CULTURE SENSITIVE EDUCATIONAL GAMES CONSIDERING COMMON SENSE KNOWLEDGE

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Abstract: When an 8th grade science teacher discusses the subject "contraceptive methods", s/he has to consider situations and facts that are known by teenagers to better understand their behavior and define his/her approach. Suppose that the teacher says "the rhythm method is not one of the most efficient contraceptive methods". But does the teacher really know which contraceptive methods are considered by that group of students? It is proposed here a framework to instance web game supported by common sense knowledge to approach the called "transversal themes" of the school curriculum in our country, like sexual education, ethic and healthcare. The quiz game framework called "What is it?" is presented as a support for teachers in contextualizing the content to the students' local culture, promoting a more effective and significant learning.

1 INTRODUCTION

To prepare citizens who are cultural and social committed is one of the goals to be reached during the children's school life. In developing countries like Brazil, many of the social and economical issues would be better faced if the education system were improved and more effective. In such situation, it is being considered that the information technologies (IT) adoption by schools is necessary. However, adopting IT to support formal education is still a challenge in the new era of knowledge for Brazil and for other developing countries.

The developing countries' effort for digital including their citizens has to start in classroom. Adopting IT solutions, it can be possible for teachers to promote new ways of building students' knowledge, and provide them pleasant tasks during their learning process, what can facilitate digital inclusion.

So, it is urgent to distribute computers for teachers and students, but it is more than urgent to prepare teachers and provide them with software tools to support the IT technology adoption inside classroom. Furthermore such software tools have to be a solution developed considering the reality, the context and the culture of that country.

To promote the use of educational games, considering the children's excitement about computer games, it is presented here an educational computer game framework to support teachers in teaching the transversal themes defined on the Brazilian curriculum. Educational games are able to promote activities that combine fun (playful activity) and seriousness (well defined rules), once they are very popular among children and teenagers.

Nevertheless there are pedagogical issues that should be considered for stimulating the learning process, even and especially when IT is adopted. Culture sensitive and contextualized learning considering the student's reality is the pedagogical issue focused in this paper. It is proposed to consider the apprentices' common sense knowledge to promote the learning aiming at: adopting a vocabulary that is familiar to the students; instantiating content and clarifying myths, beliefs and taboos that are cultural heritage. Some examples of this kind of knowledge related to sexual education, one of the transversal themes, are: teenagers believe that girls do not get pregnant during their first sexual relation, that pill has to be taken on the day she is going to have sexual relation, and that AIDS is a homosexual disease. This kind of knowledge can be mapped from the commonsense

knowledge and can be clarified by teachers during classes.

The game framework called "What is it?" ("O que é, O que é?" in Portuguese) aims to produce instances of a certain type of game that help players to infer a certain secret word related to a certain transversal theme (explained on the next section) considering a set of clues presented one at a time. There is a commonsense knowledge base used by the game framework to help on reaching such goal.

This paper is structured as follow: section 2 explains the relation between commonsense knowledge and education; section 3 presents some games which collecting commonsense knowledge is the main goal; the "What is it?" game framework prototype is presented on section 4 and some conclusions are presented on section 5 as well as some future works.

2 USING COMMON SENSE TO SUPPORT EDUCATION

Common sense is defined here as the knowledge that most people agree with in a certain community at a certain period of time related to human experiences, knowledge about social, physical, space, time and psychological aspects of our daily life (Liu and Singh, 2004). Recent researches (Anacleto et al., 2006a; Anacleto et al., 2006b) have shown that automatically collected common sense knowledge can be used to map a certain group of people.

The importance of the common sense and cultural knowledge to support the learning process is referred by a number of researchers from pedagogy. For instance, Vygotsky (1987) believes that the individual's mind model can be understood only if the social and cultural processes are considered in his/her context. Paulo Freire (1996) cites that it is necessary to respect the knowledge that students acquired by the social relations. Such knowledge can help in contextualizing the learning process to the student's reality. Papert (1985) says that the education system should consider what students learned with their family or community, the knowledge acquired before they start at school, and understand how it can influence their learning process, i.e. he is referring to the common sense knowledge.

In a convergent view, these educators highlight the relevance of the knowledge on culture and common sense as a factor that interferes in student's learning process. Teachers should consider and use the common sense knowledge in their pedagogical activities aiming to help learners to associate the content being taught to their personal experiences and knowledge. Such approach allows to bring into the classroom the discussions about what was previously described, like myths, believes, misunderstandings, so they wouldn't take as correct facts. Besides that, the use of common sense knowledge provides to teachers an adequate vocabulary to contextualize and discuss subjects with learners from a certain community (Carvalho et al. 2007).

Common sense knowledge also can be found when it is intended to teach the called transversal themes from the official school curriculum, defined by the Brazilian Education Ministry. These themes are defined considering that "the commitment on constructing the feeling of citizenship demands a pedagogical approach to reach the comprehension on the social reality and the rights and responsibilities related to the personal and collective life, what leads to the political engagement" (SEF, 1998). Transversal themes are not new disciplines, but subjects that have to be taught inside the other disciplines in the curriculum. Six themes are defined: sexual education, ethics, healthcare, environment, cultural plurality, market and consumers (SEF, 1998).

Sexual education, for example, intends to discuss with children and teenagers what the messages from media are, what they learn from family and society, intending to complete and clarify the information that they already have and, mainly, creating the possibility for students to form an opinion about the topics that were presented to them. Considering the definition presented here, it can be understood that the topics are related to the students' knowledge acquired from their group and social experiences, corresponding to the common sense knowledge. In this research, it is discussed the transversal themes through a common sense based game approach.

3 COMMON SENSE AND WEB GAMES

In an effort to facilitate the process of collecting common sense knowledge some online computer games have been developed. One of these games is Verbosity (von Ahn, Kedia and Blum, 2006), which is designed for two players, one of them plays the role of "Narrator", who gets a secret word and gives clues to the other player, the "Guesser", who tries to guess the word. The common sense fact collection is done when the guesser suggests an answer based on the clues already presented to her/him.

The game LEARNER 2 (Chklovski, 2005) consists of a web system with what they called proactive knowledge acquisition, which collects information about the everyday life, focusing on the parts that compose the things and the use of those things. The system asks the users about specific topics and compares the answers with the common sense statements stored in its knowledge base. The bigger is the number of similarities found, the more is the number of points granted to the user

FACTory (Cycorp, 2007) game presents a statement to the player who might say whether it makes sense or not. When a number of users agree with one of the two possible classifications, the statement is validated as true or false and it is not presented to the users anymore.

Common Consensus is an online game that asks some questions to the player, who is encouraged to supply as many answers as possible in a certain period of time. When time is finished a score is shown to the player (the number of times that the same answer was given previously for different users) (Lieberman, Smith and Teeters, 2007).

In the next section it is presented "What is it?" (http://lia.dc.ufscar.br/game), an online common sense-based game framework developed in the context of the Brazilian Open Mind Common Sense (OMCS-Br) Project (www.sensocomum.ufscar.br). Although "What is it?" also collects common sense knowledge, it has some issues that are being considered, as it is explained the following.

4 THE "WHAT IS IT?" GAME FRAMEWORK

This research aims to make possible the use of common sense knowledge in web-based educational games, aiming at stimulating the learning contextualization and the knowledge construction in the learning process. Furthermore, it intends to collect common sense knowledge from teachers and learners who use the generated games. It is being developed a common sense-based quiz game framework called "What is it?" which brings common sense clues up the players' mind, aiming at working on a specific subject. The main purpose is that the game is to be used by teachers to work on subjects which have been approached in classroom.

The game framework is part of the OMCS-Br project that uses a collaborative approach in order to construct a common sense knowledgebase to be used by computer applications supporting human-human interaction and human-computer interaction. It provides a web site where volunteers can contribute

with common sense statements in natural language, according to the approach presented in (Liu and Singh, 2004). In Brazil, the project is developed at LIA - Advanced Interaction Laboratory, from the Federal University of São Carlos - and focuses on supporting teachers to contextualize their learning activities, aiming at promoting meaningful learning, in a culture sensitive process (Anacleto et al., 2006a).

It is worth pointing out that "What is it?" has the differential in considering the players' profile, concerning the games presented in the previous section. Since the players have to subscribe themselves in the system before starting to use it, the new statements collected during the interaction can be related to their profile. In the registration the users provide information such as their age, gender, geographical location and school degree.

To take into account the players' profile during the collection is especially important because of the culture sensitive approach, which makes necessary to develop applications for specific groups of people in a certain region and age, considering their context. In this case, the common sense knowledge can be filtered and the designer of the application can consider only the knowledge collected from the desired profile in order to contextualize the design to the target group. This is what happens in "What is it?". It allows their users to configure instances of the game, as it is explained in the next sub-sections.

Table 1 compares the common sense-based games previously mentioned, concerning the collection and the use of common sense knowledge, as well as the consideration of the player's profile.

Table 1: Common sense-based games comparison.

GAME	ACSK	CCSK	TPP
Verbosity	-	X	-
LEARNER 2	-	X	-
FACTory	X	X	-
Comon Consensus	X	X	-
What is it?	X	X	X

Legend:
ACSK: **A**pply **C**ommon **S**ense **K**nowledge
CCSK: **C**ollect **C**ommon **S**ense **K**nowledge
TPP: **T**ake into account **P**layers' **P**rofile

As it can be noticed, Verbosity and LEARNER 2 work only on collecting new common sense statements', not making use of the statements already gathered and stored in their knowledge base. Factory, "Common Consensus" and "What is it?" go beyond, also making use in some way of the statement previously obtained – FACTory and

"Common consensus" use the knowledge stored with the purpose of validating it by the users and "What is it?" uses the knowledge to generate the clues which are presented in the game. Those clues are related to the players' answers and stored in the OMCS-Br knowledgebase. Finally, "What is it?" takes into account the players' profile.

Besides the fact of considering the players' profile, the game "What is it?" was designed considering pedagogical issues with the purpose of using it as a tool to the learning process.

As it was presented before, the use of common sense in the learning process is suggested by several educators who defend that by contextualizing the learning it is possible to promote meaningful learning in those ones involved with it (Freire, 1996; Vygotsky, 1987; Papert, 1985).

In addition to that, the use of games in education has been defended by several researchers. According to Jacquin (1963) the game is one of the most important things to children. In this way, it is an excellent tool for educators to reach their duty. Jacquin defends that the relation between children and games has the same level and intensity that the relation between adults and jobs. Huizinga (1980) and Chateu (1987) are other researchers who agree with Jacquin proposal.

Therefore, it is possible to note the importance of games in the human being's development and in the support of the educational process. Considering that games are more and more common in the information society in which people live nowadays, to design games focused on the educational process is very relevant.

The game framework is divided in two modules: (1) the player's module, a quiz game in which the players must guess a secret word, considering a set of common sense-based clues and (2) the game's editor a seven-step wizard which guides teachers to create game contextualized instances. Details of each module are presented in the following.

4.1 The Player's Module

Figure 1 presents the "What is it?" player's module main interface. To illustrate the game use, it was developed a game instance considering the theme "Sexual Education". To start the game the player should, first of all, click on the dice, represented in Figure 1 by the yellow letter "S", whose faces represent topics related to the transversal theme on which the teacher intents to work. In Figure 1, the letter "S" corresponds to the topic "**S**exually transmitted diseases". Other topics which can potentially compose the "Sexual Education" theme
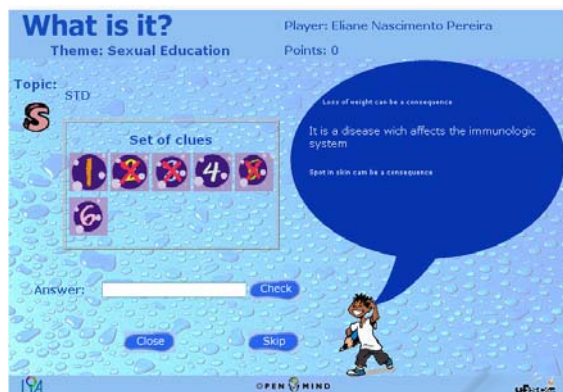

Figure 1: Player's Module Main Interface.

dice, according to the teachers' necessities, are "anatomy and physiology", "behaviour" and "contraceptives methods". The letters, which represent the topics, are presented to the player fast and randomly. When the player clicks on the dice it stops and say about which topic the secret word, which should be guessed, is.

The use of a dice to organize the game according to topics complies with Conati and Zhao (1987) proposal, who say that it should be clear to learners which knowledge area is approached in the game, avoiding that they get lost with the presented concepts. Each topic has a set of cards associated, which are related to different secret words. These cards are defined by teachers in the game's editor module, using the support of a common sense knowledge base. In addition to that, it is possible to relate a list of synonyms to each secret word. These synonyms are also accepted as expected answers.

The clues play the role of supporting the player to guess which the secret word is. Each card can have a maximum of ten clues which can be selected by the learners by clicking on a number into the "Set of clues" area, which can be seen in Figure 1. After having the topic defined by the dice, a card with clues is presented to the player and, as s/he selects a clue, it is displayed on the blue balloon. The players can select as many clues as they consider necessary before trying to guess the word.

As the players try to find out the secret word, the system collects common sense knowledge, storing the relation between the word they suggested and clues that were already displayed. This collecting process is interesting (1) for teachers, who can identify possible misunderstanding by analyzing the answers that learners with the profile of their target group give to a specific set of clues, and, therefore, approach those misunderstandings in classroom to clarify them; and (2) for the OMCS-Br knowledgebase, which will increase the number of

stored common sense statements. It is important to point out that the answers provided by the learners, which do not correspond either to the secret word or to a synonym defined by the teacher, are not considered incorrect by the system. Those answers just tell to the system that the answer provided make sense to the player considering the set of clues already displayed.

The strategy used in the game to promote the reinforcement and meaningful learning are based on the Minsky's Theory (Minsky, 1986) about the way which the mind works. In this theory Minsky proposes that the mind has several agents who are in charge of the many processes which can happen in it. Some of those agents are responsible for the learning process and, according to Minsky, each knowledge fragment learned is kept near to the agent which made possible that learning. These agents are called knowledge lines (k-lines) and are activated every time someone tries to solve a task. In this way, when someone tries to solve a task, the mind reactivates the agents which were activated when a similar task was solved, linking the knowledge fragments which are near to those agents. At the end of the task, the new and old knowledge are linked by a k-line. Each time a k-line is activated the knowledge which it uses to solve a task becomes more and more connected to it, what configures the learning reinforcement.

In the game, the clues represent the knowledge fragments which are supposed to be in the learner's mind, since it is part of the common sense knowledge gotten from people which share the same profile. Through these fragments the learners' mind will try recovery what was presented by the professor in classroom and to perform the learning reinforcement. If new knowledge is presented in a clue, the student will associate that knowledge with the knowledge they have already learned, performing a meaningful learning, according to the Learning Theory proposed by Ausubel (1963).

4.2 The Game's Editor Module

The game editor is a seven-step wizard which guides the teacher to create game instances, which fit to their pedagogical goals.

During the card definition, teachers receive the support of common sense knowledge. For that purpose, in the framework editor Step 1 teachers have to define the population profile which should be considered in the search for common sense statements in the knowledgebase. In this way, the system guarantee that the statements which are going to be presented to the teacher were gathered from people who have the desired profile to the game instance, i.e. the statements are contextualized to the target group. This process is called common sense filter definition. Once the filter is set up, the teacher can choose the secret words for each card. In the following, the teacher can define a list of synonyms for each one of the secret words.

In the two next steps the teacher must define three items: (1) the game main theme, which should be chosen from the six transversal themes available and (2) the topics, which are specifics subjects related to the transversal theme chosen, compose the game dice faces.

The next steps consist of defining the secret words, their synonyms and the set of clues for each secret word. For each secret word defined, it is performed a search on the OMCS-Br semantic network, called ConceptNet-Br, that increasing the number of words associated with the secret work. The concepts associated with the secret word and their synonyms are presented to teachers as natural language statements and, based on these statements, teachers can compose the card clues. For example, the relation *(IsA "aids", "sexually transmitted disease")*, found in the ConceptNet-Br, is presented to teachers as "Aids is a(n) sexually transmitted disease".

Then the teacher can *(a)* select a common sense statements as clues, adding them to the card set of clue; *(b)* edit a statement to make it suitable to the game purpose; or *(c)* just ignore the suggestions and compose others clues. It is worth pointing out that the sentences edited or composed by the teachers are also stored in the OMCS-Br knowledge base as new common sense statement collected from that teacher. Figure 2 presents in the box "List of clues suggested from common sense knowledge base" some statements retrieved from the OMCS-Br knowledge base which can be used as clues, as it was explained
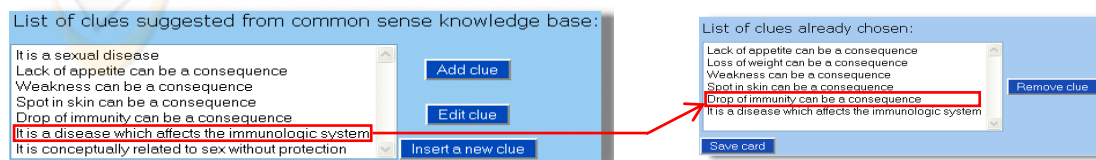

Figure 2: Game's Editor Module.

before. Those statements are related to the secret word "aids". The box "List of clues already chosen" shows the clues which were already chosen to compose the card.

It is also important to point out the fail-soft approach adopted in the framework. This means that the statements suggested to teachers can be valid or not and the teachers will decide for accepting or not the suggestion. However, the suggestion does not bring any problem to the teachers' task performance. On the contrary, it helps the teachers to finish their task faster and more efficiently (Lieberman et al., 2007).

5 CONCLUSIONS AND FUTURE WORK

This paper shows "What is it?", an educational game framework whose purpose is to help teachers to work on the transversal themes proposed by the Brazilian Secretary/Minister of Education: sexual education, ethics, healthcare, environment, cultural plurality, market and consumers. The intention is to give teachers some support for teaching these themes concerning their students' context and culture through common sense knowledge usage, and at the same time promoting a way of learning with fun. As it was discussed in section 2, the adoption of common sense based approaches for education is defended by respected educators like Papert (1985), Freire (1996) e Freinet (1993). Preliminary results of using the game point out that this approach is useful from both points of view – teacher's and students' once it is considered helpful for teachers to have a previous knowledge of their students' habits, believes, myths, and as their common sense knowledge is represented in that specific game instance, they feel like that game is specially developed for them, for their reality.

As future works it is intended to improve interfaces, after that, it is being planned to perform a case study with teachers and students from the Brazilian public education system, in different cities, in order to assess the game usefulness and to gather new requirement to fit it to the teachers and learners necessities.

ACKNOWLEDGEMENTS

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