Applying a grammatical structure to practice game design on non-computer games

Ke-Chen Pong
Asia University
500, Liufeng Rd., Wufeng, Taichung,
Taiwan 41354
+886 986466261

kechenpong@gmail.com

Miguel Tsai
Asia University
500, Liufeng Rd., Wufeng, Taichung,
Taiwan 41354
+886 929716414

miguel@asia.edu.tw

ABSTRACT

In this paper, we propose a pedagogical approach based on the grammar of sentence to teach introductory game design course. Different from the conventional courses based on developing computer games to carry out game design, we advocate to introducing game design by exercising non-computer games. We debate for those inappropriate employments of exercising non-computer games for learning game design where non-computer games are considered either as a trade-off solution or as a replacement for video game courses. In our approach, we elucidate the importance of understanding the core idea of a game by executing the game analysis to extract an identical sentence of the game on the first stage. This notion is then progressively brought to every stage of the course. On the second stage, we introduce an exercise on the activity game to exploit students' ability in conceiving the game interaction in a face-to-face multi-player environment.

We transfer this interactive experience obtained to conduct an advanced training on developing board games on the third stage. The grammatical approach is then introduced to interpret the idea of core sentence to benefits the development of their board game projects. We illustrate specific examples of each stage to describe the learned experience and the progress made by students. A final evaluation on their projects is reported. We elucidate the contribution of applying the grammatical approach to enroll students in the major of game design. Exercising game design on the board games via our proposed approach, we have demonstrated a fundamental way for students to realize how to structure their game.

Categories and Subject Descriptors

K.8 [**Personal computing**]: Games

General Terms

Design, Theory, Experimentation.

Keywords

Game design, non-computer game, grammatical structure

1. INTRODUCTION

The appealing content of computer games makes students have gained rich gaming experience and potentially become a "gamer" in a specific type of game. This kind of addiction to games may positively have students intrigued by game-related majors to explore the game creation; however, being a gamer may not equal to being a game designer and the enjoyment of rich gaming experience does not stand for realizing the original idea of the game design. An appropriate pedagogical approach is thus indispensable to conduct students concepting games.

Game design courses are considered as a key element in the curriculum offered by computer science and game related departments in universities. Certain education methodologies such as team-working [1,2,3,4] or studio-based learning [5] have been applied to this kind of course in order to motivate students in developing games. Other methodology such as interdisciplinary collaboration between different departments has also been applied to provide benefits brought by students from different background [7,8,9]. However, the position of the game course varies from different departments; for computer science departments. Computer game courses play an attractive role of motivating students to understand the knowledge of computer science involved in the game development [4,6] while design-related departments used to focus on offering more fundamental knowledge in design thinking and having students understand the nature of games so that they will be able to embody their idea to all kinds of media.

2. DEBATE OF APPROACH USING NON COMPUTER GAMES

Until now, game design courses tend to integrate the training of programming in the game creation so that students will be able to prototype their final implementation via digital medium. Beyond such programming-required training, carrying out non-computer games is also widely applied to game design courses to exercise the procedure of developing games. However, certain bias may have been made in running non-computer game as a pedagogical approach for game design courses.

In the case study of Whitehead [6], the main reason to involve non-computer game projects in this introductory game design course is owing to its advantage of being less time consuming compared to computer game projects. Moreover, even students have accomplished the analysis to develop non-computer games, we doubt if the applied pedagogical approach is clear enough for student to understand the characteristic and the core idea in game design in order to develop their game idea. Another case study is reported by Barba et al. [4] that exercising non-computer games is employed as a brainstorming tool for inspiring creativity for their AR computer game projects. A more deliberate approach is conducted to analyze non-computer games in terms of different aspects. However, the negative feedback toward this exercise is reported because analysis of non-computer games fails to inspire students of creativity for their computer game projects.

As a result, accomplishing non-computer game projects plays a role either as a small-scaled project or as a part of brainstorming practice involved in computer game projects. The main flaw of these pedagogical approaches is the lack of methodology allowing students to realize the original concept and being able to apply learned knowledge from non-computer games to their game creation. We contradict this misled pedagogical approach where students are often rushed to conduct game analysis without realizing exactly how and what they can learn from the analysis result to benefit developing their projects.

Moreover, although computer and non-computer games may have certain characteristics in common, it does not mean that they are the substitute to each other in game education. Specific pedagogical approach should be developed to deal with games on different medium.

3. CONTENT OVERVIEW

In this article, we describe an introductory game design class offered by the department of media and design in Asia University in Taiwan. This is an optional course entitled "introductory game design" for 60 sophomores. We aim to introduce and to exercise the procedure of game creation via studying and developing non-computer games. The reason to exclude computer games in this course is to achieve two pedagogical goals. The first goal is to strengthen students' understanding toward the central idea of game creation and clarify the game rule via exercising non-computer games. This goal equally allows students to working on the fundamental game design instead of immediately digging into complex structure of computer games on this early stage. The second goal is to take advantage of non-digital prototyping to fully implement student's game idea. This goal equally allows students to working on the fundamental gamed design instead of confronting potential difficulties in programming.

4. DESIGNING CURRICULUM

The principle of carrying out this course is to offer different trainings to understand the core idea of a game from the game analysis. We introduce different training phases to progressively involve students in the procedure of game creation. We firstly present "defining games" where the notion and the method of understanding a central idea are introduced. Further, students are guided to the second stage of "party games" that we describe how to present a game idea by exercising the party game with the audience.

The notion of training on a game's central idea is extended to the stage of board game where students conduct game analysis of monopoly, a classic board game, by extracting the game elements. An exercise of manipulating game elements is provided before each group starting to develop their games. Certain requirements of final evaluation are described and we report the evaluation result in the last section. We mention how to protect student's idea by introducing the contract of copyright on game creation. The detail of the curriculum is shown in **Tab.1**.

Furthermore, we illustrate the entire pedagogical approach in **Fig.1** where the point of each stage is elucidated and students are progressively involved in the training on each stage.

Table 1. Game course planning

Name of stage	Number of week(s) employed	Goal
Defining games	2	Identify the central idea of a game
Activity games	3	Conceiving the game interaction in a multi-player environment
Board games	10	Integrated training of a game project
		Evaluating both prototype and game documents
		Understanding of protecting the game creation
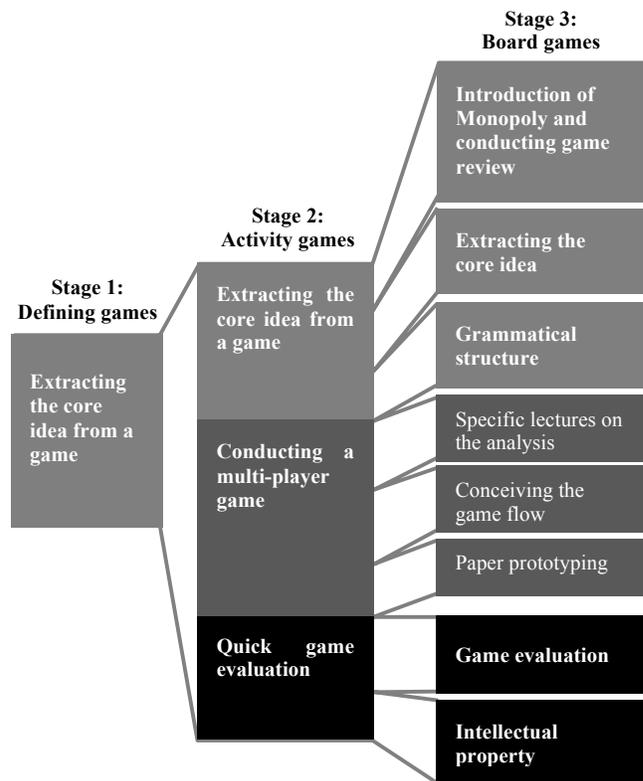
Figure 1. Overview of the course.

4.1 Defining games

On this stage, our goal is to provide a training to extract an identical sentence of a game by executing a game analysis in terms of different aspects. When most of the students in the class have already accumulated lots of gaming experience by spending time playing video games, some of them have become so-called "hardcore gamers" in the specific game category. A classic phenomenon comes to these hardcore gamers that they consider themselves to be "experts" in their favorite games and able to conceive a novel game idea by themselves [10,11,12]. However, a gamer is not equal to a game designer and the gaming experience basing on making a fetish of a certain game may not benefit developing a novel game idea [13].

Table 2. Content of analysis and steps

Step	Content
1	1. The name of the game 2. The year and the date of launch 3. On what kind of platform, what kind of game it is (FPS, RPG, MMORPG, Strategy, Simulation, Adventure.. etc.) 4. The story in the game 5. The art style in the game 6. The main characters in the game 7. A game flow that can show the player experience in the game
2	A simple sentence that can describe the core concept of the game.

Therefore we started from carrying out the game analysis where students could obtain essential information to extract the identical sentence of the game. Students were asked to form a team of 10 persons and each group had a 20-minute presentation of the chosen video game in order to share their analysis and their decided core sentence. Requirement of the game analysis is shown in **Tab.2.** At the end of each presentation, the instructor leads all the students to verify if their extracted identical sentence is correct by iteratively reviewing their analysis result.

For example, "Super Mario Bros" the third version launched in 1985 on the NES console, one of our student groups considered the core sentence to be "Mario walks to take the flag from the flagpole". However, students were asked to review their analysis from the game story and the game flow to refine the core sentence. In the end, a simple sentence that can describe the whole game and every single level should be: "Mario walks from the outside of the castle to the inside of the castle in order to save princess Peach."

At the beginning, students seem to have difficulty to identify the short sentence for describing the whole video game; nevertheless, this difficulty is progressively been reduced in party game and in board game section. This practice allows establishing a fundamental knowledge of examining all the game content to realize the original game idea.

4.2 Activity games

After 2 weeks of training of analysis on commercial video games, we turn to launch another exercise on how to express a game idea via playing activity games with the audience. This is an extended part from the former practice on extracting the core sentence of a game. We advocate that activity games are a fundamental practice to demonstrate how to create an interactive gaming experience in a face-to-face multi-player environment. Such practice may potentially be a reflection on current multi-player computer games. This stage is a linchpin that brings students the initial interactive experience before carrying out game design in more details on the next stage.

The "activity game experience" is operated within three weeks. In the first week, the instructor demonstrated how to involve the audience to exercise an activity game and a schedule was
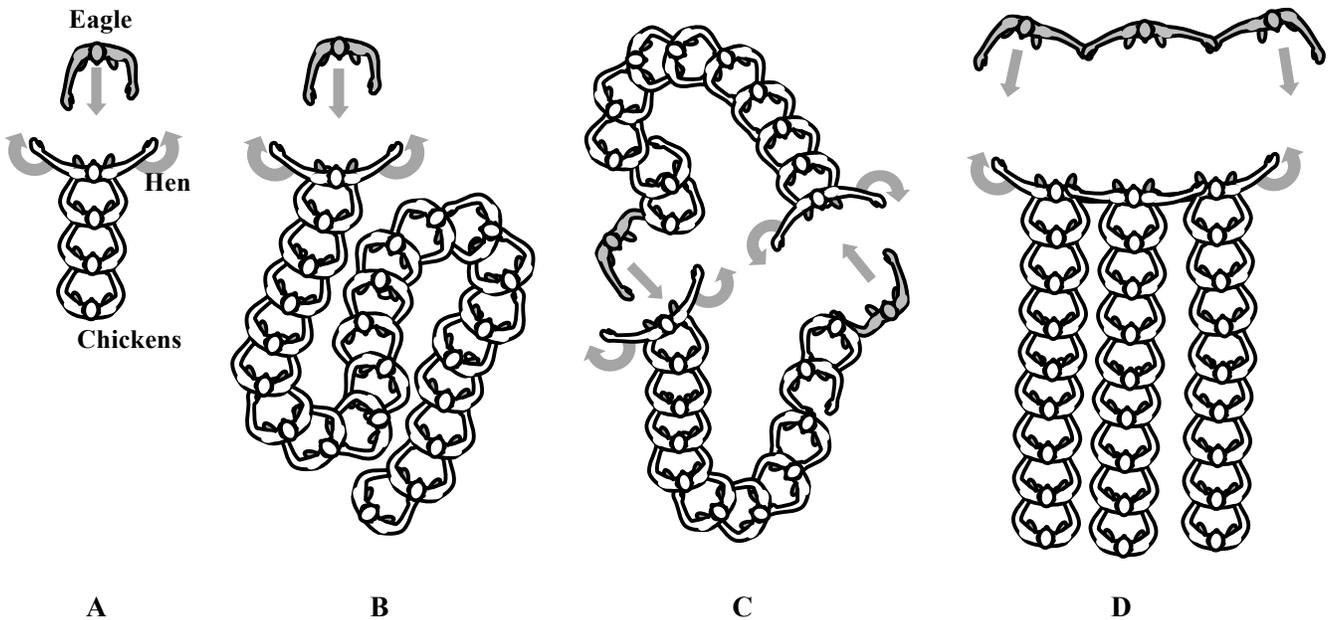
Figure 2. Game play of "Eagle Attack",

(A) Original version, (B) Scaled version, (C) First refined version, (D) Suggested version

organized in order to make sure if each team had their run to lead one activity game. For the other two weeks, students by group start to pick up an activity game. Their mission is to present the game to the class and involve the audience to play together.

A paper report is demanded for the audience after playing different activity games. The content of the report is as follows:

- The name of the game
- Define a simple sentence for the game
- Describe the presented game flow of the activity
- Describe the fun point of presented game
- Suggestions for the presented game

One of activity games demonstrated by students is called "Eagle Attack". This is a cultural game where three roles (an eagle, a hen and several chicken) are played. The gameplay is carried out by a hen protecting her chicken from being attacked by an eagle, and in a limited time the eagle has to grab the chicken behind the hen. Once there are less than 3 chickens behind the hen, the eagle wins the game. The original game play is illustrated in Fig. 2A. The fun point of this activity game goes to the synchronized reaction of the hen and chicken against eagle's attack.

At first, most of the students in the class are led to play the role of the chicken and only one two students conduct the eagle and the hen. Such arrangement, illustrated in Fig.2B, scales the game and makes it too easy for the eagle to catch the chicken due to the long line composed by students. This arrangement also makes the game less interesting and the game ends up too fast so that most students feel less involved in this game.

Later, illustrated in Fig.2C, they refine the gameplay where both the eagle and the hen lead their children, only the last child of the eagle or the hen goes to crab the children of the other side. Therefore students are divided into three groups and each group conduct the new gameplay. Although this refinement allows students to be much involved in the game, this refined gameplay has a trade-off in reducing the enjoyment of "playing together"; students are rather playing separately by groups.

Lots of suggestions are proposed in their report and an open discussion is carried out in another class time. We conducted a suggested version of the game in the class in order to verify if the game is improved. The final gameplay is shown in Fig.2D.

5. BOARD GAMES

With all the teams finished running their turns to lead a party game to the class, the course entered the "board game design period". This stage contains 10 weeks including specific lectures, idea development and prototyping. In this phase, we aim to introduce the classic board game Monopoly as a reference for students to develop their own projects. Monopoly is the oldest board game that can track back to the early 1900s, Monopoly nowadays is the most played commercial board game in the world, with at least 30 years of the game development, Monopoly maintains a strong mechanics of game play to learn the student reflect more on the game flow [12].

Several pedagogical goals are set up for students on this stage. Firstly, students are demanded to playing Monopoly and to conducting game review. An oral presentation is specified with the following requirements:

- Define the simple sentence for the board game of choice
- Prove the simple sentence that is applicable to the whole game
- Find the game flow of the board game
- Indicate the fun point

The reason of playing Monopoly is to quickly realize the game flow and to facilitate figuring out the core sentence of the game. With the experience learned from the former stages, students are more familiar with this approach and encounter less difficulty in identifying the core sentence.

The second pedagogical goal is to provide lectures to reinforce the game review executed by students and to bridge the core sentence to the game play of the board game. When the practice of extracting the core sentence was introduced to the first stage, students were only demanded to roughly figure out a sentence to identify the game. Here we begin to involve the grammatical structure (subject + verb + adverb) to re-interpret the notion of core sentence in a game. Take the former example of Mario, where "Mario walks from the outside of the castle to the inside of the castle in order to save princess Peach." Mario refers to the subject and walking is an action (a verb = walk) with an adverb phrase of "from the outside of the castle to the inside of the castle in order to save princess Peach". The core sentence interpreted by the grammatical structure turns to reveal and to underline the fundamental element of the gameplay in super Mario bros.

Therefore, similarly, we try to disassemble Monopoly into three parts, which are the pawn, the dice and the path. These three elements represent the elements to compose the fundamental gameplay structure of Monopoly. In Tab.3, the grammatical structure is mapped on the three elements of Monopoly in order to determine the associated properties in the game. Defined properties of three gameplay elements are shown in Tab.4. As the pawn is the subject in a game, it regards how it will act according to the game story. Therefore, potential properties can be about how many pawns in a game and what kind of role does each pawn play? Each role may possibly be assigned to a different characteristic in order to enrich the story, and moreover, the capacity to evolve a game role may also be taken into consideration.

When it comes to the dice, we regard it as a mechanism functioning to progress a game either by having a player move or switch turns among multiple players. Therefore, we may have to consider what kind of medium can be employed to make players move and what is the unit of movement. As for the path, it refers to a geographical arrangement composed by the starting point, middle point and end point. We list certain potential paths along with the one of Monopoly in Fig.3 where the starting point can be multiple and the end point is relatively determined by how players complete their journey (Fig.3A). The second possibility can be the unique starting and end point in a non-linear path either as a s-shape (Fig.3B) or a spiral one (Fig.3C). Another possible path is that the starting point acts as well as the end point in a cycled round (Fig.3D). The original path of Monopoly is equally illustrated in Fig.3E. The path provides an orientation for players to go through different arrangement from start to the end while a middle point of the path plays an important role to bring in different conditions to switch the game flow. That is also why the path in the board game is often reversible. Furthermore, defining the winning condition for a game is indispensable to motivate players. Potential winning condition for board games can be
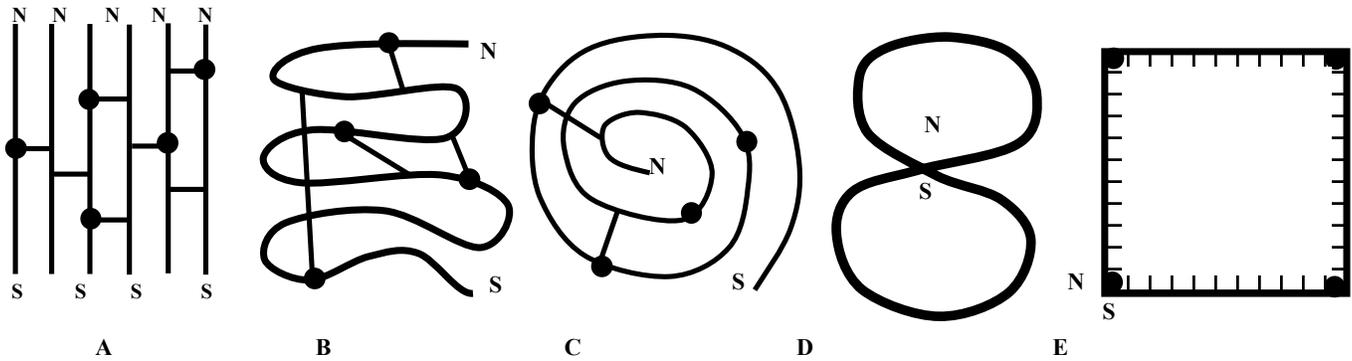
Figure 3. Potential path of a board game (S: starting point, E: end point, black dot: the middle point)

defined either by the score earned within a limited time or by the firstly-arrived player at the end point.

Via expanding the game analysis in terms of the grammatical structure and defining properties, we endeavor to encourage students to inspire more innovative idea from these provided lectures.

Table 3. Mapping of the core sentence to the gameplay

Type	Combination		
Core sentence presented in a grammatical structure	Subject	Verb	Adverb
Monopoly presented in the structure of gameplay	Pawn	Dice	Path

Table 4. Associated properties of the elements in Monopoly

Elements	Properties in the game
Pawn	1. Numbers of roles in the game. 2. Related characteristic in the game story. 3. Related story of the character. 4. Art style of the role. 5. Possibility to evolve a character.
Dice	Movement in the game. 1. How to take turns for each player? 2. How to move and how many units should it move?
Path	Geographical arrangement to orient players during the game. 1. The starting point 2. The middle point: a turning point allows players to obtain some reward by risk. 3. The end point 4. Direction of a path can be reversible

6. PROTOTYPING AND EVALUATION

After an advanced analysis of the board game is presented in terms of the lecture, students are asked to develop their own project and related requirement is listed as follows:

- A board game along with its packaging.

- A manual to explain how to play the game and the game caution such as the age.
- A game document including
  - Presentation of the team
  - Responsibility of each teammate
  - Game story
  - Process of idea development
  - Characters of the game
  - Position of their game compared to commercial products
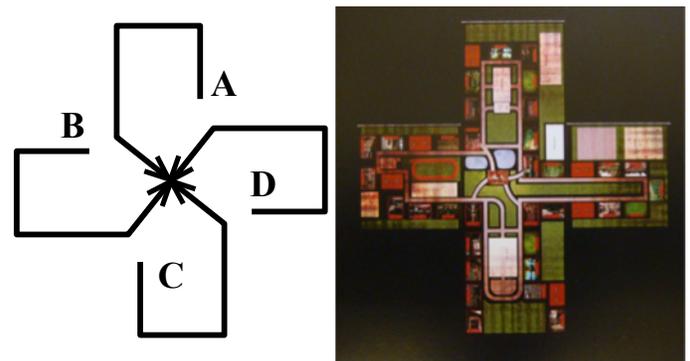 - Art works
  - Meeting notes

Figure 4. The game path in a symmetrical form toward the end point in the center. Photo from the original board game (right) and illustrated path (left)
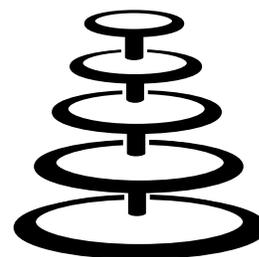

Figure 5. Illustrated game path in a three-dimensional installation.

In the final presentation, we are very encouraged by their work and in this section we report two projects illustrating the effects of lecture embodied in their innovative creation. The first student project is called "Forbidden campus", which is developed by a

girl team. Their story describes four players engaged in a campus at night full of horror legends. The mission of each player is to collect horror story pieces belonging to their specific pawn and each player's story is independent and parallel to others. The condition of winning is that players have to arrive at the end point with their completed story collection as soon as possible. Their symmetrical game path in Fig.4 illustrates four dependent roads toward the end point in the center.

Another students' project entitled "Run for your life!" is about the invasion of aliens from outer space to a building. This game allows nine players at most to start their mission and a three-dimensional spiral game path is implemented (Fig.5). The mission of players is to escape from a five-floor building full of monsters where they start from the top floor to move to the lowest floor. A classic mechanism as "chance" or "luck" area is provided in this game but the difference is that players can use the "chance" to play tricks on others in order to delay their movement.

In their final presentation, students of different teams have to conduct the game test on other teams as the evaluation to provide suggestions. After their final evaluation, we have planned a lecture of intellectual property, which offers the knowledge in protecting their game creation. In this lecture, the core sentence of the game is used as an evidence to verify if other game is produced basing on their game idea. At the end of the class, students from the same team are demanded to sign a contract with the department and it effectuates to protect their game.

7. CONCLUSIONS AND FUTURE WORKS

From an introductory game design class, we propose a pedagogical approach to progressively teach students from understanding the central idea of a game to applying the central idea to develop a game. For students in all kinds of domains, experiencing the team working is always an essential task and there is no exception for the game creation. We have tried to encourage them to take advantage of all kind of medium (such as setting up a blog or an community on Facebook) as the communication tools to benefit their project; however, the most-used communication way is talking on the phone.

Another finding concerning the team working on the game development is the organization of teammates. As a coincidence, when demanding students to form up their own team, we have certain teams entirely by boys and by girls. The game project proposed by boys in our class is often more violence-oriented and their project somehow reflects on the popular game on the current market. The project carried by the girls' team reveals their strong capacity in conceiving the game stories but they seem to lack of the ability in integrate their rich story content with more playability. Similar discussions have been reported in certain studies [10, 11]

We are vey encouraged by the result of exercising game design on the non-computer games. We consider it to be essential to adapt a heuristic approach to guide students to the right orientation on game development. Basing on the grammatical structure of the core sentence, we plan to apply the same principle to develop computer games in the next semester as an advanced level to enroll students in game design.

8. REFERENCES

[1] Shannon Duvall. 2009. Creating a games class: a walkthrough. In *Proceedings of the 4th International Conference on Foundations of Digital Games* (FDG '09). ACM, New York, NY, USA, 279-284.

[2] José P. Zagal, Amy Bruckman. « Novices, Gamers and Scholars :Exploring the Challenges of Teaching About Games ». Volume 8 issue 2, december 2008.
ISSN :1604-7982

[3] A. T. Chamillard. 2006. Introductory game creation: no programming required. In *Proceedings of the 37th SIGCSE technical symposium on Computer science education* (SIGCSE '06). ACM, New York, NY, USA

[4] Evan Barba, Yan Xu, Blair Maclntyre, and Tony Tseng. 2009. Lessons from a class on handheld augmented reality game design. In *Proceedings of the 4th International Conference on Foundations of Digital Games* (FDG '09). ACM, New York, NY, USA

[5] Anthony Estey, Jeremy Long, Bruce Gooch, and Amy A. Gooch. 2010. Investigating studio-based learning in a course on game design. In *Proceedings of the Fifth International Conference on the Foundations of Digital Games* (FDG '10). ACM, New York, NY, USA

[6] Jim Whitehead. 2008. Introduction to game design in the large classroom. In *Proceedings of the 3rd international conference on Game development in computer science education* (GDCSE '08). ACM, New York, NY, USA

[7] Rafael Bidarra, Jerke Boers, Jeroen Dobbe, and Remco Huijser. 2008. Bringing a pioneer games project to the next level. In *Proceedings of the 3rd international conference on Game development in computer science education* (GDCSE '08). ACM, New York, NY, USA

[8] Quincy Brown, Frank Lee, and Suzanne Alejandre. 2009. Emphasizing soft skills and team development in an educational digital game design course. In *Proceedings of the 4th International Conference on Foundations of Digital Games* (FDG '09). ACM, New York, NY, USA

[9] Guy W. Zimmerman and Dena E. Eber. 2001. When worlds collide!: an interdisciplinary course in virtual-reality art. In *Proceedings of the thirty-second SIGCSE technical symposium on Computer Science Education* (SIGCSE '01). ACM, New York, NY, USA

[10] Marc J. Natale. 2002. The effect of a male-oriented computer gaming culture on careers in the computer industry. *SIGCAS Comput. Soc.* 32, 2 (June 2002)

[11] Cecilia M. Gorriz and Claudia Medina. 2000. Engaging girls with computers through software games. *Commun. ACM* 43, 1 (January 2000)

[12] Fullerton. T. 2008. Game Design Workshop: A Playcentric Approach to Creating Innovating Games. Elsevier, Burlington, MA.

[13] Jessica D. Bayliss and Sean Strout. 2006. Games as a "flavor" of CS1. In *Proceedings of the 37th SIGCSE technical symposium on Computer science education* (SIGCSE '06). ACM, New York, NY, USA