Parcours - Teaching Primary School Children Logical Thinking and Coordination Skills through a Collaborative Smart Table Game

Patrick Dohrmann, Niels Pinkwart, Andreas Rausch, Alke Jürgens, Tim Warnecke, Department of Informatics, Clausthal University of Technology, Julius-Albert-Str.4, 38678 Clausthal-Zellerfeld, Germany
Email: Patrick.Dohrmann@tu-clausthal.de, Niels.Pinkwart@tu-clausthal.de, Andreas.Rausch@tu-clausthal.de, juergens37@kabelmail.de, Tim.Warnecke@tu-clausthal.de

Abstract: Today, typical classrooms are still equipped with blackboards, chalk and sometimes overhead projectors. Technology-enriched rooms can often only be found in school libraries or computer pools where students can research topics on the WWW or use other specific computer applications. In this paper, we present the design of an educational game called "Parcours", developed for the interactive SMART table. This game, installed on a tabletop that is located within a classroom, is designed to teach primary school children collaboration and coordination skills as well as logical thinking.

Introduction

Today, technology is getting increasingly ubiquitous, even for children at younger ages. Many devices such as interactive cell phones, game consoles or PCs are widespread and children often use them for a variety of purposes, including gaming. Device manufacturers as well as educational practitioners and researchers have tried to include educational games into their portfolio. Regrettably, many existing educational games can only be played in an unsupervised manner, are rather disconnected from education in schools and are single-user based or competitive (rather than truly collaborative). A number of studies has indicated that collaboration can promote children's learning (e.g., Webb & Palincsar, 1996; Johnson & Johnson, 1990).

The SMART Company regularly starts application contests in which ideas (and prototypes) for innovative collaborative educational games for tabletop devices are invited. In this paper, we present the design and of the 2010 contest winner, the "Parcours" game. Exploiting the benefits of the table top device, this cooperative and co-constructive game is designed to teach primary school children coordination as well as logical thinking skills.

State-of-Art

Educational tools using large interactive displays have gained currency in recent years. The StoryTable application (Cappelletti, Gelmini, Pianesi, Rossi & Zancanaro, 2004) enforced co-operation during story-telling activities, and studies conducted with this system showed that cooperative storytelling can increase the level of engagement of less motivated children without affecting the involvement of the more active ones. Harris, Rick, Bonnett, Yuill, Fleck, Marshall & Rogers (2009) have described a study with the OurSpace application, a groupware tool for solving seat assignment tasks. A result of this study was that multi touch displays reduced group conversations about turn-taking activities and increased task-focused discussions (as compared to single touch interfaces).

In summary, research results indicate that multi touch applications specifically targeted for CSCL are not only technically feasible but also potentially valuable, since they combine intuitive interaction concepts with new face-to-face cooperation mechanisms, leading to novel CSCL application areas, particularly within classrooms. In this paper, we describe the design of "Parcours", a co-constructive application which, compared to the existing research results as discussed in this section, is unique in its combination of target group (primary school), learning goals (coordination and logical thinking) and group activity type (collaborative game).

Parcours: Purpose and Design

While many educational games focus on specific cognitive educational objectives like improving mathematical, language or memorizing skills, a discussion with a pedagogue spawned the idea to design a collaborative educational game that focuses on teaching *logical thinking* and *coordination skills*. These skills are important for everyday life and child development, yet there is typically no dedicated school subject for them. The design goals of Parcours include that the children of the age group 5-10 should be able to intuitively understand the game, coordinate themselves to win, and enjoy the game.

Basic Game Concepts and Their Relation to the Learning Goals

Parcours is a bridge builder game. It provides a rasterized gaming area where the players have to build a path from a starting point to a goal point by using certain tiles, surrounding the gaming area, in order to help a playing figure across the map, winning the game. Figure 1 depicts the user interface of the game (one of four

available visual themes) and shows that the game can be operated from all sides of the tabletop display. There are two main actions that can be done in the game at the same time: building the path and moving the player.

A small playing figure can be moved across a built path by touching the arrow buttons, thus maneuvering the figure in the direction the arrows are indicating. The path building process is complicated by different obstacles like rocks and ditches: here, the players have to build a path either around them or across them using special tiles. The game features ten different difficulty levels, differing in the amount of obstacles on the screen.

All tiles in the game can be dragged intuitively onto the gaming area by touching and dragging them. They can also be rotated by using at least two fingers, making a rotation movement. All tiles are slightly larger than the raster of the playing field and can be dropped into the gaming area with a "minimizing" gesture.

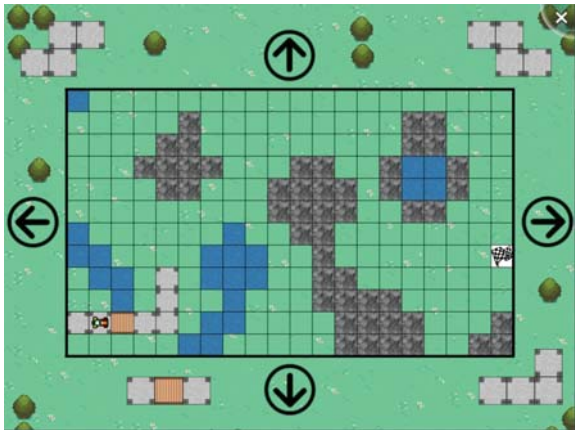

Figure 1. The Game Parcours.

The main opportunity to learn coordination skills is connected to the use of the tiles surrounding the gaming area. The players have to cooperate and agree concerning which tiles to use next, then choose them and pass them to other players around the table, who will then drop them down. Furthermore, they have to coordinate themselves and to cooperate while using the special tiles. Another feature supporting coordination and cooperation is the movement of the figure because the arrow buttons are distributed around the area, forcing the players to discuss the next steps and to work together to allow the playing figure to reach the goal.

Furthermore, the players are forced to think logically because they have to choose the tiles they will use wisely. If there are no tiles left to finish a path, they will lose the game.

Pilot Tests and Teacher's Feedback

We tested the game in a primary school. Children who played the game confirmed the simple and intuitive handling of the game. As expected, the children were discussing about the next steps they wanted to do and helped each other using the special tiles, which require cooperation and coordination.

We also interviewed the pedagogue who observed the children playing Parcours. She stated that she believes that this kind of game can be very useful for multiple school subjects. While the game was intended to teach coordination and logical thinking, the teacher also discovered other possible beneficial side effects in learning, e.g. language and geometry skills. The teacher also stated that she believes the concept of learning with a multitouch screen is very enjoyable and has potential to keep the school children excited and motivated.

In summary, while not constituting solid evidence, first tests of Parcours in school suggest that this game has the potential to help primary school children learn a set of diverse skills, including logical thinking and coordination. The next steps on our research agenda include an extended empirical evaluation of the system.

References

Cappelletti, A., Gelmini, G., Pianesi, F., Rossi, F., and Zancanaro, M. 2004. Enforcing Cooperative Storytelling: First Studies. In *Proceedings of ICALT*. IEEE Computer Society, Washington, DC, 281-285.

Harris, A., Rick, J., Bonnett, V., Yuill, N., Fleck, R., Marshall, P., and Rogers, Y. 2009. Around the table: are multiple-touch surfaces better than single-touch for children's collaborative interactions? In *Proceedings of CSCL*, pp. 335-344.

Johnson, D. W., & Johnson, R. T. (1990). Co-operative learning and achievement. In S. Sharan (Ed.), Co-operative learning: Theory and research (p. 23-37).New York, NY (USA): Praeger.

Webb, N. M., & Palincsar, A.S. (1996).. Group processes in the classroom. In D.C. Berliner & C. Calfee (Eds.), *Handbook of Educational Psychology* (pp. 841-873). New York: Simon & Schuster Macmillan.