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Abstract. In this paper we describe a social learning game we implemented to evaluate various means of ubiquitous learning support. Making use of game design patterns it was possible to implement information channels in such a way that we could simulate ubiquitous learning support in an authentic situation. The result is a prototype game in which one person is chosen randomly to become "Mister X", and the other players have to find clues and strategies to find out who is the wanted person. In our scenario we used 3 different information channels to provide clues and compared them with respect to user appreciation and effectiveness.

Keywords: Ubiquitous Learning, Ambient Information Channel, Awareness, Game Based Learning, Game Learning Patterns

1 Background

1.1 Ubiquitous Learning and Informational Awareness

The mobile learning paradigm [1], [2] encourages learning that is personalized, authentic, and situated [3]. Environmentally based upon this paradigm is the principle of ubiquitous learning. This concept rests upon the idea of ubiquitous computing [4], offering mobility combined with pervasive computing functionality [5]. These concepts are then orchestrated by instructional designs. Permanency, accessibility, immediacy, interactivity, situatedness, and adaptability have been identified as the main characteristics for information support in ubiquitous learning [6]. Learners need to navigate more efficiently through information and find the right information in any given context [7]. One essential aspect to implement this concept is to keep the learner continuously aware about the learning environment. Several types of awareness can be distinguished [1]: social, task, concept, workspace, knowledge, and context awareness. We suggest utilizing these types to feed information channels in the environment of the learner, which may adhere to the notion of ambience, hence contributing to a non-intrusive way of interaction, as suggested by the Ambient Information Channels (AICHE) model proposed by Specht [2].

1.2 Game Patterns

There are different ways to provide informational awareness within ubiquitous learning environments in a contextualized manner. One of the most motivating and versatile ways of doing so is the methodology of serious games (SG) and game design patterns. The discussed information channels can technically be realized as game elements, giving clues about the game's storyline or progress of opponents or collaborators. In game design, such elements are formally described as game design patterns. These can be matched with educational purposes in order to foster certain cognitive processes and sustain motivation. Similar to the Web 2.0 patterns [8], from a technical design point of view the use of such pattern has several advantages supporting reusability and interoperability [9]. A pattern consists of several data fields in which there is information on the pattern itself, its functionality, its consequences and examples. On top of that there is also information how and together with what other patterns one pattern can be combined (modulation and instantiation), or is in conflict (two patterns that cannot occur in a game without contradiction). A large repository of game design patterns derived from actual game elements has been compiled by Björk & Holopainen [10].

2 Approach

2.1 Research Objectives

The combination of a game-based and ubiquitous learning perspective forms the linkage between the theoretical concept and its implementation. While the concept of information channels is the theoretical construct we used for our basic design, the corresponding game design patterns formed the basis for the actual implementation of our prototype. In our study we focus on the following research questions: 1. Do alternations in use of different information channels influence the user activity and appreciation? And 2. Does the use of these information channels create a meaningful and productive environment to foster social collaboration?

2.2 Analysis and Design

Social, workspace, and task awareness have been identified as the awareness types they provide the most support for a social game setting where information is shared and distributed across different contexts.

Social awareness reflects how the other participants are progressing in comparison to the individual progress; we decided to implement this with a *competition pattern*. Competition can be a social concept especially when competing teams are formed. In a more fuzzy sense competition also would have a social dimension because it draws attention and creates a "motto" for social interaction. According to [10] competition is "the struggle between players or against the game system to achieve a certain goal where the performance of the players can be measured at least relatively".

Workspace awareness facilitates different types of resources supporting ubiquitous learning in a shared workspace. These resources are fed into the system and visualized using a various displays. Game elements in this case can be realized using the *Clues* and *Gain Information pattern*. The clues pattern is described in [10] as "the game elements that give the players information about how the goals of the game can be reached". The *Gain Information* pattern is described as "the goal of performing actions in the game in order to be able to receive information or make deductions".

Task awareness supports the learner by facilitating and indicating the accomplishment of goals. Applying a *goal pattern* thus extends the abstract task into a concrete set of actions the participants can choose from, for reaching a goal, i.e. accomplishing the task. Being aware of the progress in accomplishing the task, individually or socially, creates an additional clue with respect to keeping up a certain momentum of motivation, which is supported by the *score pattern*, where score "is the numerical representation of the player's success in the game, often not only representing the success but also defining it" [10].

2.3 Methodology

Based on the previous analysis and the elaborated research questions a technical design has been implemented covering different design dimensions for the selected awareness types. A main point of interest was how the implementation got assimilated and perceived in a social setting simulating a ubiquitous learning environment. Furthermore the implications for its usage in a game based learning scenario were assessed experimentally.

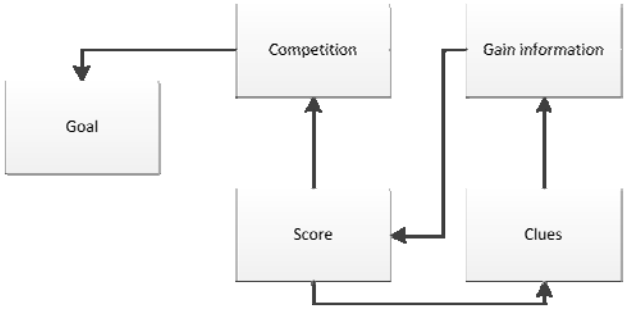

Fig. 1. Core structure of the game with patterns relevant to the aware

Figure 1 shows how the mentioned game patterns are interdependent. While clues could come from different sources it is noteworthy that a reflection of score would likely be a clue in itself, enabling the user to gain information, necessary to take the right decision that leads to an increased score to compete with other players and ultimately to reach the goal: to win the game. More concretely it was assessed which types of awareness are best to be targeted by which contextualized information channels: professional information was displayed in the workspace environment, while social and personal information was displayed in a social environment (see

implementation section for more details). Reflecting the current score as well as the status of the game finally provided task awareness. On day one, the information clues were given via email only, on day two they were given only with information displays, and on day three we used both channels.

2.4 Implementation

The scenario selected for application of the game was at a seminar-style international meeting of PhD students of educational technology and a set of renowned instructors drawn from around Europe [11]. In this setting, the authors implemented a social learning game in which one of the participants was assigned the role as “Mr. X”, and the other players needed to find out by using various clues given according to social, workspace and task awareness. These information clues were derived from a user database that was generated from a questionnaire in which the participants entered both professional and more personal (or social) characteristics and preferences like background, age, place of birth, favorite color, etc. The gathered data was then used to display clues on screens installed in the main lecture room (workspace environment), and in the entrance respectively cafeteria (personal and social environment). The data was grouped according to the different environments: “professional” information was displayed in the workspace environment, “personal” and “social” information was displayed in the personal and social environment.

The following rules were given to the participants: The game was played in several rounds. At the beginning of each round one of the participants was selected as Mr. X by random. Periodically the participants received three hints about the wanted person. These hints described Mr. X in person as well as his/her social and professional life. The task was to get information about fellow participants by getting acquainted with them and discussing who could be the wanted person. After authenticating the participants were prompted with a voting screen in which they could vote for the person they suspected to be Mr. X. The vote for the suspected person could be given by clicking on one of the person names. They were allowed to change their mind anytime and vote again as long as the current round was open. The round closed once more than 50% of all participants voted for the right person OR the wanted person was not identified after giving five times three hints. Finally, after Mr. X was revealed an according email was sent to every participant, as well as the name of Mr. X was displayed on the information displays. The score was allocated accordingly and could be found in a high score list that was also online. Alternatively, if Mr. X was not revealed within half a day, the authors stopped the round manually and declared that Mr. X had won the game. Everybody who voted for the right Mr. X got 100 points, everybody who voted for the wrong person got -50 points, Mr. X him/herself got 200 points if not revealed, and -100 points were the punishment for not voting at all.

The game was technically implemented by making use of the Google Application Engine [12] and the Adobe FLEX framework [13], facilitating the FLAR toolkit [14].

3 Results

The effectiveness of the game with respect to the prospective benefit for social interaction was monitored in two ways: the user activity (system logs) and the user response to a feedback questionnaire at the end of the event. The results of the user monitoring are shown in **Error! Reference source not found.**. There were 3 days with two rounds of the game each. The user activity was highest (135 votes) on the first day, slightly slacked down during day 2 (114 votes) and picked up again on day 3 (134 votes). Within the table the number of votes is broken down into intervals throughout each round of the game. It can be read that the use of both emails and information displays created the highest dispersion of vote frequency in the according game rounds, which postulates the use of these information channels was most powerful.

Table 1. Frequency of Votes per Intervention

Intervention	**Round**	**Frequency of votes / per time interval (20min)**								
Email	I	1	4	12	19	20				
	II	27	11	21	19	1	8	2	3	2
Ambient Display	III	13	9	6	0	2	26	5		
	IV	13	4	27	10					
Both	V	11	5	5	9	10	12			
	VI	16	17	7	12	3	19	4		

In the questionnaire we had asked the participants if they preferred being sent the information clues via email or via the information displays. 66 % preferred the information displays. 63% actually preferred a combination of both information displays and emails. The game's intention was to help fostering social interaction, but only 33% of the participants thought it achieved that goal (the majority was undecided about this point). Most of the participants had the impression that the game rather helped fostering social interaction not because of specific mechanisms like “personal” or “professional” information clues, but simply by the fact that there was a game being played. In contrast to this, the questionnaire results indicate that “talking to people and pondering who could be Mr. X” influenced 44% of the participants’ voting activity (the rest undecided). The dynamic voting screen (adaptive size of the name fields) had an even stronger influence (66% claimed they were influenced). The motivational power of the user authentication was only rated mediocre.

4 Conclusion

From a critical point of view the game in its current form and limited time frame has not proven to significantly enhance social collaboration. Due to the overall rising user

activity it could be theorized that a growing social bond between the participants might have led to a higher incentive to play the game together, and not the other way round. Our study, however, gives indications that over a longer period of time noticeable effects possibly could be measured. We will analyse more detail of the log files to support this hypothesis. Besides the evaluation of data and feedback we could notice that people would in fact talk about the game in a cheerful way suspecting each other to be Mr. X. For the use of information channels regarding the different awareness types a strong influence was measurable for task awareness, where workspace and social awareness ranked lower. Finding ways how to implement those latter awareness types in a more efficient way will be a matter of our attention in future research.

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References

1. Ogata, H.: Assisting Awareness in Ubiquitous Learning. Proceedings of the IADIS Mobile Learning 2009. pp. 21-27, Barcelona, Spain (2009).
2. Specht, M.: Learning in a Technology Enhanced World. OCÉ, The Netherlands (2009).
3. Traxler, J.: Current State of Mobile Learning. Mobile Learning: Transforming the Delivery of Education and Training. p. 9AU Press, Edmonton (2009).
4. Weiser, M.: The computer for the 21st century. Scientific American. 272, 78–89 (1995).
5. Lyytinen, K., Yoo, Y.: Issues and challenges in ubiquitous computing. Communications of the ACM. 45, 63–65 (2002).
6. Ogata, H., Yano, Y.: Context-aware support for computer-supported ubiquitous learning. Proceedings of the 2nd IEEE international Workshop on Wireless and Mobile Technologies in Education (Wmte'04). p. 27 (2004).
7. Koole, M.: A model for framing mobile learning. Mobile Learning: Transforming the Delivery of Education and Training. 25 (2009).
8. O'reilly, T.: What is web 2.0. Design patterns and business models for the next generation of software. 30, 2005 (2005).
9. Agerbo, E., Cornils, A.: How to preserve the benefits of design patterns. Proceedings of the 13th ACM SIGPLAN conference on Object-oriented programming, systems, languages, and applications. p. 143 (1998).
10. Björk, S., Holopainen, J.: Patterns in Game Design. Charles River Media (2004).
11. TEL Europe: JTEL Winter School on Advanced Learning Technologies 2010, http://www.teleurope.eu/pg/groups/43.
12. Google App Engine - Google Code, http://code.google.com/appengine/.
13. Adobe Flex, http://www.adobe.com/products/flex/.
14. Saqoosha.net: Start-up guide for FLARToolkit, http://saqoosha.net/en/flartoolkit/start-up-guide/.