	Between Groups	(Combined)	2.331	7	.333	2.302	.147
	Within Groups		1.013	7	.145		
	Total		3.344	14			
MeanC4 * MR	Between Groups	(Combined)	10.218	7	1.460	5.003	.025
	Within Groups		2.042	7	.292		
	Total		12.260	14			

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
MeanA * MI	Between Groups	(Combined)	13.058	10	1.306	5.543	.057
	Within Groups		.942	4	.236		
	Total		14.000	14			
MeanA2 * MI	Between Groups	(Combined)	4.818	10	.482	.935	.579
	Within Groups		2.061	4	.515		
	Total		6.879	14			
MeanA3 * MI	Between Groups	(Combined)	12.979	10	1.298	5.086	.065
	Within Groups		1.021	4	.255		
	Total		14.000	14			
MeanA4 * MI	Between Groups	(Combined)	11.765	10	1.176	2.883	.160
	Within Groups		1.633	4	.408		
	Total		13.397	14			
MeanA5 * MI	Between Groups	(Combined)	12.686	10	1.269	3.861	.102
	Within Groups		1.314	4	.329		

	Total		14.000	14			
MeanA6 * MI	Between Groups	(Combined)	4.796	10	.480	1.373	.407
	Within Groups		1.397	4	.349		
	Total		6.193	14			
MeanA7 * MI	Between Groups	(Combined)	6.034	10	.603	.547	.800
	Within Groups		4.415	4	1.104		
	Total		10.449	14			
MeanA8 * MI	Between Groups	(Combined)	9.890	10	.989	1.286	.436
	Within Groups		3.077	4	.769		
	Total		12.967	14			
MeanA9 * MI	Between Groups	(Combined)	10.261	10	1.026	2.092	.248
	Within Groups		1.962	4	.490		
	Total		12.222	14			
MeanB1 * MI	Between Groups	(Combined)	4.743	10	.474	4.986	.068
	Within Groups		.380	4	.095		
	Total		5.123	14			
MeanB2 * MI	Between Groups	(Combined)	6.432	10	.643	.340	.924
	Within Groups		7.568	4	1.892		
	Total		14.000	14			
MeanB3 * MI	Between Groups	(Combined)	3.307	10	.331	1.142	.488
	Within Groups		1.159	4	.290		
	Total		4.466	14			
MeanC1 * MI	Between Groups	(Combined)	1.267	10	.127	.345	.921
	Within Groups		1.468	4	.367		
	Total		2.735	14			

MeanC2 * MI	Between Groups	(Combined)	4.184	10	.418	6.587	.042
	Within Groups		.254	4	.064		
	Total		4.438	14			
MeanC3 * MI	Between Groups	(Combined)	2.913	10	.291	2.701	.175
	Within Groups		.431	4	.108		
	Total		3.344	14			
MeanC4 * MI	Between Groups	(Combined)	11.529	10	1.153	6.305	.045
	Within Groups		.731	4	.183		
	Total		12.260	14			

```
MEANS TABLES=ZGPA ZMath ZProgramming ZArt BY MeanA MeanA2 MeanA3 MeanA4 MeanA5 MeanA6 MeanA7 MeanA8 MeanA9
MeanB1 MeanB2 MeanB3 MeanC1 MeanC2 MeanC3 MeanC4
  /CELLS=MEAN COUNT STDDEV
  /STATISTICS ANOVA.
```

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
Zscore(GPA) * MeanA4	Between Groups	(Combined)	6.689	5	1.338	1.647	.243
	Within Groups		7.311	9	.812		
	Total		14.000	14			
Zscore(Math) * MeanA4	Between Groups	(Combined)	7.834	5	1.567	2.287	.133
	Within Groups		6.166	9	.685		
	Total		14.000	14			
Zscore(Programming) * MeanA4	Between Groups	(Combined)	9.732	5	1.946	4.104	.032
	Within Groups		4.268	9	.474		
	Total		14.000	14			

Zscore(Art) * MeanA4	Between Groups	(Combined)	3.741	5	.748	.656	.665
	Within Groups		10.259	9	1.140		
	Total		14.000	14			

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
Zscore(GPA) * MeanA5	Between Groups	(Combined)	6.615	4	1.654	2.239	.137
	Within Groups		7.385	10	.739		
	Total		14.000	14			
Zscore(Math) * MeanA5	Between Groups	(Combined)	6.248	4	1.562	2.015	.168
	Within Groups		7.752	10	.775		
	Total		14.000	14			
Zscore(Programming) * MeanA5	Between Groups	(Combined)	9.705	4	2.426	5.649	.012
	Within Groups		4.295	10	.429		
	Total		14.000	14			
Zscore(Art) * MeanA5	Between Groups	(Combined)	2.097	4	.524	.440	.777
	Within Groups		11.903	10	1.190		
	Total		14.000	14			

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
Zscore(GPA) * MeanC4	Between Groups	(Combined)	8.860	8	1.108	1.293	.388
	Within Groups		5.140	6	.857		
	Total		14.000	14			
Zscore(Math) * MeanC4	Between Groups	(Combined)	10.723	8	1.340	2.454	.145
	Within Groups		3.277	6	.546		
	Total		14.000	14			
Zscore(Programming) * MeanC4	Between Groups	(Combined)	7.694	8	.962	.915	.559
	Within Groups		6.306	6	1.051		
	Total		14.000	14			
Zscore(Art) * MeanC4	Between Groups	(Combined)	11.963	8	1.495	4.406	.044
	Within Groups		2.037	6	.339		
	Total		14.000	14			

```
MEANS TABLES=MeanA MeanA2 MeanA3 MeanA4 MeanA5 MeanA6 MeanA7 MeanA8 MeanA9 BY Age Year YearofExperience
TimetoPlay Duration GPA Math Programming Art
  /CELLS=MEAN COUNT STDDEV
  /STATISTICS ANOVA.
```

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
MeanA * YearofExperience	Between Groups	(Combined)	9.638	3	3.213	8.103	.004
	Within Groups		4.362	11	.397		
	Total		14.000	14			
MeanA2 * YearofExperience	Between Groups	(Combined)	.426	3	.142	.242	.865
	Within Groups		6.453	11	.587		
	Total		6.879	14			
MeanA3 * YearofExperience	Between Groups	(Combined)	8.663	3	2.887	5.951	.012
	Within Groups		5.337	11	.485		
	Total		14.000	14			
MeanA4 * YearofExperience	Between Groups	(Combined)	6.200	3	2.067	3.159	.068
	Within Groups		7.197	11	.654		
	Total		13.397	14			
MeanA5 * YearofExperience	Between Groups	(Combined)	3.002	3	1.001	1.001	.429
	Within Groups		10.998	11	1.000		
	Total		14.000	14			
MeanA6 * YearofExperience	Between Groups	(Combined)	1.821	3	.607	1.527	.262
	Within Groups		4.372	11	.397		
	Total		6.193	14			
MeanA7 * YearofExperience	Between Groups	(Combined)	4.429	3	1.476	2.698	.097

	Within Groups		6.020	11	.547		
	Total		10.449	14			
MeanA8 * YearofExperience	Between Groups	(Combined)	6.309	3	2.103	3.474	.054
	Within Groups		6.659	11	.605		
	Total		12.967	14			
MeanA9 * YearofExperience	Between Groups	(Combined)	4.072	3	1.357	1.832	.200
	Within Groups		8.150	11	.741		
	Total		12.222	14			

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
MeanA * Programming	Between Groups	(Combined)	4.308	5	.862	.800	.577
	Within Groups		9.692	9	1.077		
	Total		14.000	14			
MeanA2 * Programming	Between Groups	(Combined)	2.172	5	.434	.830	.559
	Within Groups		4.708	9	.523		
	Total		6.879	14			
MeanA3 * Programming	Between Groups	(Combined)	6.854	5	1.371	1.727	.224
	Within Groups		7.146	9	.794		
	Total		14.000	14			
MeanA4 * Programming	Between Groups	(Combined)	6.425	5	1.285	1.659	.240
	Within Groups		6.973	9	.775		
	Total		13.397	14			

MeanA5 * Programming	Between Groups	(Combined)	7.014	5	1.403	1.807	.208
	Within Groups		6.986	9	.776		
	Total		14.000	14			
MeanA6 * Programming	Between Groups	(Combined)	3.070	5	.614	1.770	.215
	Within Groups		3.123	9	.347		
	Total		6.193	14			
MeanA7 * Programming	Between Groups	(Combined)	6.297	5	1.259	2.730	.090
	Within Groups		4.152	9	.461		
	Total		10.449	14			
MeanA8 * Programming	Between Groups	(Combined)	10.532	5	2.106	7.784	.004
	Within Groups		2.435	9	.271		
	Total		12.967	14			
MeanA9 * Programming	Between Groups	(Combined)	5.884	5	1.177	1.671	.237
	Within Groups		6.338	9	.704		
	Total		12.222	14			

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
MeanB1 * YearofExperience	Between Groups	(Combined)	3.122	3	1.041	5.721	.013
	Within Groups		2.001	11	.182		
	Total		5.123	14			
MeanB2 * YearofExperience	Between Groups	(Combined)	2.578	3	.859	.827	.506
	Within Groups		11.422	11	1.038		
	Total		14.000	14			

MeanB3 * YearofExperience	Between Groups	(Combined)	.425	3	.142	.386	.766
	Within Groups		4.041	11	.367		
	Total		4.466	14			

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
MeanC1 * YearofExperience	Between Groups	(Combined)	.080	3	.027	.110	.952
	Within Groups		2.655	11	.241		
	Total		2.735	14			
MeanC2 * YearofExperience	Between Groups	(Combined)	1.198	3	.399	1.356	.307
	Within Groups		3.240	11	.295		
	Total		4.438	14			
MeanC3 * YearofExperience	Between Groups	(Combined)	1.058	3	.353	1.697	.225
	Within Groups		2.286	11	.208		
	Total		3.344	14			
MeanC4 * YearofExperience	Between Groups	(Combined)	9.813	3	3.271	14.707	.000
	Within Groups		2.447	11	.222		
	Total		12.260	14			

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
MeanC1 * Math	Between Groups	(Combined)	1.969	4	.492	6.424	.008
	Within Groups		.766	10	.077		

	Total		2.735	14			
MeanC2 * Math	Between Groups	(Combined)	1.360	4	.340	1.104	.407
	Within Groups		3.079	10	.308		
	Total		4.438	14			
MeanC3 * Math	Between Groups	(Combined)	.860	4	.215	.866	.517
	Within Groups		2.484	10	.248		
	Total		3.344	14			
MeanC4 * Math	Between Groups	(Combined)	1.963	4	.491	.477	.752
	Within Groups		10.297	10	1.030		
	Total		12.260	14			

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
MeanC1 * Programming	Between Groups	(Combined)	1.210	5	.242	1.428	.302
	Within Groups		1.525	9	.169		
	Total		2.735	14			
MeanC2 * Programming	Between Groups	(Combined)	1.553	5	.311	.969	.485
	Within Groups		2.886	9	.321		
	Total		4.438	14			
MeanC3 * Programming	Between Groups	(Combined)	1.303	5	.261	1.148	.403
	Within Groups		2.042	9	.227		
	Total		3.344	14			
MeanC4 * Programming	Between Groups	(Combined)	10.229	5	2.046	9.068	.003
	Within Groups		2.031	9	.226		
	Total		12.260	14			

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
Zscore(GPA) * MeanA4	Between Groups	(Combined)	6.689	5	1.338	1.647	.243
	Within Groups		7.311	9	.812		
	Total		14.000	14			
Zscore(Math) * MeanA4	Between Groups	(Combined)	7.834	5	1.567	2.287	.133
	Within Groups		6.166	9	.685		
	Total		14.000	14			
Zscore(Programming) * MeanA4	Between Groups	(Combined)	9.732	5	1.946	4.104	.032
	Within Groups		4.268	9	.474		
	Total		14.000	14			
Zscore(Art) * MeanA4	Between Groups	(Combined)	3.741	5	.748	.656	.665
	Within Groups		10.259	9	1.140		
	Total		14.000	14			

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
Zscore(GPA) * MeanA5	Between Groups	(Combined)	6.615	4	1.654	2.239	.137
	Within Groups		7.385	10	.739		
	Total		14.000	14			
Zscore(Math) * MeanA5	Between Groups	(Combined)	6.248	4	1.562	2.015	.168
	Within Groups		7.752	10	.775		

	Total		14.000	14			
Zscore(Programming) * MeanA5	Between Groups	(Combined)	9.705	4	2.426	5.649	.012
	Within Groups		4.295	10	.429		
	Total		14.000	14			
Zscore(Art) * MeanA5	Between Groups	(Combined)	2.097	4	.524	.440	.777
	Within Groups		11.903	10	1.190		
	Total		14.000	14			

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
Zscore(GPA) * MeanC4	Between Groups	(Combined)	8.860	8	1.108	1.293	.388
	Within Groups		5.140	6	.857		
	Total		14.000	14			
Zscore(Math) * MeanC4	Between Groups	(Combined)	10.723	8	1.340	2.454	.145
	Within Groups		3.277	6	.546		
	Total		14.000	14			
Zscore(Programming) * MeanC4	Between Groups	(Combined)	7.694	8	.962	.915	.559
	Within Groups		6.306	6	1.051		
	Total		14.000	14			
Zscore(Art) * MeanC4	Between Groups	(Combined)	11.963	8	1.495	4.406	.044
	Within Groups		2.037	6	.339		
	Total		14.000	14			

ตัวอย่างผลการเรียนนักศึกษา

มหาวิทยาลัยธุรกิจบัณฑิตย์

โครงสร้างหลักสูตร

คณะ เทคโนโลยีสารสนเทศ สาขาวิชาการออกแบบเชิงโต้ตอบและการพัฒนาเกม หน้าที่ : 1 / 2

หลักสูตร 4 **ปี** 138 **หน่วยกิต** 31/07/2557

รายวิชา	นก./เกรด/แต้ม	รายวิชา	นก./เกรด/แต้ม
กลุ่มวิชาศึกษาทั่วไป 30 หน่วยกิต		FA208 การวาดภาพ 1	3/B /9.0
กลุ่มวิชามนุษยศาสตร์ 6 หน่วยกิต		GT201 การออกแบบเชิงโต้ตอบและการพัฒนาเกมเบื้	3/C+/7.5
กลุ่มวิชามนุษยศาสตร์ (บังคับ) 3 หน่วยกิต		GT202 คณิตศาสตร์สำหรับนักพัฒนาเกม	3/D /3.0
GE120 พลศึกษาเพื่อคุณภาพชีวิต	1/C+/2.5	GT203 การวาดภาพสำหรับการพัฒนาแอนิเมชั่นและ	3/B /9.0
GE139 องค์รวมแห่งชีวิต	1/B+/3.5	GT204 แนวคิดการเขียนโปรแกรมคอมพิวเตอร์	3/D+/4.5
IL103 สารสนเทศเพื่อการค้นคว้า	1/B /3.0	GT205 แนวคิดและการออกแบบเกม	3/C+/7.5
กลุ่มวิชามนุษยศาสตร์ (เลือก) 3 หน่วยกิต		GT206 เทพปกรณัมกับการพัฒนาเกม	3/C+/7.5
GE121 มนุษย์กับการใช้เหตุผล	3/__/____	GT207 กฎหมายและจรรยาบรรณทางวิชาชีพพัฒนาเ	3/B+/10.5
GE122 ปรัชญากับชีวิต	3/C /6.0	GT208 การเขียนแผนธุรกิจธุรกิจสำหรับสื่อโต้ตอบแล	3/C /6.0
GE123 ไทยศึกษา	3/__/____	LA201 ภาษาอังกฤษเพื่อจุดประสงค์เฉพาะ 1	3/C+/7.5
GE124 ภูมิปัญญาไทย	3/__/____	LA202 ภาษาอังกฤษเพื่อจุดประสงค์เฉพาะ 2	3/C+/7.5
GE131 อารยธรรมโลก	3/__/____	กลุ่มวิชาเอก 45 หน่วยกิต	
กลุ่มวิชาสังคมศาสตร์ 9 หน่วยกิต		FA209 การวาดภาพ 2	3/C+/7.5
กลุ่มวิชาสังคมศาสตร์ (บังคับ) 6 หน่วยกิต		GD303 การออกแบบกราฟิกเบื้องต้น	3/D+/4.5
BA102 การวิเคราะห์และการทำแผนธุรกิจ	3/D+/4.5	GD304 การออกแบบตัวอักษร 1	3/C /6.0
LW102 ความรู้เบื้องต้นเกี่ยวกับกฎหมาย	3/D+/4.5	GT301 โครงเรื่องดิจิตอล	3/B /9.0
กลุ่มวิชาสังคมศาสตร์ (เลือก) 3 หน่วยกิต		GT302 คอมพิวเตอร์กราฟิกและแอนิเมชั่น	3/C /6.0
BA101 การจัดการธุรกิจสำหรับผู้ประกอบการใหม่	3/__/____	GT303 แบบตัวละครดิจิตอล	3/B+/10.5
GE125 การเมือง เศรษฐกิจ และสังคม	3/__/____	GT304 การออกแบบส่วนอินเทอร์เฟสเกม	3/C+/7.5
GE126 จิตวิทยาเพื่อคุณภาพชีวิต	3/C+/7.5	GT305 การออกแบบวัตถุและเครื่องมือดิจิตอล	3/C /6.0
GE137 จิตสำนึกสาธารณะเพื่อชุมชน	3/__/____	GT306 การออกแบบสภาพแวดล้อมและระดับ	3/D+/4.5
กลุ่มวิชาวิทยาศาสตร์และคณิตศาสตร์ 6 หน่วยกิต		GT307 วีดีโอและเสียงดิจิตอลสำหรับการผลิตเกม	3/C /6.0
MA103 คณิตศาสตร์และสถิติในชีวิตประจำวัน	3/D+/4.5	GT308 การจัดการโครงงานสำหรับการผลิตเกม	3/C /6.0
SC103 วิทยาศาสตร์และเทคโนโลยีเพื่อคุณภาพชีวิตแ	3/C /6.0	GT309 เครื่องประมวลผลเกม	3/D /3.0
กลุ่มวิชาภาษา 9 หน่วยกิต		GT310 การวิจารณ์และวิเคราะห์การออกแบบเกม	3/C /6.0
LA010 ภาษาอังกฤษปรับพื้นฐาน	-/S /0.0	GT311 โครงงานพัฒนาเกม 1	3/C /6.0
LA101 ภาษาอังกฤษ 1	3/A /12.0	GT312 โครงงานพัฒนาเกม 2	3/C+/7.5
LA102 ภาษาอังกฤษ 2	3/C /6.0	กลุ่มวิชาเลือก 15 หน่วยกิต	
TH103 ทักษะการสื่อสารภาษาไทย	3/D+/4.5	AD301 การโฆษณาและพฤติกรรมผู้บริโภค	3/__/____
กลุ่มวิชาแกน 42 หน่วยกิต		BT321 การสร้างภาพระบบดิจิตอล	3/__/____
FA201 สุนทรียศิลป์	3/D+/4.5	BT322 การถ่ายภาพระบบดิจิตอล	3/__/____
FA205 ศิลปะไทย	3/D /3.0	BT323 การทำธุรกิจสื่อประสม	3/__/____
FA207 องค์ประกอบศิลป์	3/C+/7.5		

หมายเหตุ เอกสารฉบับนี้ใช้สำหรับภายในมหาวิทยาลัยเท่านั้น กรุณาตรวจสอบความถูกต้องของรายวิชาตามระเบียบการและหลักสูตรของปีการศึกษาที่นักศึกษาเริ่มเข้าศึกษา

มหาวิทยาลัยธุรกิจบัณฑิตย์

โครงสร้างหลักสูตร

คณะ เทคโนโลยีสารสนเทศ สาขาวิชาการออกแบบเชิงโต้ตอบและการพัฒนาเกม

หลักสูตร 4 **ปี** 138 **หน่วยกิต** 31/07/2557

รายวิชา	นก./เกรด/แต้ม	รายวิชา	นก./เกรด/แต้ม
BT345 การออกแบบกราฟิกสำหรับเว็บไซต์	3/D+/4.5		
BT401 การศึกษาตามแนวแนะ	3/__/____		
BT402 หัวข้อพิเศษเกี่ยวกับระบบสื่อประสม	3/__/____		
GT351 เทคนิคแสงและมุมกล้องดิจิตอล	3/C /6.0		
GT352 เทคนิคการจัดการพื้นผิวขององค์ประกอบ	3/C /6.0		
GT353 การออกแบบเว็บไซต์เชิงโต้ตอบ	3/D /3.0		
GT354 การพัฒนาแฟ้มภาพผลงาน	3/C /6.0		
GT355 การเขียนโปรแกรมภาษาซี	3/__/____		
GT356 การเขียนโปรแกรมภาษาซีพลัสพลัส	3/__/____		
GT357 การเขียนโปรแกรมเกมแบบสองมิติ	3/__/____		
GT358 การเขียนโปรแกรมเกมแบบสามมิติ	3/__/____		
GT410 สหกิจศึกษา	6/__/____		
IT207 ธุรกิจอิเล็กทรอนิกส์	3/C /6.0		
MK201 หลักการตลาด	3/__/____		
รายวิชาที่รอการตรวจสอบหมวดวิชา			
GE356 การกีฬาเพื่อสุขภาพ	3/B /9.0		

ปัจจุบัน : **หน่วยกิตสะสมที่สอบผ่านและไม่ผ่านรวม** : 138 **นก.** **แต้มสะสม** : 295.50 **แต้ม**

หน่วยกิตสะสมเฉพาะที่สอบผ่าน : 138 **นก.** **แต้มเฉลี่ยสะสม** : 2.14 **แต้ม**