

EDUCATIONAL GAME DESIGN: BRIDGING THE GAB BETWEEN COMPUTER BASED LEARNING AND EXPERIMENTAL LEARNING ENVIRONMENTS

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ABSTRACT

Considering the rapidly growing amount of digital educational materials only few of them bridge the gap between experimental learning environments and computer based learning environments (Gardner, 1991). Observations from two cases in primary school and lower secondary school in the subject of home economics shows that problems in computer based learning occurs when the basis of the learning process changes from being hands-on experimental with the subject to being experienced through or with a computer. Some of the central problems in home economics are to force abstraction from the specific course to general principles of cooking, food, variation, energy and nutrition. We believe, that the computer can help doing this. This paper describes a innovative model for integrating technology as a part of practical experimental working with own ideas. The model is exemplified with a prototype of a MOO storyline. The aim of the MOO storyline is to challenge the potential of dialogue, user involvement, and learning responsibility and to use the children's natural curiosity and motivation for game playing, especially when digital games involves other children. The paper proposes a model, based on the narrative approach for experimental learning subjects, relying on ideas from Csikszentmihalyi's notion of flow (Csikszentmihalyi, 1991), storyline-pedagogy (Meldgaard, 1994) and ideas from Howard Gardner (Gardner, 1991). The model forms the basis for educational games to be used in home economics, and thus is a step on the road to produce a learning resource in an area, until now mostly populated with electronic recipe-managers and digital health-tracking ditto.

KEYWORDS

Home economics, IT-integration, MOO-environments, storyline, interactive dialogue game, flow, enjoyment

INTRODUCTION

When observing children in 7th grade in home economics in a Danish primary school one comes to ask: "How can IT be integrated in home economics in a way, that solves basic subject-related problems, and empowers the students' curiosity and joy of cooking?" Observations of children experimenting with ingredients and cooking, shows that this is a subject where engagement and pleasure is the bias for learning. Pupils simply enjoy producing meals and have hands-on activities with ingredients and food items. This paper describes how these observations are used for designing a courseware prototype to the subject of home economics.

We define the notion of 'integrating technology' as a way to deal with learning processes where technology is considered an integrated part of experimental working with own ideas in order to learn about phenomena of home economics. This is in opposition to using technology as a 'stand-a-lone' tool and is rather an attempt to consider the use of technology in science related subjects in a more integrated way.

Home economics in the Danish primary school is a compulsory subject in one or more grades from 4th grade to 7th grade and it is optional between 8th and 10th (The Danish Ministry of Education, 1995) The

subject itself is interdisciplinary because basic knowledge from both science and the humanities is used when the pupils work with production of meals and reflection on the derived meaning for health and quality of life. In the Danish school home economics has been a subject for more than a 100 years (Benn, 1995). In the latest year the subject has turned out to be one of the most popular optional subjects among girls and boys (Petersen, 2001).

Just as other school subjects in Denmark home economics puts an effort in using IT as an integrated part of the subject. The Danish school law says that IT is to be considered integrated in every subject where it can be regarded as a potential for working processes with different aspects of the subject (The Danish Ministry of Education, 1995). Analysis of our empirical observations reveal that there are certain problems when using software in home economics because of the switching between two very different kinds of learning environments. Empirical results gathered show that even though software is relevant to a specific meal cooking activity learning processes get disturbed when moving from one learning environment to another. This has an impact on the pedagogical methods used and therefore also on the learning processes.

International as well as Danish national research shows that children love to interact with computers and graphical experiences (Druin, 1999 and Sørensen, 2002). We find this is a joyful opportunity for children to deal with abstract levels of nutrition education. If the computer is integrated in the right way, it can serve as motivational material in learning processes with food, nutrition and meals and contribute to changes in cognition and in children's understanding of the connection between nutrition and food (Benn, 1997).

THE THEORETICAL BASIS

As the basis for understanding the above-mentioned phenomena, we will use Mihaly Csikszentmihalyi's notion of flow (Csikszentmihalyi, 1991). Flow describes the understanding of humans optimal experience:

“...*flow* – the state in which people are so involved in an activity that nothing else seems to matter; the experience itself is so enjoyable that people will do it even at great cost, for the sheer sake of doing it”. (Csikszentmihalyi 1991:4)

Flow is an optimal experience, where body or emotions are strained to its limits in the attempt to achieve something difficult or desirable (Csikszentmihalyi, 1991). Such experiences are autotelic, which means, that they become a goal in it self. Human might carry out the activities in order to reach a goal, but the pleasure by doing the activities is autotelic:

“The doing itself is the reward [...] when the experience is autotelic, the person is paying attention to the activity for its own sake; when it is not, the attention is focused on its consequences”. (Ibid 1991:76)

Csikszentmihalyi (Csikszentmihalyi, 1991) offer us another angle to analyse phenomena in home economics because of his three terms of pleasure, happiness and enjoyment. In this paper we treat activities in the subject of home economics as experiences of *enjoyment*.

Enjoyment occurs when there is accordance between challenges and skills in human experience. When a human can be absorbed into an activity it is because the goals are experienced as very clear, and there is an immediate feedback to ones action. This makes the feeling of control and engagement. The individual engagement in an activity becomes an importance for the concentration on the present assignment. And when the individual human uses its full attention on the activity, everything else is experienced as triviality. One becomes absorbed into the activity and forgets time and space - action and attention simply fluid together into a higher unit (Csikszentmihalyi, 1991).

These elements are relevant when considering the area of cooking in home economics. Our observations have shown that enjoyment appears when pupils are allowed to experiment with ingredients and food items. One of the most remarkable elements is the presence of wondering in order to control the activity. We consider expressions of wondering as expressions about dealing with own intuition. As described by Howard Gardner (Gardner, 1991) children have very strong intuitions about science phenomena. And learning processes that consider the importance of the child's own ideas and intuitions about science have better probabilities to achieve success than learning processes that do not. It is Gardner's belief that children's understanding of science phenomena only will occur if their ideas are considered seriously and with engagement (Gardner, 1991).

We believe that both cooking and working with computers can serve as activities with potentials for enjoyment and learning. This will occur if they are integrated in a way, where they can take advantage of each other. In order to integrate the two areas, the software must be developed to facilitate the working processes in the kitchen. The software must contend possibilities for children to deal with abstract levels of cooking with very concrete activities.

In our observations of two 7th grade classes the term of enjoyment has been relevant to describe pupil's experience. On the basis of these analyses this paper will propose a model for educational games to be used in home economics, and thus create a learning resource in an area where enjoyment is considered important.

PROCEDURES USED FOR DESIGNING

In order to find out how working and learning processes elaborate when using IT in home economics we have gathered empirical data through observations in two different 7th grade classes. The two case studies were organized as a comparative classroom study of two events in order to investigate the use and influence of different applications on learning processes in home economics. The participants were pupils from the two classes, their teacher and one of the authors.

The classroom study consisted of three activities:

- Planning the class experiment with the teacher in order to integrate computer software with kitchen experimenting
- Observations of the classroom events in order to track the engagement, motivation and learning, which took place, and in order to understand the conditions for these
- Evaluation with the pupils in order to analyse how the classroom events had influenced their understanding of the theme and to analyse what kind of learning had occurred

Case one

In the first case an edutainment game was used as a point of departure to cooking and preparing different kinds of shakes with different amount of energy. Because of the edutainment genre, the class started out with the game (UNI-C 2001) and hereafter continued with cooking in the kitchen. The sequence processed as follows:

20 pupils in a Danish 7th grade class enter the school kitchen and spreads into 5 groups. The teacher begins the class by introducing the goal and the progress of the next 3 hours. The exercise involves playing the Danish edutainment game Harmonia (UNI-C 2001) and hereafter the cooking of shakes with different kinds of energy. In the Harmonia the goal is to help a figure reach the goal by making sure it eats the right amount of food and with variation. The relation between variation and the amount of food constitutes the complexity in the game. The teacher asks the pupils to think about how the food we eat has an influence on our needs of energy, while they play the game.

The 5 groups move to a computer laboratory, where they separate 2-3 persons around a computer. The edutainment game starts out and the members in the groups find out how to share the mouse and the keyboard. The first 20 minutes they all get very involved with the game and engage with the topic about

food and variation. They give suggestions to each other about what the figure should eat and not eat and they get excited when the games feedback tells the player that the figure doesn't feel well and must have a little more of this and that, before it will 'die'. Some pupils talk about the quality of the game and the solution of the complexity in it, other pupils need technical help from the teacher.

After 45 minutes the pupils move back to the kitchen. Ingredients to the shakes are spread out to each group and they start experimenting with it in order to produce a special shake with a unique taste and amount of energy. Some of the groups start to mix the shake as they think it should be mixed. After a quick taste they realize, that they might have forgot something, and they start all over by looking in the recipe. Other starts looking in the recipe and finds it necessary to change a little bit in order to get a unique taste.

When all the shakes are produced the groups taste each other's and decide which one taste sweet, sour and ugly. The teacher poses a question about which of them they think have the highest level of energy. The pupils respond to her question. A few pupils mention other aspects of the taste and content of energy such as the ingredients in it. The teacher raises more questions and relates them to the edutainment game, such as: what influence did the food have on the figures energy and how could they tell. The lecture and discussion occupy the final 20 minutes of the class time.

In this case the integration of the software in the lesson was complicated by the fact that the pupils needed to move away from the kitchen to a computer laboratory. This meant that the sequence in the kitchen had to be short and focused because of the time limits. It also meant that the context changed remarkably since the 'smell' of kitchen and food was absent in the computer laboratory. Therefore the teacher had to make sure that the two sequences were kept related by connecting them together in the last discussion. But what the analysis also reveals is, that the children's learning processes are interrupted by the change of learning environment. Instead of ongoing learning- and work processes they are divided in two different kind of learning, cognitive learning and praxis based learning only connected by the teacher's last evaluation.

In the computer laboratory, the pupils focused on the content in the game and engaged with the solution of its complexity. Their comments were mostly related to their knowledge about playing games, but also very cognitive processes came into play when trying to keep the figure 'alive' by eating the right amount of food and energy. The dialogue between the pupils was very important in these solutions not only concerning the influence it had on the pupil's change of choice and activity but also on their engagement with the game. They would for instance say to each other: "don't eat the ham, because you have already eaten too much meat; Hurry, hurry eat the apple before you die". This kind of dialogue witnessed, that learning was taking place between the pupils and that they were contributing to each other's knowledge about food and nutrition (Dysthe, 1999)¹. The dialogue was also very connected with the game play. The children were very busy with completing the game correctly, and it was therefore important to make the right choices. This gave reason to analyse the playing sequence as an experience of enjoyment. In the last evaluation with the pupils they pointed out that they liked the game, but they found it more reasonable to play it at home instead of in home economics. This was because they didn't feel they had time enough to explore the whole game except from the first level.

In the kitchen the pupils used two different kinds of strategies when experimenting with their shakes. Two of the groups believed they could make the shake relying on own intuition (Gardner, 1991). The other believed they could qualify the recipe by using their knowledge of the ingredients' taste. In both situations the pupils used their intuition and experimented with it. Not until the taste was very bad and the mixture felt wrong the pupils looked in the recipe and changed their mixture. In order to Howard Gardner (Gardner, 1991) this is an important learning process, since the pupils explore their own ideas and intuitions before they are taught how things should be done otherwise. And this kind of

¹ Olga Dysthe who invented the notion of 'learning potential' in her text "Web-mediated discussions from a learning perspective" (1999) used the analyses of dialogues between learners as a method to analyse learning processes.

experimenting with own ideas and intuitions is one of the elements in Csikszentmihalyis' notion of flow and enjoyment (Csikszentmihalyi, 1991).

The observation analysis also revealed that children like to experiment with mixtures and consistency. It seemed like the process of getting the consistency right made the pupils wonder about measures and content. It could therefore be assumed that learning took place, but that the conditions for these were independent of the progress in the sequences.

The problems outlined were how the computers could be more integrated and have a potential for the learning processes which took place in the kitchen. It was therefore planned to try another software programme that was a lot more dependent on children's feedback to it and was independent of time and place. Case two shows how this turned out in another class using a menu planning application (UNI-C, 2000).

Case 2

16 pupils in a Danish 7th grade class met each other by the entrance to a supermarket. With help from their teacher they started the class with buying ingredients to make meatballs and coleslaw. A half an hour later the session continues in the school kitchen and the teacher introduces the progress of the next 3 hours. The exercises involve cooking meatballs and coleslaw and to compute the amount of energy and content of fat, carbohydrate and proteins. In the kitchen there was two computers to share among 4 groups. The groups decided when to do the computing.

The teacher demonstrated how to cut the head of cabbage and he gave tips to the roasting of the meatballs. Hereafter the groups were handed the recipe and started out cooking.

The next 1½-hour was dominated by engagement, dialogue, wondering and experimenting. The teacher contributed with tips and good ideas to each group dependent on their needs. Most of the groups had decided to compute while the meatballs were roasting. This meant that only some of the members did the computing while others took care of the meatballs.

In front of the computers there was a lot of questions concerning the use of the software. The teacher helped them out. Some of the pupils preferred to use a calculator to work out the right amounts. After the calculating the pupils entered the amounts to the programme and got the results printed out to each member. While eating the meatballs and the coleslaw the teacher evaluated and asked questions about food and energy. The lecture and discussion occupied the final 20 minutes of the class time.

In this case the integration of the software was complicated by the fact that it was too difficult to use for the children and required technical as well as mathematical skills, which they didn't have. Even though the menu planning application was designed for school use there was not accordance between challenges and skills concerning children in the age of 12-13 in 7th grade (Contento, 1981). It had no possibilities for the children to use their own fantasy or solutions of the problems. They had to find a calculator to enter the right amounts instead of using the calculator in the planning application. The enjoyment in the class was therefore solely related to the cooking and the social interaction between the pupils while doing this.

THE FINDINGS

It seems like the two attempts in the cases to integrate technology with cooking turns out to ignore children's ideas and intuitions with cooking to the advantage of the use of technology. In case two, we saw that even though the computers were moved into the school kitchen, and the use of the software was independent of time and space, the pupils experienced it as an interruption in the cooking. Neither in this case we can talk about integration of technology. It was more like using the computer as a tool besides the practical meal cooking. But both cases have shown, that home economics as well as the use of computers are areas that talk to many of children's intelligences, and can cause enjoy full of

experiences. We would like these two areas to be integrated in a way, where they can take advantage of each other and therefore also have a better opportunity for learning in home economics.

The two cases show how difficult it can be to integrate software programme in home economics, and probably as well in other science related subjects. But they also show, that the use of software in home economics has good possibilities for working with complex coherences between food, variation, energy and nutrition. This tells us, that there is a basis for learning about home economics with technology but that the software should content better opportunities for integration with the subject. The integration between technology and practical based cooking in home economics is limited to what the software can offer. We therefore consider it a problem to integrate technology with the subject if we do not change it.

From the empirical analysis above we can outline four important findings in the need of integrating technology in home economics:

- Use coherence between the subject and the technology
- Use joy full learning environments such as workshop oriented praxis and motivating computer applications
- Use children's own ideas and intuitions as important elements in learning processes
- Use dialogues and interactions between pupil's as important elements in learning processes

With a point of departure in the problem domain outlined above, we here propose a model for design of software bridging the gab between the use of technology and practical cooking in home economics.

USING STORYLINES AND MOO ENVIRONMENTS AS POINTS OF DEPARTURE

We are inspired by the pedagogical method called storyline. The storyline method structures a learning process with consideration of interdisciplinary and basic competencies. The storyline method uses children's conceptions about phenomenon in the world as the point of departure. The storyline structure is intended as a guide to children's work processes and learning processes, but in it self it is empty and the children and teachers must fill content in it. The computer can be a tool, a library of inspiration and a medium for connecting the 'eager' groups of kids in the story line.

A storyline structure urges the children to go through different activities that will make them question their own knowledge. Through these activities they arrange and revise their own conceptions and put up hypothesis to investigate and even to reject. The method is built on learning principals where children are aloud to experiment, investigate and reject assertions in order to find their own solutions (Meldgaard, 1994).

Like this the storyline method uses holistic learning principles by letting the learning process jump out of the individual child. This means that children can start where they want to start and do what they find most interesting. The goal is to let the child develop own knowledge. In this process it is in principal of no matter if the child's knowledge is right or wrong as long as the child has the possibility to adapt it by him or her self.

Storylines are by nature cross-curricular with several subjects, for instance science, home economics and math. But it is also possible to work with different aspects within the subject itself. A broad theme can be chosen and within this theme, the pupil's picks out roles. This could for instance be in the theme "The food we eat as an important element in the quality of life"; some pupils work with health matters, some with economy and some in the actual production of meals. What we propose here is that IT can serve as the genre that links all the activities together in a storyline. To this proposal we have designed a prototype based on a MOO-environment.

We have chosen a MOO-environment as the software-genre. A MOO is a Internet-based multi-user environment that allows multiple users to share a textual world of rooms and objects, and to interact with each other (Holmevik *et.al*, 1998). A MOO can serve as a virtual meeting place for pupils and teachers when using storylines as the pedagogical method (Holmevik *et.al*, 1998). The environment

offers an opportunity for pupils to play role games and to participate in creating narratives using own ideas, intuitions and experience.

In the MOO-environment reside a number of the skills, we want to stimulate: Exploration, investigation, collection of artefacts and the possibility to deliver important information to other pupils (Holmevik *et.al*, 2000). We call the game genre an *interactive dialogue game*. This means, that the pupils develops the game on the basis of dialogue and choices made upon own knowledge, experimenting in the kitchen and common intuition.

In the case we find it very important, that the MOO primarily is a text-based object. Writing and linguistic solutions are potentials for children's learning and cognitive skills. We also find it very important, that the MOO is a multi-user environment. Many groups can participate in a storyline with the MOO as a central communication media, delivering information, results and questions to each other's processes. It offers an opportunity for integrating computers in workshop-oriented praxis using storyline as the structuring pedagogical method.

Our example in the prototype shows a storyline where pupils are going to throw a party. The pupils are in the role of employees in an ecological restaurant called 'Chez Victor'. At Chez Victor they produce everything needed for the perfect party. The pupils enter the MOO, and starts navigating and collect information and recipes. The economy department group examines the business plan. They meet the production planner group, and for instance ask the question "What is the production costs of the product, we are going to produce?". The group goes to the kitchen, and starts to experiment with various recipes, in order to find the best and cheapest. Results are entered in the MOO and thus sent to the economy department.

The prototype is implemented in Encore StoryMOO, hosted by The Danish University of IT (Klastrup, 2001)

THE INTERACTIVE DIALOGUE GAME PROTOTYPE

The dialogue game has a goal that the pupils can only solve in collaboration. For instance to make a factory, that can produce meals, that are both healthy and competitive of the market. The pupils must communicate with each other in order to help and develop the storyline. They must solve tasks, answer questions, experiment in the kitchen and make sure that the storyline continues going on in the game. The task has different characters structured by thematic areas as well as technological opportunities. This could for instance be:

- The economy department group
- The laboratory group
- The production planner group

When the pupils enter the storyline, they see the entrance of the restaurant:

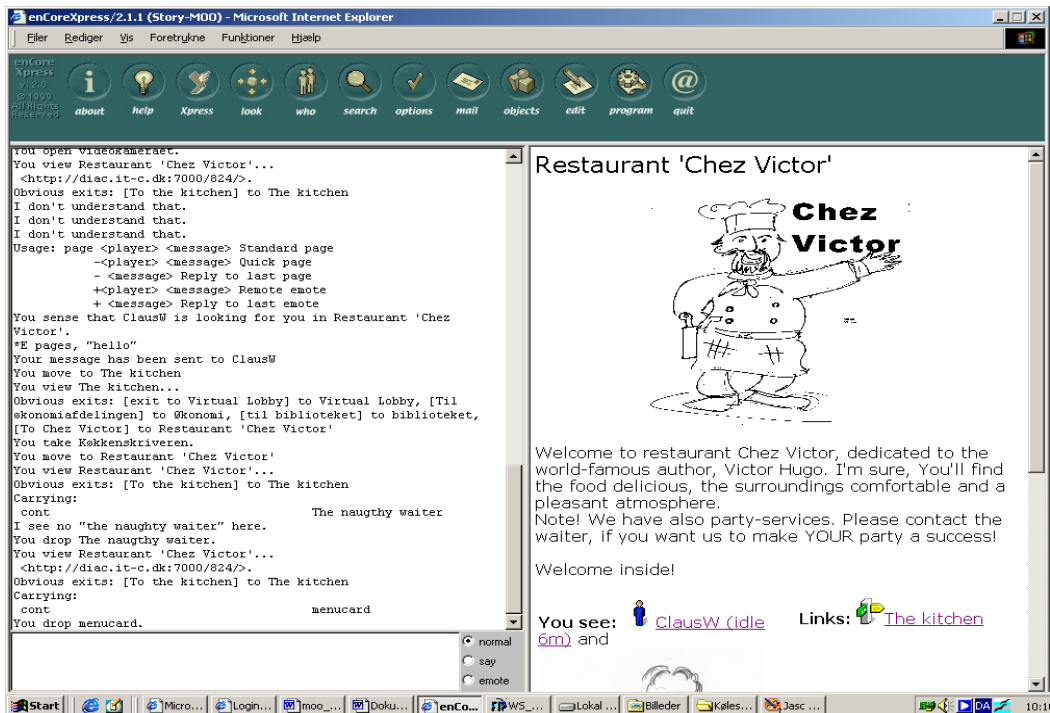


Figure 1. The entrance in the storyMOO showing to the right a profile and a link, to the left a dialogue between a storyMoo robot and a player

In the entrance the pupil's are invited inside the storyline. Here they have the opportunity to go to the kitchen and start out the process. The pupils are not only supposed to play the game but also to use resources from the kitchen and each other in order to solve the task. As a respond to the pupils solutions new task and situations to relate to will occur. Therefore the game has two goals. One is to solve the task. In order to do this, the pupils have to cooperate and experiment in the kitchen. On the way through this process, they have to decide about ingredients, cost, amounts and production. The other is related to play the game. The better the pupils solve the task the more complex the story develops. Pupils can navigate in the space, created by the narrative of the story (usually denoted as a room). If a status of a certain height is reached, the pupil can define an own room, furnish it with his/her own drawings and events.

In the kitchen several objects can be found, scrutinized and new produced, such as new recipes, reports to the economy department and for instance the menu-card. Very few information are given, only small-scale recipes. When producing in large scale, the pupils will have to experiment, helped by some interactive services (Javascripts on a webpage in the MOO). A lot of traffic and communication between the computer lab and the workshops is needed.

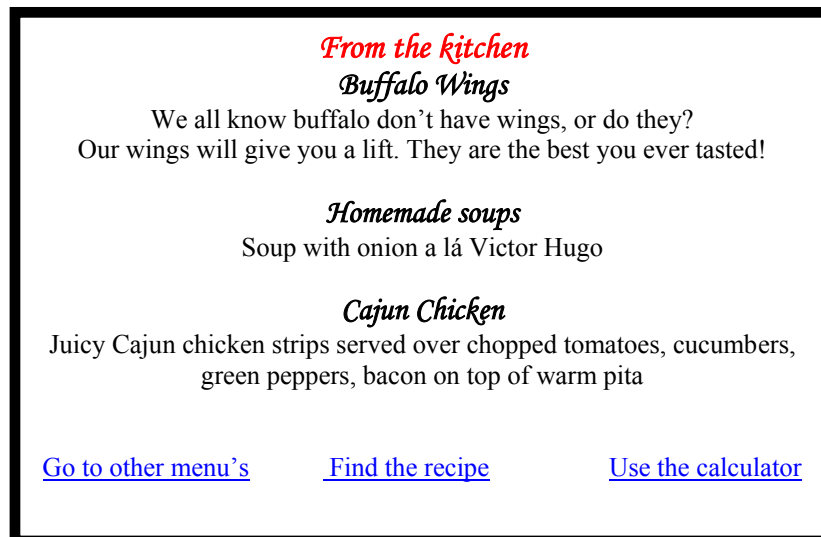



Figure 2. On the menu card, you see some delicious courses, including specialties, soup and main courses

Rooms to visit and furnish

There are a number of rooms in the actual MOO: Economy, kitchen, main entrance and director's office. Pupils can help furnish the various rooms, chat with other users, examine objects and ask questions in order to get help.

In the MOO space pupils can always see, who is also in the room and you can chat with these persons. Pupils can also see descriptions and pictures of these persons. We believe that this is a key to collaboration in the storyline between various groups, some working in the kitchen, some in physics lab, some in the class-room.

 **Profile: Brian**
Hello, I have in the StoryMoo
received the level of waiter,
even though I started as a
dishwasher.
I will do anything possible to
make you stay in the
restaurant 'Chez Victor' as
pleasant as possible.

I'm carrying
A knife
Towel

Figure 3. A description of a profile created by the pupils participating in the MOO.

Robots

The actions in the storyline are mainly created by the communication between the various groups of students and to some extent also by the teacher. A third agent is also available in the MOO. In some of the rooms, simple AI-based robot reside. Robots can be programmed to give hints on specific questions.

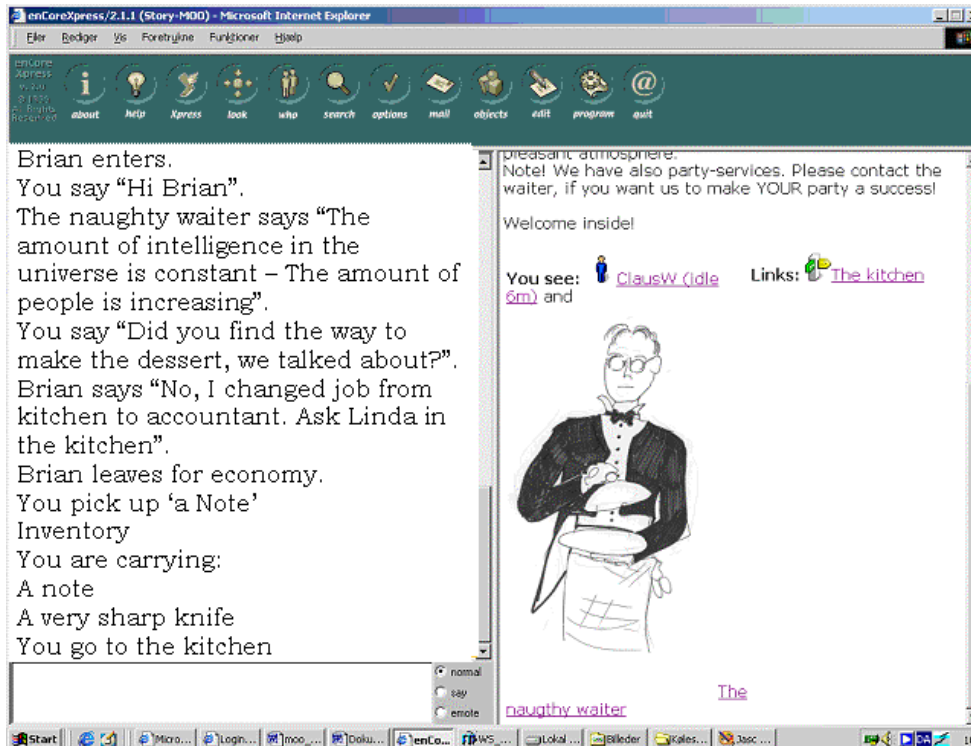


Figure 4. The text at the left shows a dialogue between a pupil-profile and a robot

The robot can also give hints at random, if the students don't do anything or ask questions that cannot be interpreted by the robot. This could for instance be a hint about where to find more information. Maybe older pupils can work as guides in the MOO as well or programmers of the robots. When it comes to more detailed questions, the robots cannot answer. Here the teacher is the special subject expert in the workshop.

Calculations

In Encore StoryMoo, it is also possible to add rooms in HTML-format. This enables us to form not only Moo-pages, but also pages like the one, seen below, 'The Office' where pupils can use various simple, interactive calculators and other services.

Welcome to the office

Todays total:

Monthly Surplus:

Figure 5. Shows a calculator service

HYPOTHESIS ON STUDENTS LEARNING ACHIEVED THROUGH THE PROGRAMME

We find, that the structure above can be one way to provide a communication infrastructure in storylines that includes several groups' work at different lab and maybe even on different schools. The room's calls for exploration and the multi-user-interface calls for communication, discussion and the possibility of storing and exploring objects calls for investigation and sharing of results. We also find, that the possibility of creating characters in the MOO, with description and pictures can easily be exploited in storylines.

The dialogue game prototype is only a supporting structure. Much work needs to be done on the graphical and didactical side in order to force the pupil's reflection and thus learning. Even though we can outline three hypotheses on students learning achieved through the program:

1. The storyline-MOO will motivate pupils in Home Economics to use their curiosity for game playing and experimenting in the kitchen. This motivational aspect brings new activities to the subject and therefore also new ways of dealing with abstract nutrition education. In this case it is important to have in mind, that the goal is not to change behaviour in children's buy and use of food, but to facilitate children's understanding of the connexion between many variables in home economics. This could for example be questions related to food and culture, food and economics, food and homecare etc.

2. The storyline method connected with the MOO environment will bridge the gap between cognitive and practical based learning in home economics. In terms of integration this will happen because the MOO will serve as the base for communication and collaboration. Children will work with own ideas and communicate them with others in order to keep the process ongoing. In order to experiment with food items new ways of cooking must be sought. It will be necessary to interpret and develop understandings of culture, economics, nutrition, meals and so on, and to find out how to talk about the topics.

3. The game play will support the pupil's experimental working with own ideas in order to learn about phenomena of home economics. If a group does not participate in the game play, they will have to continue on their own. However the game play will not die, it will just have an unsolved link. The product developments from the groups will make sure, that there is a goal to reach and that other might take a look at it and perhaps also take a taste.

In order to evaluate the prototype these areas needs to be considered. It is also important for the evaluation to make sure, that the use of the computer is not regarded as the goal in itself but as a pedagogical method used in order to learn about topics in home economics. Therefore children's writings and written dialogue between them must be included in the evaluation. It is important to notice, why and how children have developed their cognitive skills as well as the end product. It might also be considered if the learning processes could have happened without the use of a computer although it might not have been the same joyful experience

REFERENCES

Benn, J., (1995). Skolekøkkenet et rum for husgerninger for disciplinering og udfoldelse, In: Nielsen Vagn Oluf (Ed.), Skolefag i 100 år, Danmarks Pædagogiske Universitet.

Benn, J., (1997). Nutrition Education in Question: A critical educational approach to nutrition education in schools, The Royal Danish School of Educational Studies, Department of Biology, Geography and Home Economics. Copenhagen.

Contento, I., (1981). Children's Thinking about Food and Eating – A Piagetian-Based Study. Research paper, Journal of Nutrition Education.

Csikzentmihalyi, M., (1991), Flow – the psychology of optimal experience, HarperPerennial ed. New York : HarperPerennial.

Druin, A. (Ed), (1999). The Design of Children's Technology, San Francisco, CA: Morgan Kaufmann.

Dysthe, O., (1999). Web-mediated discussions from a Learning Perspective, In: Proceedings of 27th annual Congress for NFPF, Copenhagen, The Royal Danish School of Educational Studies.

Gardner, H., (1991), The Unschooled Mind - How children think and how schools should teach, New York: BasicBooks

Harmonia – Mad Der Dur, (2001). software edutainment developed by The Danish IT Center for Education and Research, Denmark.

Holmevik, J.R. and Haynes C., (1998). High Wired. On the Design, Use, and Theory of Educational MOOs, University of Michigan Press.

Holmevik, J.R. and Haynes C., (2000). MOOniversity. A student's guide to Online Learning Environments, Allyn & Bacon, Chestnut Hill Enterprises, Inc.

Kostguiden2, (2000). Software developed by The Danish IT Center for Education and Research, Denmark

Klastrup, L., (2001). Adventures in StoryMOO - online textuality in play, In: Collection of Papers - Computer Games & Digital Textualities (eds. Järvinen, Koskimaa, Juul, Klastrup), IT University of Copenhagen.

Meldgaard, (1994). In: Jørgensen, Ingelise and Rasmussen, Anelise Birkvad (red.): Storyline-pædagogikken – nye veje til tværfaglighed og undervisningsdifferentiering, Gyldendal.

Petersen, H.B., (2001). Der er flow i hjemkundskab. In: Faglighed i højden: 15 articles about the didactics of engagement. Ed. Susanne V. Knudsen and Hanne Birkum Petersen. Vejle : Kroghs Forlag.

Sørensen, B., (Ed.), (2002): Børn på nettet. Kommunikation og læring, 1. udg., 1. oplag, Gads Forlag, Copenhagen

Undervisningsministeriet (1995): Vejledning hjemkundskab. Faghæfte 11.

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