Tropical Medicine Open Learning Environment[1]

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INTRODUCTION

Educational goals have generally shifted from knowing everything in a specific domain to knowing how to deal with complex problems. Reasoning and information-processing skills have become more important than the sheer amount of information memorized. In medical education, the same evolution has occurred. Diagnostic reasoning processes get more strongly emphasized. Whereas previously knowing all symptoms and diseases was stressed, reasoning skills have now become educationally more important. They must enable professionals to distinguish between differential diagnoses and to recognize patterns of illnesses (e.g., Myers & Dorsey, 1994).

BACKGROUND

Authentic or realistic tasks have been advocated to foster the acquisition of complex problem-solving processes (Jacobson & Spiro, 1995; Jonassen, 1997). In medical education, this has led to the use of expert systems. Such systems were initially developed to assist practitioners in their practice (NEOMYCIN, in Cormie, 1988; PATHMASTER in Frohlich, Miller & Morrow, 1990; LIED in Console, Molino, Ripa di Meana & Torasso, 1992) and simulate real situations. These systems were expected to provoke or develop students' diagnostic reasoning processes. However, the implementation of such expert systems in regular educational settings has not been successful. Instead of developing reasoning processes, these systems assume them to be available. They focus on quickly getting to a solution rather than reflecting on possible alternatives. Consequently, it was concluded that students need more guidance in the development of diagnostic reasoning skills (Console et al., 1992, Cromie, 1988; Friedman, France & Drossman, 1991), and that instructional support was lacking.

KABISA is one of the computer programs purposely designed to help students in the development of their diagnostic reasoning skills (Van den Ende, Blot, Kesten, Van Gompel & Van den Enden, 1997). It is a dedicated computer-based training program for acquiring and optimizing diagnostic reasoning skills in tropical medicine.

DESCRIPTION OF THE PROGRAM[2]

KABISA confronts the user with cases, or 'virtual patients'. The virtual patient is initially presented by three 'characteristics'[3] randomly selected by the program. After the presentation of the patient (three characteristics), students can ask for additional characteristics gathered through anamnesis, physical examination, laboratory and imaging. If students

click on a particular characteristic, such as a physical examination test, they receive feedback. Students are informed about the presence of a certain disease characteristic, or whether a test is positive or negative. If students ask a 'non-considered' characteristic; that is, a characteristic that is not relevant or useful in relation to the virtual patient, they are informed of this and asked whether they want to reveal the diagnosis they were thinking about. When they do so, students receive an overview of the characteristics that were explained by their selection and which ones are not, as well as the place of the selected diagnosis on a list that ranks diagnoses according to their probability given the characteristics at hand. If students do not want to show the diagnosis they were thinking about they can just continue asking for characteristics. A session is ended with students giving a final diagnosis. KABISA informs them about the correctness. If the diagnosis is correct, students are congratulated. If the diagnosis is not correct, students may be informed that it is a very plausible diagnosis but that they do not have enough evidence, or they may get a ranking of their diagnosis and an overview of the disease characteristics that can and cannot be explained by their answer. Additionally, different non-embedded support devices – that is, tools are made available to support learners. These tools allow students to look for information about certain symptoms or diseases, to compare different diagnoses or to see how much a certain characteristic contributes to the certainty for a specific diagnosis. Students decide when and how they use these devices (for a more detailed description, see Clarebout, Elen, Lowyck, Van den Ende & Van den Enden, 2004).

FUTURE TRENDS AND CRITICAL ISSUES

KABISA is designed as an open learning environment (Hannafin, Hall, Land & Hill, 1994); that is, students are confronted with a realistic and authentic problem, there is a large amount of learner control and tools are provided to guide students' learning. However, the evaluation study performed revealed some interesting issues. A first revelation was that students do not follow a criterion path when working on KABISA. Prior to the evaluation, two domain experts in collaboration with three instructional designers constructed a criterion path. This path represented the ideal paths students should go through to optimally benefit from KABISA (following the "normative approach" of Elstein & Rabinowitz, 1993), including when to use a specific tool. Only 5 out of 44 students followed this path.

A second issue relates to the use of the tools. KABISA offers different tools to support students. These tools can help students in their problem-solving process. Results suggest that students consult some help functions more than others. However, overall they do not consult them frequently, and if they use them, they do not use them adequately. Students also tend to not use the feedback that can be obtained when asking for a 'non-considered' characteristic.

Although this environment can be described as an open learning environment, it seems that students do not perceive it as a learning environment. Thinking aloud protocols reveal that students think they are cheating or failing when consulting a tool. Giving the limited use of the tools, their impact on the learning process cannot be but limited.

However, in spite of the observation that in only a small number of consultations the criterion path was followed, students do find the right diagnosis in 80% of the consultations. It seems that by trial and error students can also obtain the right diagnosis.

The results of this evaluation suggest that KABISA is currently not used by students to foster their diagnostic reasoning skills. Rather, it enables them to train readily available skills. The results are an example of a well-designed learning environment used by learners as a performance environment. With the use of more open and online learning environments, this raises the issue of how to realize that students see such environments as learning environments with learning opportunities, rather than a performance environment.

In the design and development of KABISA, a lot of time and effort was spent in developing the tools. However, results show that students do not (adequately) use these tools. Other authors have found similar results with other programs (e.g., see Crooks, Klein, Jones & Dwyer, 1996; Land, 2000). This raises questions about the amount of learner control in open learning environments. Should the environment be made less open and provide embedded

support devices instead of tools, so that students cannot but use these devices? Or should students receive some additional advice towards the use of these tools? In the first case, support might not be adapted to the learners' needs. This might cause problems, given that either too much or too little support can be detrimental (Clark, 1991). The second option leaves the environment open. But here also, it can be questioned whether this advice should not be adapted to the learners' needs. A possible solution might come out of the animated pedagogical agent-research. These agents are animated figures that aim at helping learners in their learning process and adapt their support based on the paths learners follow (Shaw, Johnson & Ganeshan, 1999). Certainly in online learning environments where there is by definition a large extent of learner control, such agents might provide a solution, and act even as a personal coach for learners.

Another aspect revealed by the analysis is the importance of an evaluation phase in the development of computer-based training programs. For instance, a more thorough analysis of student characteristics could have provided a means to adapt the difficulty level to the level of the students or to identify what guidance students actually need. Apparently, the feedback given to students does not encourage them to adapt their problem-solving process. Being product- rather than process-oriented, feedback may not be adapted to students' actual needs. Likewise, students' instructional conceptions about computer-based learning environments or their perceptions about KABISA (game vs. educational application) may influence the use of the program. Students' instructional conceptions should be taken into account through the design process of the program. One possible way to influence these conceptions might be through an introduction of the program. In the introduction, the aims of the program, the different functionalities and the relationship with the different courses should be clearly defined (see Kennedy, Petrovi & Keppell, 1998).

Given the difficulty of anticipating potential problems and difficulties students might encounter in open learning environments, the introduction of a formative evaluation during the design and development of this program seems warranted. This would enable the redirection of the program while developing it, rather than after implementation. Rather than only evaluating a final product, the development process should be taken into consideration, as well. Rapid prototyping would allow for testing the program at different phases of the development. This leads to a more spiral cycle rather than a linear design process.

CONCLUSION

The evaluation of KABISA addressed some general issues important to consider in the design, development and implementation of open learning environments. Although these environments are advocated to foster the acquisition of complex problem-solving skills, there seems to be a gap between the intention of the designers and the use by the learners. This relates to the issue addressed by Winne and Marx (1982) about calibration. For an instructional intervention to be effective, calibration is needed between the conceptions of the various people involved. The introduction of a pedagogical agent might help to calibrate the conceptions of students towards those of the designers. Moreover, these agents might help in encouraging students to adequately use tools without reducing the openness of the learning environment.

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KEY TERMS

Animated Pedagogical Agents: Animated figures operating in a learning environment and aiming at supporting learners in their learning process and capable of adapting their support to the learners' paths.

Criterion Path: This a representation of an 'ideal path' to go through a specific learning environment. It specifies for each possible step in the program the most ideal subsequent steps.

Embedded Support Devices: These are support devices integrated in the learning environment. Learners cannot but use these devices (e.g., structure in a text).

Instructional Conceptions: These are conceptions about the functionalities (elements) of a learning environment. These conceptions can relate to the effectiveness or efficiency of specific features in a learning environment (e.g., tools) or to the environment as a whole (e.g., KABISA as a learning environment).

Non-Embedded Support Devices (Tools): These are support devices put to the disposal of learners. Learners decide when and how to use these tools.

Open-Ended Learning Environments: Aim at fostering complex problem-solving skills by confronting learning with a realistic or authentic problem in a learning environment with a large amount of learner control and different tools.

Perceptions: Students' perceptions relate to how they perceive a specific environment (KABISA). They are the results of an interaction between students' instructional conceptions and a specific learning environment.

END NOTES

1 A more extended version of this manuscript with more background information was published in Armstrong, A. (Ed.). (2004). *Instructional design in the real world. A view from the trenches.* Hershey: Information Science Publishing.

2 The authors are grateful to Stefano Laganà, who invested a lot of effort to adapt KABISA and to develop a log file system.

3 The term 'characteristic' refers to either a symptom or disease characteristics, either a request for results of a physical examination, laboratory test or imaging.

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