Promoting Active Learning in STEM Subjects

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Literature does not provide a universal definition of active learning. Bonwell & Eison (1991) defined active learning as “instructional activities that involve students in doing things and thinking about the things they are doing”. Active learning can be considered as anything but passive listening to a lecture. Most typically the concept of active learning encapsulates methods that activate students during in-class sessions (Prince, 2004).

Several research studies have advocated active learning methods in teaching and learning STEM subjects (see e.g. Freeman et al. (2014), Theobald et al. (2020) and Prince (2004)). Many benefits of active learning have also been highlighted. Meta-analysis of Freeman et al. (2014) revealed increased course scores and passing rates in STEM courses under active learning. The effects seemed to be greatest with small group sizes (under 50) even though active learning methods appeared to work across all group sizes (Freeman et al., 2014).

The drop-out rates are high in the field of engineering throughout Europe. In Finnish universities of applied sciences the percentage of graduates in ICT engineering after 5 years of studying is 40 % and in engineering 48 % (Vipunen). These figures are quite low. Engaging students in their learning process seems to promote retention rates. One way to engage students in their studies seems to be using active learning methods.

The objective of this proposed workshop is to enhance educators' competence of such instructional design that improves students’ active learning. The workshop aims to promote digital and pedagogical competence of engineering educators by introducing methods and tools for promoting active learning. By increasing such competences of educators, it gives them tools and knowledge to redesign their teaching and implement digital resources and activities (e.g. TPACK, active learning, self-regulated learning, digital languaging and assessment) for different personalized learning scenarios.

The content of the proposed workshop will be twofold. On one hand, it presents DigiSTEM project results, and on the other one, participants will share their experiences and expertise related to using digital tools and pedagogy in STEM education. The session itself utilizes active learning methods. Participants will keep small pitches of their best pedagogical practices in teaching/learning of STEM subjects and participate in group working. Hence, participants will actively construct content for the workshop. Working activities in the groups will be focused on the following issues:

- Many forms of assessment - In what ways is it possible to reduce the amount of teacher’s assessment work?
- What kind of learning technology / digital tools do you use in teaching? Share your best experiences.
- What kind of active learning methods are you using?

The authors will collect a list of participants. As a result of the workshop, a collection of best practices, examples of using digital tools, pedagogical solutions and summary of workshop ideas will be created and sent to the session participants. Aim is to create a collection that includes elements among others e.g. innovative pedagogies, utilizing digital assessment, promoting self-regulated learning and using online resources for STEM subjects’ learning purposes. This collection seeks to support pedagogical and digital learning methods that activate students and promote self-regulated learning.

The workshop focuses on the pedagogical issues and also on concrete actions and examples of usability of technology. At the end of the workshop participants are expected to experience for example the following outcomes:

- Reflect on how their courses support pedagogical and digital learning methods that activate students and promote self-regulated learning.
- Share concrete actions and examples of usability of technology and pedagogical solutions in STEM education.
- Discuss how using digital tools and pedagogy in STEM education could be designed to optimize learning outcomes in engineering studies.
• Obtain relevant information about various possibilities of online tests used for assessment of acquired knowledge and competencies by means of both - formative and summative testing
• Learn about available software options and solutions for digital (online) testing and receive practical advice on good experience with the development and use of online tests (suitable topics, design of questions, choice of answers, ways to insert answers, automatic evaluation, etc.)
• Analyze the impact of digital learning scenarios (on-line, distance, blended, hybrid, …) on the quality and sustainability of acquired knowledge and competencies

References:


