

## Active Learning Methods in Mathematics

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**Abstract :** Plenty of ideas on how to adopt active learning methods in education are available nowadays. Mathematics is a subject where the active involvement of students is required in particular in order to achieve desirable results regarding sustainable knowledge and deep understanding. The present article is based on the outcomes of an Erasmus+ project DrIVE-MATH, that was aimed at developing a novel and integrated framework to teach maths classes in engineering courses at the university level. It is fundamental for students from the early years of their academic life to have agile minds. They must be prepared to adapt to their future working environments, where enterprises' views are always evolving, where all collaborate in teams, and relations between peers are thought for the well-being of the whole - workers and company profit. This reality imposes new requirements on higher education in terms of adaptation of different pedagogical methods, such as project-based and active-learning methods used within the course curricula. Active learning methodologies are regarded as an effective way to prepare students to meet the challenges posed by enterprises and to help them in building critical thinking, analytic reasoning, and insight to the solved complex problems from different perspectives. Fostering learning-by-doing activities in the pedagogical process can help students to achieve learning independence, as they could acquire deeper conceptual understanding by experimenting with the abstract concept in a more interesting, useful, and meaningful way. Clear information about learning outcomes and goals might help students to take more responsibility for their learning results. Active learning methods implemented by the project team members in their teaching practice, eduScrum and Jigsaw in particular, proved to provide better scientific and soft skills support to students than classical teaching methods. EduScrum method enables teachers to generate a working environment that stimulates students' working habits and self-initiative as they become aware of their responsibilities within the team, their own acquired knowledge, and their abilities to solve problems independently, though in collaboration with other team members. This method enhances collaborative learning, as students are working in teams towards a common goal - knowledge acquisition, while they are interacting with each other and evaluated individually. Teams consisting of 4-5 students work together on a list of problems - sprint; each member is responsible for solving one of them, while the group leader - a master, is responsible for the whole team. A similar principle is behind the Jigsaw technique, where the classroom activity makes students dependent on each other to succeed. Students are divided into groups, and assignments are split into pieces, which need to be assembled by the whole group to complete the (Jigsaw) puzzle. In this paper, analysis of students' perceptions concerning the achievement of deeper conceptual understanding in mathematics and the development of soft skills, such as self-motivation, critical thinking, flexibility, leadership, responsibility, teamwork, negotiation, and conflict management, is presented. Some new challenges are discussed as brought by introducing active learning methods in the basic mathematics courses. A few examples of sprints developed and used in teaching basic maths courses at technical universities are presented in addition.

**Keywords :** active learning methods, collaborative learning, conceptual understanding, eduScrum, Jigsaw, soft skills

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