

mLearning for kindergarten's mathematics teaching

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Abstract

The aim of this study was to develop a geometry learning game for handheld devices that adapts to the user's behaviour. The learners in this study were six years old Finnish pre-school pupils. The adaptive system was very limited and the observed behaviour was defined to be very simple. Despite that, the developed software achieves good learning results among the tested pupils. The study shows that the learning effect is very promising with this kind of a handheld platform and simple adaptation system. This study gives good visions of what can be achieved with more complex behaviour adaptive systems in the field of eLearning.

1. Introduction

The WWW looks promising as a very rich environment for educational research: The WWW can deliver various types of learning materials and because many powerful data collection systems can easily be added to WWW-based learning materials. Mobility is one important research area in the field of learning materials.

2. Research questions and method

The present study contains two stages. In the first stage the aim is to find out some key factors in the user's behaviour which explain the learning results. In the second stage the aim is to develop an adaptive learning system.

The substudy in the first stage includes three groups of six-year-old children: experiment group 1 (n=21), experiment group 2 (n=20) and a control group (n=30). All groups were pre- and post tested regarding their geometric skills. Only the experimental groups used the learning materials on geometry, the control group did not get any educational effect. In the second stage there was only one experiment group (n=17). That group was compared to the groups in the first stage. More detailed descriptions can be found from Ketamo & al. (2001) & Ketamo (2001).

Three different learning games was implemented for this study. For the first stage there were two slightly different games implemented for laptop PC. One adaptive learning game for the second stage was implemented for handheld devices, Compaq iPaq especially (figure 1).



Figure 1. The adaptive geometry game on Compaq iPaq (PDA).

The user was asked to find and mark the required polygon. If the polygons were recognised correctly, the system allows the user to continue the game. In other case, the system informs that there are mistakes and user should modify the answer.

3. Game development

For the second stage geometry game was implemented for a handheld computer. Handheld computers gives new opportunities for teaching and they seem to be very suitable for this kind of a solution. In fact, handheld computers with a touch screen are likely to be faster to use than PC's with a mouse. The second version of the geometry game was implemented for Compaq iPaq PocketPC. When the PDA version of the game was tested, the assumption about easily utilised hardware showed to be true. The pupils learned

immediately to use the touch screen and the use of the handheld computers was very easy for them.

The iPaq's were connected to a server with a wireless network, which is the most powerful way to utilise these terminals. The wireless network behaves as wired and the network in that way is invisible for http-services. The game works perfectly also in PC environments, because the utilised code was very simplified according to the limitations of iPaq scripting.

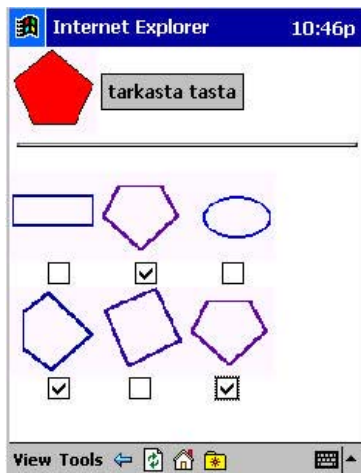


Figure 2. Handheld user interface for geometry game

The game itself inherits the best parts of the previous interfaces (figure 2). The illustration in the top of the display was meant to show the requested shape. The polygons that should be recognised were below the illustration and the 'check'-button. The interface was simple and easy to use in the pre-test of the game.

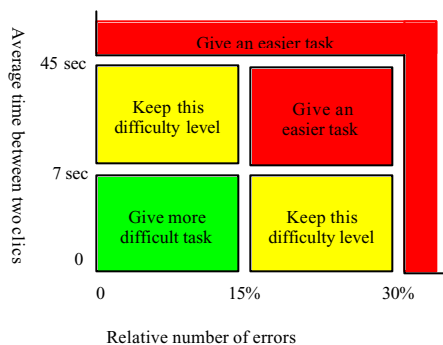


Figure 3. The rules for learning results optimising.

The adaptive learning game requires naturally more than scalability to different platforms. The calculation rules (figure 3) for learning result optimising were developed according to the results of the first sub study.

The calculation rules were executed on a WWW-server and according to the rules, the following display was constructed. The system constructs the new interface partly by randomising the presented shapes according to calculation rules. With this solution it is almost impossible that the same interface appears twice to one player, no matter how long the game takes.

4. Conclusions

The most important result was that all low skilled pupils reached the level of the group represented by average skilled pupils. This is important in order to give all pupils the same possibilities in the future. This result support the assumption that computer based teaching helps most the low skilled pupils (Sinko & Lehtinen 1999). The tested population in the second stage was quite small. Small population naturally lowers the significance of the second stage results. On the other hand, the achieved results were quite clear and the results were not meant to be general properties of the learning materials. The results were only meant to fulfil the needs of this study. When transferring these ideas to other learning games, the factors and the limits for the adaptation system should be examined from the starting points of the learning material.

Though the PDA version of the geometry game worked well, some development has to be made: When the player gets tired, which is quite usual with six year old children, players behaviour changes a lot. The system should be taught to understand when the unexpected behaviour is about lack of skills and when it is due to tiredness. The second issue which needs improvement is the user interface. Though the children used the touch screen well, they still made some mistakes only by accident. The user interface development could be difficult task because the good usability of the software should be remained.

5. References

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