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# Implementation of Active Learning in BPM Education

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*Abstract.* The challenges that are faced by BPM educators are not only related to the evolution of the BPM concept and technological trends but also to the changing expectations and attitudes of students as well as the requirements of the labor market. Active learning promotes the better memorization and understanding of even tricky issues. Active-learning methods are increasingly being implemented, and their effectiveness is being studied in numerous scientific studies. Many studies have confirmed that better learning outcomes are achieved through active learning. Implementing flipped learning in a previous academic year and supplementing it with other active methods in the following year allowed for course improvements; students showed more outstanding commitment and satisfaction with the classes. The introduction of changes to the Business Process Modeling and Process Management courses was dictated by, among other things, the desire to adapt to the postulates that have been developed in the BPM educator community regarding the scope of the knowledge and the skills that were transferred within the courses. The changes concerned both lectures (reviews and updates of content, abandonments of the form of administration) and the laboratory (changes of program, preparations for certification). The conclusions from the observations of the pilot implementation of the changes in the courses constituted the basis for refining the materials and methods in the next academic year.

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## 1. INTRODUCTION

Modern schools, students, and educations pose several challenges for teachers. The ability to cope in a dynamically changing environment among young people, and subsequent generations require flexibility from the teachers, quick adaptations to new conditions, focus on the students' needs, and understanding the changes that are taking place in society (including primarily generational differences).

The principles of active learning come to the rescue here[1]. Bonwell and Eison (1991) defined this term as everything that engages students/pupils in doing things and thinking about the things they do, eg. engaging students in more than listening, increasing emphasis on developing skills, engaging students in higher-order thinking (e.g. analysis, synthesis, evaluation) and action (e.g. reading, discussion, writing), increasing emphasis on students exploring their attitudes and values. While Prince (2004) stated that active learning "works," Bernstein (2018) said that it was necessary to look at which active methods worked and which did not. The use of active forms is particularly useful in education at a technical university – mainly since better effects were found for using active forms for engineers (Freeman et al., 2014; Hartikainen et al., 2019; Prince, 2004).

Later research that was conducted by Theobald et al. (2020) among students of science, technology, engineering, and mathematics showed that active learning allowed students to achieve better exam results. More-significant benefits could also be observed in underrepresented groups.

Research that was conducted at Carnegie Mellon University's Human-Computer Interaction Institute (Aupperlee, 2021) also confirmed that improvements in academic performance was achieved by engaging students through interactive activities, discussions, feedback, and AI-enhanced technologies, resulting in improved academic performance instead of traditional lectures, lessons, or readings.

The bibliometric analysis confirmed the growing interest in active-learning implementation and conducting active-learning efficiency studies. Based on the number of publications that are registered in the Scopus[2] database, a significant increase in interest in those issues that are related to the effectiveness of active learning can be seen (see Fig. 1).

For years, flipped learning[3] has been used in teaching BPM and related subjects at the Faculty of Management and Economics of the Gdańsk University of Technology. In recent years, however, attempts have been made to organize the courses and systematically implement changes. The project of the changes that were developed based on student feedback (Grzesiak & Moszyński, 2024) included other active-learning methods.

[1] Engaging students in more than listening. Greater emphasis on developing skills. Engaging students in higher-order thinking (e.g., analysis, synthesis, evaluation) and action (e.g., reading, discussion, writing). Greater emphasis on students' examination of their attitudes and values (Bonwell & Eison, 1991).

[2] The Scopus database was filtered on October 4, 2024, for key sactive learning & effectiveness." Additional filters concerned the language of publication (English), the type of publication (article or chapter), the fields (social sciences, engineering, computer, business), and the following keywords: Active Learning, Higher Education, Engineering Education, Active-Learning Methods, Active-Learning Strategies, Active-Learning Algorithm, Outcome Assessment, Treatment Outcome, Educational Measurement, Performance, Reinforcement Learning).

[3] More about flipped learning: (Talbert & Bergmann, 2017).

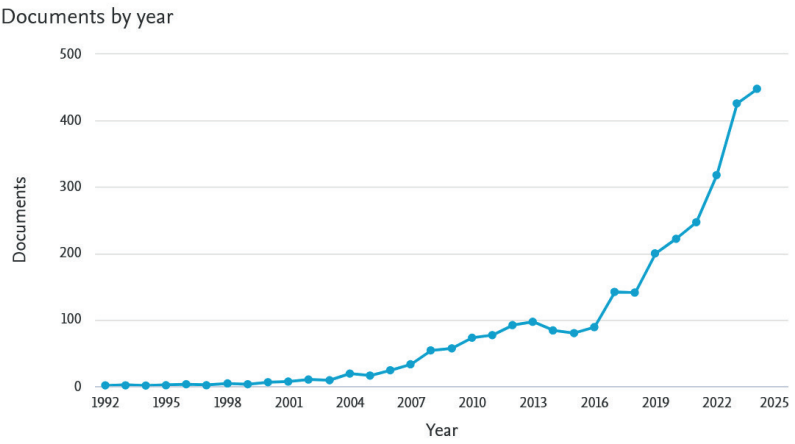


**Fig. 1.** *Number of publications on effectiveness of active-learning area*
*Source: own work based on Scopus database*

While flipped learning usually allows for the more effective achievements of academic, intra-/interpersonal, and satisfaction-related outcomes in higher education when compared to traditional methods (Bredow et al., 2021; Strelan et al., 2020), better results are generally achieved simply by active learning (not necessarily by using flipped learning) (Jensen et al., 2015).

The following part of the article describes the implementations of active-learning methods in sample academic courses.

## 2. CASE DESCRIPTION

BPM elements appear to varying degrees in several courses in the Faculty of Management and Economics of the Gdańsk University of Technology. In various courses, the thematic scope of those classes that are related to process modeling, process analysis, and process management was adapted to the specifics of the given field of study.

According to the authors of *Business Process Management Education in Poland: A Manifesto for Academic Teaching* (Sliż et al., 2024), BPM education should be based on the comprehensive approach that was proposed by Rosemann and vom Brocke (2014). After completing the course, the students should be equipped with knowledge of the Six Core elements (Strategic Alignment, Governance, Methods, IT, People, and Culture) and their correlations.

Taking this and the other postulates formulated regarding BPM education in the Manifesto (Sliż et al., 2024) into account, an attempt was made to modify the programs and teaching methods so that they would be adapted to certification requirements on one hand and updated to reflect class topics and engage students on the other.

The implemented changes were of a test nature; the students were informed at the beginning of the semester about the purpose of the introduced changes and the

principles of the work. The results of our observations and the students' opinions will be considered in the next edition of the courses.

After many discussions in the BPM educators' community, a specific range of competencies was proposed for the students after completing a course. Because practical skills were not previously developed for BPM certification, the laboratory programs were redesigned so that the learning outcomes that were achieved would provide a basis for attempting to take the certification exam. On the other hand, the content of the lectures was analyzed in terms of their relevance and adequacy to the given subject. In the case of this form of class, the challenge was to activate students and motivate them to seek knowledge independently.

## 3. UNDERTAKEN ACTIONS

In the summer semester of the 2023/2024 academic year, two subjects were subjected to modifications:

- Business Process Modelling was implemented in first-cycle studies in field of Data Engineering;
- Process Management was implemented in second cycle (changes were introduced for all forms of studies: full-time, part-time, and part-time 75ONLINE).

Data engineering combines IT and management in order to analyze large data sets for informed decision-making in business and economics. Students learn to process and interpret data using algorithms, mathematics, statistics, and economics. With a strong focus on practical skills, our graduates are well-prepared for careers in the business environment.

The Management program combines engineering and managerial knowledge with practical problem-solving skills. Students gain expertise in modern IT tools and learn to leverage contemporary technologies (including the Internet) in management. The program's teaching methods ensure that our graduates can effectively collaborate with engineers from various fields.

Table 1 includes the scope of the activities.

**Table 1.** *The scope of changes in the scope and method of implementing subjects*

| **Subject name** | **Lecture** | **Laboratory** |
|---|---|---|
| Business Process Modeling | 1. Organizing and updating the topics.<br>2. Active lecture – changing the form of the presentation to the tasks that are performed by the students (after introducing the topic). | Developing new tasks with increasing difficulties considering BPMN principles, culminating in implementing individual projects. |
| Process Management | 3. Organizing and updating the topics. | Developing new tasks with increasing difficulties considering BPMN principles, culminating in implementing team projects (projects are only for full-time studies). |

### 3.1. Business-process modeling

The lecture topics included issues that were related to the implementation of the process approach to an organization, the business-process's life cycle, process identification and classification, process mapping, modeling and simulation tools, process metrics, basic diagrams and shapes of Business Process Model and Notation (BPMN), modeling for variation and flexibility, and verifications of business processes.

The lectures were conducted actively, allowing for testing various forms of activities (including teamwork, workshop work, co-assessment, presentations, and work with a scientific article). Students earned points for their activities and could receive a final grade without a final test. However, some students were required to take the test.

The laboratories were conducted in flipped learning – the students prepared for a specific topic before their classes. In the laboratories, students built process models in BPMN – from simple models of private processes to modeling exceptional flows to public and cooperation processes. During the second part of the semester, the students carried out individual projects using their acquired skills.

### 3.2. Process management

Two people conducted the lectures. The lecture group was a manageable size, which allowed for closer interactions with the students during the classes. The learning outcomes were verified by using a credit (an electronic test).

Some lectures concerned the issues that were covered in the laboratories (including the terminology that was used, symbols, and BPMN principles). The following issues were also discussed: process as an object of building an organization's functioning system, process management as a response to the turbulent nature of the economic environment, the life cycle of process management, the measurement of business processes, the standardization of business processes, the features of a process organization, the transformation of the organizational structure that supports process management, and the process maturity of the organization.

In the laboratories, the students built process models in BPMN – from simple models of private processes to modeling exceptional flows to public and cooperation processes. During the second part of the semester, the full-time students carried out individual projects using their acquired skills. The completed exercises and the project were the bases for assessing the practical part of the subject. The part-time students received credit based on exercises and a final assignment that proposed improvements to the previously modeled process.

## 4. RESULTS

### 4.1. Business process modeling

Although the students (73 people) were informed about the impact of completing pre-laboratory tasks and homework on the final grade, they seemed surprised by the results. When comparing the average final grades for the course over the last three years (see Fig. 2), it can be seen that the average grade decreased.

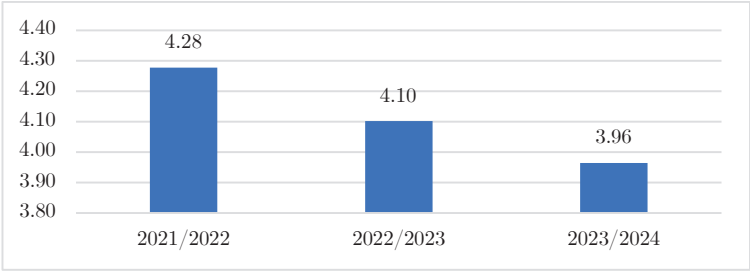


**Fig. 2.** *Averages of final grades – Business Process Modelling*

An analysis of the pre-laboratory students' activities showed that they needed more time to prepare for the classes. Moreover, some students only completed the mandatory tasks (as mentioned above). In the next edition of the course, more time should be devoted to explaining the principles of flipped learning to the students and presenting the benefits of active learning. The students' opinions on the active methods that were used in the lecture were positive. Based on our observations, some task times were underestimated; this should be corrected in the next edition.

### 4.2. Process management

Although the students (88 people) knew that the tool (not the notation) from the previously completed course and the sample tasks were to be completed together, some of the students needed help completing the subsequent exercises or the project/credit assignment. Comparing the average final grades for the actual courses, it can be seen that the average grade was not the highest (although it was higher than in the previous edition of the course – see Fig. 3).

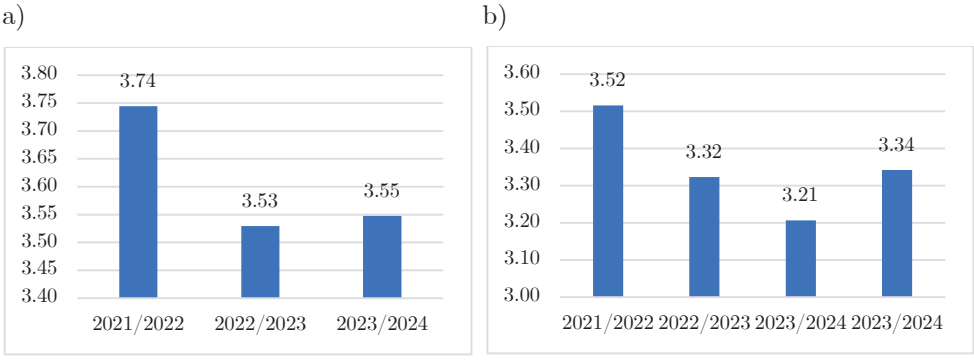


**Fig. 3.** *Averages of final grades – process management: a) stationary; b) part-time studies*

Based on the students' opinions and observations, it is necessary to consider the preparations of supporting materials and the inclusion of flipped learning in the next edition of the course.

### 4.3. Theoretical, practical, and social implications

In a changing world, reaching the next generation of students is challenging; what may have worked in the past may not work now, and what worked in one group may only sometimes work in another. A good (academic) teacher fits perfectly into lifelong learning; however, inspiration can be found in other organizations (e.g., SkillHub, n.d.; CITL, n.d.; CTE, n.d.; CITL, n.d.) or prepared catalogues (e.g., PDST, n.d.)

Implementing changes in the contents of the subjects and the methods that were used allowed us to collect valuable observations on student engagement and motivation as well as their planning of times for individual activities. This information can be used to improve future classes in terms of the contents and methods that are used.

Inclusive education requires greater student engagement, knowledge-seeking involvement, and active problem-solving. Curiosity should be a natural feature of every student; a good teacher should stimulate this curiosity (or help them discover it).

## 5. SUMMARY

The effective implementation of active learning requires a teacher to be well-prepared and responsive to the diverse expectations of students. The strategies that were described by Nguyen et al. (2021) or our own (which were developed in our subsequent years of classes with students) may be helpful here. Due to the pilot nature of the introduced modifications, it was not possible to examine the effectiveness and efficiency of the methods; this could be the goal of future research. However, a problem may be the sizes of the groups (the numbers of students are decreasing) and the need for more opportunities for conducting the classes – both in the traditional form and using active-learning methods; therefore, the results may not be representative.

*"Tell me and I forget. Show me and I remember. Involve me and I understand."*

Confucius

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