B. Chang et al. (Eds.) (2010). Joint Proceedings of the Work-in-Progress Poster and Invited Young Researcher Symposium
at the 18th International Conference on Computers in Education. Putrajaya, Malaysia: Asia-Pacific Society for Computers in Education.

Example Choice and ExampleWiki

--A step towards making formal principles interesting to students

Weiqin CHEN[a*] & Rolf REBER[b]
[a]*Department of Information Science and Media Studies, University of Bergen, Norway*
[b]*Department of Biological and Medical Psychology, University of Bergen, Norway*
*weiqin.chen@infomedia.uib.no

Abstract: We first present the concept of Example Choice which links formal principles in science to examples that students find interesting. We then describe a platform – ExampleWiki – which allows teachers to contribute and retrieve examples and students to choose the most interesting examples in order to learn formal principles.

Keywords: Example Choice, wiki

Introduction

Modern technology - especially the Internet - enables educators to let students choose from examples of their interest before or after they gather in class to discuss the formal principle which underlies all those examples. With example choice [11], we have developed a theoretical framework with implications for practice. Our first laboratory study on example choice shows that students are both more interested and use more time to learn the formal principles.
To implement example choice, we developed ExampleWiki, a web-based platform with a backend database that combines formal principles with students' personal interests by providing real life examples. This platform will allow entering, editing and retrieving formal principles and examples. Currently we focus on mathematics, with applications in science. The platform supports self-regulated learning that is adapted to the students' skills and needs.

1. Theoretical Background

Both constructivist and situated learning approaches have been criticized by cognitive psychologists. Some constructivist methods – such as pure discovery learning – generally have been proven ineffective [10]. Although some studies documented better understanding of arithmetic operations when they were performed in everyday situations (e.g., [4]), situated learning is often inefficient (see [1]). A proven learning method is to combine teaching of basic principles with practice in relevant settings, as shown in studies on learning to throw darts to targets underwater [8], or on sexing chickens [3]. In the latter study, novices learned a formal principle that enabled them to perform the task within 20 minutes at an expert level; practitioners who never have learnt the formal principle needed years to attain expert performance from mere practice.
When constructivist approaches apparently fail to provide high-quality science teaching: Shall schools go back to traditional modes of teaching, e.g., teaching formal principles and presenting an example which often is unattractive to students, such as teaching probability

calculus with an example from gambling? We do not think so. Modern information technology makes possible what would not have been possible two decades ago. For example, a teacher could not think of giving different examples – suited to individual interests – for every student. Teachers often do not know the individual interests of their students; even if they do, they do not know good examples connected to each topic of interest; even if they do, they are not able to present all examples simultaneously.

We address these issues by building a shared platform including a database that provides different examples for formal principles. Teachers then have a choice: Before or after presenting the basic principle, they either can let students work on their favorite examples, or they can print out examples and distribute them to the students. The use of different examples for each individual student does not stop here: For example, a teacher can assign the task that some students have to present their favorite example in class so that every student gets multiple worked examples that illustrate the principle to be learned (see [2] for the use of multiple worked examples).

2. ExampleWiki

In recent years, Wiki technology has become a popular pedagogical tool to support information dissemination, sharing knowledge resources, and collaborative learning [12]. ExampleWiki can facilitate the community of practice [9] and community of interests [6].

ExampleWiki provides a platform that allows entering, editing and retrieving formal principles and examples. The system architecture includes three main components: examples, short explanation of the formal principles linked to the related examples, and the formal principles themselves. This design reflects the principle of example choice [11]. The prototype is shown in Figure 1 and it is based on MediaWiki.

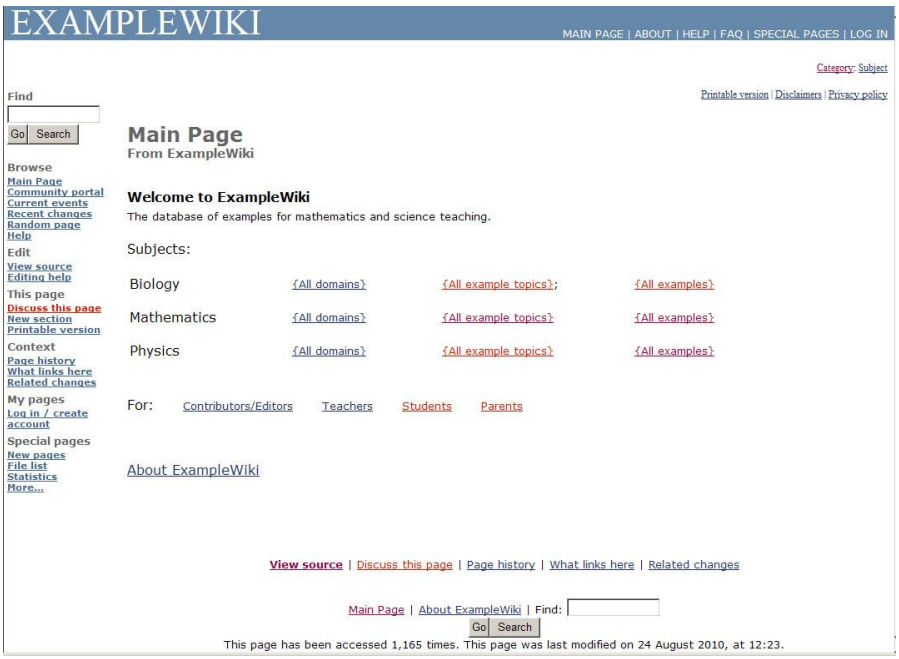

Figure 1. ExampleWiki main page

3. Discussion

Hoffmann [7] reported an intervention study that comes close to ExampleWiki, but it did not include example choice. She assessed what could make basic physics training in high school

more interesting for both boys and girls. She then connected formal contents to contents that students judged as being interesting and compared this interest-based instruction to more traditional instruction. She indeed found that interest-based instruction helped increasing physics achievement, and students became more interested in the topic. Another approach lets students generate examples [13]. The idea is that understanding is promoted by construction of own examples. Our approach does not preclude that students later construct their own examples and even submit it to ExampleWiki, but before students can construct their own example, they have to know a minimum about the formal principle. In line with criticisms from the viewpoint of cognitive psychology [10], we start with guiding students to elaborate on the formal principle before they then may construct their own examples, as proposed by [13].

Our long-term goal is to create a web-based learning environment that helps teachers "making things interesting" by connecting what students have to learn to what students are interested in. Such an environment allows teachers to contribute and retrieve examples and students to choose the most interesting examples to learn formal principles. One scenario for using such an environment could be that after choosing an example, students can answer a question that relates the example to the formal principle. The student gets feedback from the environment and then is instructed in class about the formal principle. Such a tool would facilitate diversity in teaching that an educator could provide only with much effort, and it provides teachers with multiple good examples from the same topic. In sum, we try to link formal principles that are not interesting in themselves to topics that are intrinsically interesting; thus, fascination for a formal topic may be elicited by the fact that it helps understanding more deeply the things one has a real interest in – according to Dewey [5] the only proper way of "making things interesting".

References

[1] Anderson, J. R., Reder, L. M., & Simon, H. A. (1996). Situated Learning and Education. *Educational Researcher*(25), 5-11

[2] Atkinson, R. K., Derry, S. J., Renkl, A., & Wortham, D. (2000). Learning from examples: Instructional principles from the worked examples research. *Review of Educational Research* (70), 181-214.

[3] Biederman, I., & Shiffrar, M. (1987). Sexing day-old chicks: A case study and expert systems analysis of a difficult perceptual learning task. *Journal of Experimental Psychology: Learning, Memory and Cognition* (13), 640-645.

[4] Carraher, T. N., Carraher, D. W., & Schliemann, A. D. (1985). Mathematics in the streets and in the schools. *British Journal of Developmental Psychology* (3), 21-29.

[5] Dewey, J. (1913). *Interest and effort in education*. Boston: Riverside.

[6] Fischer, G. (2001). Communities of Interest: Learning through the Interaction of Multiple Knowledge Systems. In S. Bjornestad, R. Moe, A. Mørch & A. Opdahl (Eds.), *Proceedings of the 24th IRIS Conference* (pp. 1-14): University of Bergen.

[7] Hoffmann, L. (2002). Promoting girls' interest and achievement in physics classes for beginners. *Learning and Instruction* (12), 447-465.

[8] Judd, C. H. (1908). The relation of special training to general intelligence. *Educational Review* (36), 28-42.

[9] Lave, J., & Wenger, E. (1991). *Situated learning. Legitimate peripheral participation*. Cambridge, UK: Cambridge University Press.

[10] Mayer, R. E. (2004). Should there be a three-strikes rule against pure discovery learning? The case for guided methods of instruction. *American Psychologist* (59), 14-19.

[11] Reber, R., Hetland, H., Chen, W., Norman, E., & Kobbeltvedt, T. (2009). Effects of Example Choice on Interest, Control, and Learning. *Journal of the Learning Sciences* (18), 509-548.

[12] Ruth, A., & Houghton, L. (2009). The wiki way of learning. *Australasian Journal of Educational Technology, 25*(2), 135-152.

[13] Watson, A., & Mason, J. (2002). Student-generated examples in the learning of mathematics. *Canadian Journal of Science, Mathematics and Technology Education, 2*(2), 237-249.