11. Instructional Design in Serious Game fo earning based on Inquiry and Situated Learning Theory

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Instructional Design in Serious Game for Learning Based on Inquiry and Situated Learning Theory

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Keywords: INQUIRY LEARNING; LEARNING MODEL; SERIOUS GAME; SITUATED LEARNING
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Instructional Design in Serious Game for Learning based on Inquiry and Situated Learning Theory

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Abstract

Digital game for learning or Serious Game for Learning (SGfL) need to be developed and refined at many level of abstraction, in particular to address concerns from education experts about aspects of learning are applied in the gaming interaction. This paper will explain about learning model that comply to be implemented in (SGfL) to make its design can be accounted for pedagogics and for high flexibility in subject/domain that be learned.

Instructional design that suitable with cause-effect flow model are inquiry based learning with flexible guidance and situated learning within meaningfull learning context. Question or problem based in inquiry model was suitable with task based in flow model. Situated learning that need autothelic learning context is have same concept with immersion, especially about modeling reality.

Transformation the instructional model into game design was inspired by The SIM Career. The proposed SGfL's genre is role playing and simulation of life game as profesional. TASK was transformed into working. For life, player must work. For get job position, player must have a competency certificate through Training. In working, player must complete a task. By completing the task, player learning by doing. The elements in the gameworld design adapted to the field of work, so that the player feels like working on a real-world environment. From this point can be concluded that gameworld could not be domain independent, because environment of working is dependent on the domain learned (learning context).

The task completion interaction was managed like quiz or test in Moodle. It was not soo good from immersion aspect but high flexibility, so can be domain independent.

Keywords: Serious Game, Learning Model, Inquriy Learning, Situated Learning

1 Introduction

Pedagogical aspects in the game for learning is a hot issue. Education experts sharply criticized the pedagogical aspects in edugame. Serious games for learning (SGfL) is a movement of the game developers to address these challenges.

This paper does not describe the game from the aspect of its ability in generating motivation to learn but rather explores the learning model or instructional design to be applied within a SGfL. In pedagogics, before running the learning, it must be done the planning process to ensure that learning will be efficient, effective, and appealing. The planning was mention as instructional design (ID) document . Dick & Carey [1] declared that ID consist of (a) learning outcome (b) learner context (c) learning context (d) performance objective (e) assessment instrument (f) learning content (g) instructional strategy (h) evaluation

Instructional strategy consist of (1) organizational strategies, are talk about how the lesson be properly arranged and sequenced (2) delivery strategies on how information is carried to the student. It is more about media for delivery (3) management strategies are design about how the learners interact with learning activities to increase knowledge or skill or emotion

From three elemens of instructional strategies, in this paper will discussed about management and organizational strategies with DIGITAL GAME as delivery strategies. The purpose of this research is develop desain learning model equal with instructional design that will be implemented in game desain elemen of SGfL. The SGfL in this paper focus on adult learner, with domain independent in learning content and learning context, and independent from type and level of learning outcome.

The methodology in this research are literature study, conceptual analysi, s/w product exploration, and then desain model. Case study was conducted as instance for evaluate the model of game design.

2 Literature Review

2.1Cause-Effect Model of Flow Theory and Game Design Element

As was described at fig 1, it has been concluded that the task is challenging, clear goals, immediate feedback, cognitive feedback, a sense of control will be able to create a flow experience.[3] There are 6 Indications of flow experience. These conditions resulted in highly motivated, focused and durable of players in the game.

The 5 aspects of premises will be gain with game elemen and gameplay. Richard Rouse [4] classified game elemen into 3 categories, Character, Item, and Object/Mechanisme.

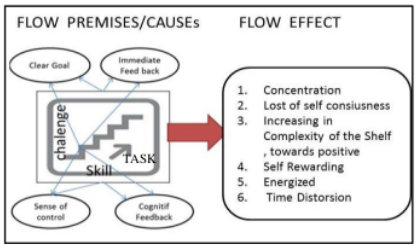

Figure 1 Cause-Effect Model of FLOW Theory[2]

There are 2 kinds of characters, the player character (PC), non-

player character (NPC). PC may appear in the game, could also not represented in the game so it only plays from outside the game. While the NPC is classified into three, namely facilitator or partner support, enemies, and allied.

Rouse[4] declared key functional feature of gameplay. Those are

1. Chalenging task /conditions/ enemy
2. Nonlinierity
3. Realworld Modelling
4. Teaching the Player
5. Input & Control
6. Output and Feedback

Some facts was founded by Mihalyi, associated with the work and the flow experience are as follows

a. Flow more easily achieved in high chalenge and high skill conditions. The condition can be achieved through play as well as work situation.
a. Significantly high chalenge and high skills situation be acquired in the work situation than the leisure time.
b. Manager that declare having *flow* experience was 64%, clerical 51%, dan blue cholar 47%. This means that the more dynamic the work challenges the more likely to experience flow.

2.2 Inquiry Learning

Inquiry based learning (IBL) or Enquiry based Learning (EBL) is learning model that be developed based on Constructivisme. There is claim that problem based learning is included in IBL. **Inquiry** is mean " a seeking for truth, information, or knowledge or seeking information by questioning [5]. The characteristic of IBL are: [6], [7],[8],[9]

a. Question or Task, provided by teacher is an entry point for student to tune in the process. The Question/Task must be sufficiently open-ended
b. There are many choice of task/question to evoke interest from students.
c. Student pursue the own line of the learning process , take responsible for seek knowledge or evidence , but not meaning take all of the process

There are 5 step learning activity in IBL, engage, explore, explain, elaborate, evaluation.

2.3 Situated Learning Theory

Situated learning is learning knowledge and skills in contexts that reflect the way they will be used in real life [12] . Situated cognition is a theory that posits that knowing is inseparable from doing by arguing that all knowledge is situated in activity bound to social, cultural and physical contexts[11]. Implication for this theory for instructional design is educators must create a meaningfull environment to immerse learners. This meaningfull environment is mean that as closely as posssible with context in which the new knowledge or behaviour or skill will be apllied in the real world.

Based on Situated Learning theory, Herington propose an instructional model using web unit[14]. The key element of the model are

1. Authentic context that reflects the way the knowledge will be used
2. Authentic activities
3. Access to expert performances and the modelling of processes
4. Multiple roles and perspectives
5. Collaborative construction of knowledge
6. Reflection
7. Articulation
8. Coaching and scaffolding
9. Authentic assessment.

3 ANALYSIS AND DESIGN

3.1 Concept Maping between Inquiry Based Learning , Situated Learning Theory, and Cause Effect Flow Model

Table 1 Concept Maping

No	Cause Effect Flow Model & Feture of GamePlay	IBL	Situated Learning Theory	Instructional strategy in Game Design of SGfL
1	Task	Question/Task is entry point		Tasks to be completed in working (management strategy)
2	Sense of Control	Provide many choice of task		Job opportunity in some companies (management strategy)
3	Immediate & Cognitif Feedback / Realworld modelling	Design meaningfull learning environment	Authentic context, activities, and assesment	Real Life simulation, Have time, work to get money, LEARN to solve task in the working, have leisure time (management strategy)
4	Skill & chalenge of task was managed in flow channal	Nudge for guided Inquiry	Scaffolding & Coaching	Task sequence, complexity level of City, grade of Job Position, Level of training, level of consultation Flexible Guidance (organizational strategy)

Inquiry-based learning theory (IBL) states that by learning through inquiry corresponding to preferences of the learner will be easier to make the learner engaging with intensive. He became the center of their own learning process. Inquiry-based learning theory is in accordance with the principles of game interaction revealed by premises of flow theory to create a flow experience in the game. From tabel 1, be described that IBL have strong correlation with cause effect flow model. In IBL, learning is started from *engage* (need solve the question/task, understanding the task), *explore* (search knowledge to complete the task and solve the task), *explain & evaluation* (getting feedback), *extend*(ready to the more task).

Gameworld with gameplay is supporting tools to implement concept authentic contenxt, authentic activities, and authentic assessment. This is the best way for learning, according to Chinese Proverbs : "*Tell me and I'll forget*; *show me and I may remember*; *involve me and I'll understand*. From this point can be concluded that learning in game, using concept in game pedagogically sound.

3.2 Transformation into Game Design

Based on (1)IBL learning model, (2) Create Authentic context, activity, assessment, (3)Working with dynamic challenge can create flow experience as well as "play", (4) inspired by the sim career game , was decided that genre of the proposed SGfL is "Role Playing game" as worker in the professional job related to the domain that be learned and Simulation of daily life. So, Task, the core of gaming is generated from problem in the work.

Detail interaction in task completion was managed like test phase in Moodle. Learning activities of player are read a book, get a training, or ask to someone about how to solve a task beside solve the task itself. For the learner, psychological impact will be different, between teacher ordered learners to read a book with the learner aware by themselves that they had to read the book to resolve a problem. Why does they have to resolve a problem , because it is essential to accomplish the mission in his personal life.

State diagram player character as learner in SGfL was described in fig 2. In SGFL There are three main activity (1) daily life (2) working (3) training. At working, the player must complete some task / Question. If the player was not able to resolve the question, SGfL provide knowledge as a guide solve it. There are three level guidance, a minimal guidance provided through reading books, middle ones provide by consultancy and examples of a similar problem. Strong guidance is given in limited amounts in the form of a straight answer from the question. In working activity was used method of inquiry based learning with flexible guidance.

In a job there is a career path. It is used to apply the scaf-folding principles, that was suggested in situated learning. To get a certain position required competency level that be specified by requiring the player to have a certificate of expertise. That Certificate gained from the training. In SGfL there is one element of the game that serves as a training center. Player must pay some money to take a training course.

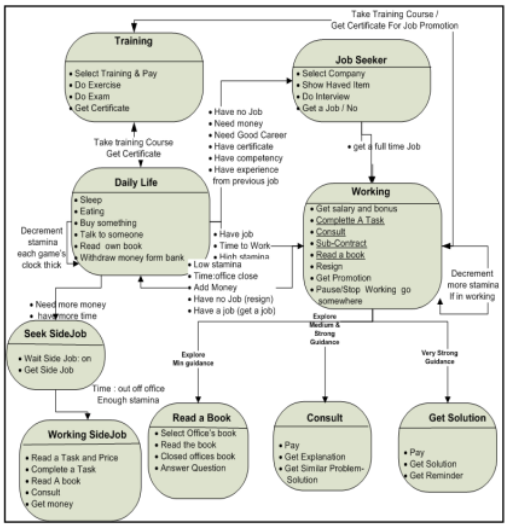

Figure 2 player character's state diagram

With feature of game design concept that have been described, Figure 3 showed the functional system of SGfL that was needed. There are 3 kind of modul , game interaction modul for learner, gameplay management modul for manage game interaction, and back-end modul for teacher to modify the game-play and review the learner status

Figure 3 Functional Feature of SGfL

3.3 Case Study Design for Meaningfull Environment in SGfL Mastering SQL

The meaningfull environment principles was implemented by game world for learning SQL, visually see fig 3. Maping from learning outcome, scaffolding of learning content and complexity authentic problem solving activity into game activity was described in table 2 .

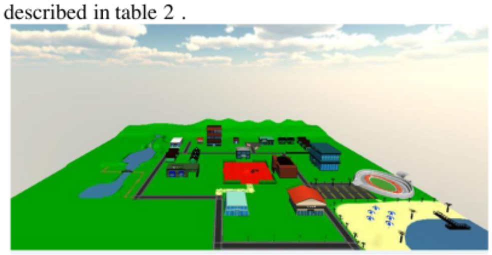

Figure 3 Example of Game World in Digital Game for Learning SQL

Table 2 Maping Learning outcome, learning content, and authentic problem solving activity into Level in Game

Profesional Grade	Task Declaration	Learning Outcome	Number of Table in DB	Topics of SQLCourse Material
onboarding	SQL's Card Puzzle	Understanding tupple relational calculus and SQL Syntax	1	Projection & selection
Staff (level 1)	Information Requirement declare in Technical Language, source table was given	Writing right SQL (syntax and semantic)	3	Projection, Selection, Join, datetime & string function
Supervisor (level 2)	Information Requirement in Technical Language, source table was not given	Comprehension database context, Writing right SQL (syntax and semantic)	5	Projection, Selection, Join, Grouping, Having
Analyst (level 3)	Information Requirement in bussines / management Language, source table was not given	Understanding bussines context, Formulate Information Structure, comprehension database context, Writing right SQL (syntax and semantic)	8	Projection, Selection, Join, Grouping, Having Nested Sql Crude

About bussines context of Problem to be solved , there are some company with specific database schema according to their bussines. Those are described in table 3.

Level	Companies for Databases Learning Context (provide Job Vacancy)						
	Hospital	Alter Mart	BANK	University	Library	Government	Car Dealer
On boarding	D	E	D	D	D	**D**isabled	E
1	E	E	E	E	D	**D**	D
2	E	E	E	E	E	**E**nabled	E
3	E	E	E	E	E	E	E

Ilustration of some user interface in SGfL for SQL

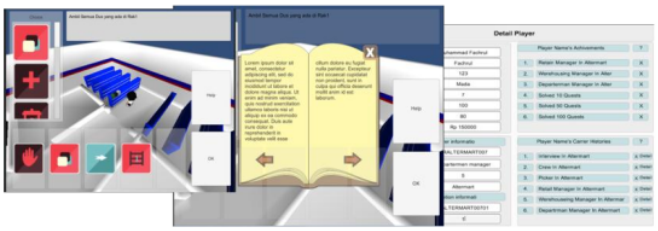

Figure 3 Example of SGfL for SQL

4 Conclusion

1. Inquiry learning with flexible guidance and situated learning theory was suitable with Game based interaction
2. Result from the case study, at application level design of gameplay and game mechanics of SGfL could be subject/domain independent, but the game world that consist of character, item, and decoration was subject dependent

Further Research for refine the model of SGfL was listed below,

- Case Study SQL learning content with another Genre (adventure)
- Case Study for Another learning content and learning outcome
- Rule for mapping Instructional Design Element into game design of SGfL

5 Acknowledgment

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