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Learning Mathematics Online: Characterizing the Contribution of Online Learning Environment's Components to the Development of Mathematical Knowledge and Learning Skills

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Abstract : Teaching for the first time an online course dealing with the history of mathematics, we were struggling with questions related to the design of a proper learning environment (LE). Thirteen high school mathematics teachers, M.Ed. students, attended the course. The teachers were engaged in independent reading of mathematical texts, a task that is recognized as complex due to the unique characteristics of such texts. In order to support the learning processes and develop skills that are essential for succeeding in learning online (e.g. self-regulated learning skills, meta-cognitive skills, reflective ability, and self-assessment skills), the LE comprised of three components aimed at "scaffolding" the learning: (1) An online "self-feedback" questionnaires that included drill-and-practice questions. Subsequent to responding the questions the online system provided a grade and the teachers were entitled to correct their answers; (2) Open-ended questions aimed at stimulating critical thinking about the mathematical contents; (3) Reflective questionnaires designed to assist the teachers in steering their learning. Using a mixed-method methodology, an inquiry study examined the learning processes, the learners' difficulties in reading the mathematical texts and on the unique contribution of each component of the LE to the ability of teachers to comprehend the mathematical contents, and support the development of their learning skills. The results indicate that the teachers found the online feedback as most helpful in developing self-regulated learning skills and ability to reflect on deficiencies in knowledge. Lacking previous experience in expressing opinion on mathematical ideas, the teachers had troubles in responding open-ended questions; however, they perceived this assignment as nurturing cognitive and meta-cognitive skills. The teachers also attested that the reflective questionnaires were useful for steering the learning. Although in general the teachers found the LE as supportive, most of them indicated the need to strengthen instructor-learners and learners-learners interactions. They suggested to generate an online forum to enable them receive direct feedback from the instructor, share ideas with other learners, and consult with them about solutions. Apparently, within online LE, supporting learning merely with respect to cognitive aspects is not sufficient. Leaners also need an emotional support and sense a social presence.

Keywords : cognitive and meta-cognitive skills, independent reading of mathematical texts, online learning environment, self-regulated learning skills
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