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The Role and Significance of Learning Methodology in Engineering Education

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Abstract– In 21st-century higher education, learning methodology has emerged as a key instrument for fostering independent, conscious, and lifelong learning. This study investigates its pedagogical and psychological relevance, focusing on time management, motivation, metacognitive awareness, and individual learning styles. Based on a questionnaire survey conducted among first- and second-year students at the Alba Regia Faculty of Óbuda University, the findings reveal that learning methodology is more than a set of techniques, it is a mindset that promotes autonomy, self-regulation, and reflective thinking. Most students reported using time-planning tools and recognized their positive impact on academic performance and psychological well-being. Intrinsic motivation, driven by interest, personal growth, and career goals proved more sustainable, while extrinsic motivators, such as grades and recognition were effective when aligned with intrinsic drivers. The study also highlights the importance of the VARK learning styles model, showing that awareness of individual preferences enhances learning efficiency. Overall, 75.6% of respondents felt the course helped them adapt to university life, and 84.7% considered it important or very important in higher education. The results affirm that learning methodology supports not only academic success but also personal development and career readiness, underscoring its essential role in modern educational practice.

Keywords-Learning methodology, learning mindset, time management, learning styles, educational innovation

I. The Role of Learning Methodology in Higher Education

In 21st-century higher education, increasing emphasis is placed on pedagogical approaches that focus not only on the transmission of knowledge but also on supporting the process of learning itself. Learning methodology, understood as a tool for fostering independent learning, plays a crucial role in enabling students to effectively process, organize, and apply acquired knowledge [1].

The application of learning methodology in higher education serves not only to improve academic performance but also contributes to the development of self-regulated learning, critical thinking, and the capacity for lifelong learning [2]. Recognizing students' learning styles, integrating active learning techniques, and incorporating digital tools are all key components of modern learning methodology [2].

The development of digital competences is particularly significant in higher education, as the workplaces of the future are increasingly embedded in digital environments. The methodology of educational informatics provides opportunities for both instructors and students to consciously employ ICT tools in the learning process [3].

Thus, learning methodology is not merely a subject or a set of techniques, but rather a perspective that positions the learner as an active participant in their own knowledge-construction process. Higher education institutions therefore bear a vital responsibility in supporting students' competence development, whether through courses, training sessions, or dedicated learning support services (As shown in Figure 1).

Fig.1. Learning methodology

II. Key Aspects of Learning Methods

The effectiveness of learning in higher education depends not only on the content being studied but also on the methods and strategies students apply throughout their academic journey. Understanding the key aspects of learning methods allows educators and learners alike to optimize the learning process, enhance performance, and foster long-term development. This chapter explores four essential components (time management, motivation, awareness, and applied learning techniques) each of which plays a critical role in shaping successful and sustainable learning experiences.

A. Time Management and the Allocation of Study Time

Time planning represents a key element of learning methodology, closely associated with academic performance, student engagement, and psychological well-being. Effective time management enables students to structure, organize, and consciously pursue their learning activities in a goal-oriented manner, thereby enhancing achievement while reducing stress [4].

When examining students' time management habits, it is particularly important to explore whether they employ time planning consistently and what concrete strategies they apply in their daily routines. Addressing these questions can support the design of more targeted learning methodology interventions, especially in higher education, where student autonomy and responsibility are significantly heightened [5].

Research has shown that time planning not only improves academic performance but also has a positive impact on self-regulation, concentration, and learning motivation [6]. Consequently, it is of special importance to investigate how students integrate time management techniques into their everyday lives.

B. Motivation in Learning

Motivation is one of the most significant driving forces of the learning process. In higher education, it is particularly important that students are motivated not only by external expectations but also by intrinsic factors [7]. Intrinsic motivation stems from the joy of learning and genuine interest. This type of motivation results in deeper and more sustainable knowledge acquisition. For part-time students, a career change often represents a turning point in their professional trajectories. In such cases, existential changes, professional burnout, organizational restructuring, or the technological obsolescence of job roles may prompt individuals to pursue further higher education [8]. Thus, career change or the acquisition of a new profession may become not only an opportunity but a necessity. With digital transformation, artificial intelligence, and automation reshaping labor markets, many traditional jobs are disappearing, evolving, or requiring entirely new skills [9].

Extrinsic motivation, on the other hand, refers to external incentives such as grades, scholarships, recognition, or the promise of future career opportunities. While extrinsic motivation may effectively boost short-term performance, it proves sustainable in the long term only if it fosters the development and strengthening of intrinsic motivation [10].

Grades, for example, often act as external motivators, with students perceiving high marks as rewards that provide feedback on their performance and influence their self-esteem. Scholarships serve as both financial and prestige-based incentives, strengthening academic commitment—especially for students facing financial barriers to higher education [11]. Teacher or institutional recognition—such as praise, awards, or public acknowledgement—enhances students' self-confidence and reinforces positive learning behaviors, thereby exerting a motivating effect [12]. Finally, the prospect of future career opportunities—such as a desirable job or professional advancement—functions as an external goal that motivates students to pursue their studies consciously and purposefully [13].

C. Awareness in Learning

Conscious learning constitutes a key competence in higher education, encompassing students' ability to reflect on their own learning processes, set goals, and independently regulate their learning strategies [14]. This metacognitive awareness enables learners to recognize both their strengths and areas for improvement and to adjust their learning behaviors accordingly [15].

Self-regulated learning (SRL) is a cyclical process in which students set goals, plan their learning activities, apply appropriate cognitive and metacognitive strategies, and subsequently evaluate their performance [16]. This process is particularly relevant in higher education, where autonomy and responsibility are significantly increased [17]. Developing metacognitive skills not only improves academic outcomes but also contributes to enhanced self-confidence, problem-solving abilities, and lifelong learning competences [18].

D. Applied Learning Techniques

Learning style refers to an individual's preferred mode of processing information, which determines how they most effectively acquire new knowledge. One of the most widely known and applied models is the VARK (Visual, Auditory, Reading/Writing, Kinesthetic), developed by Neil Fleming in the late 1980s. This model distinguishes four sensory modalities that reflect individual learning preferences [19]. Importantly, these learning styles are not mutually exclusive, as many students employ multiple modalities to maximize learning effectiveness. The primary aim of the VARK model is to help learners recognize their learning preferences and tailor their strategies accordingly [19].

Visual learners process information most effectively through graphical elements such as diagrams, charts, maps, and symbols. They benefit from visual representations that facilitate comprehension, recognition of relationships, and structured thinking. For these students, material presented visually often leads to improved understanding and recall.

Auditory learners acquire knowledge most effectively through listening, such as during lectures, discussions, or auditory materials. They process information through verbal explanations and interpersonal communication, often recalling spoken information with ease. Group discussions, oral recitation, and audio-based learning activities are particularly beneficial for them.

Reading/Writing learners prefer textual information and rely heavily on note-taking, reading, writing summaries, and creating lists. They tend to thrive in traditional academic environments where written texts dominate, and they benefit from organizing knowledge through writing and textual synthesis.

Kinesthetic learners learn best through physical activity, experimentation, and hands-on practice. Activities such as experiments, modeling, role-playing, fieldwork, and interactive exercises are most effective for them. These learners require active engagement and direct interaction with the material to fully internalize knowledge.

III. Processing of the Questionnaire

The primary objective of the quantitative research was to validate the relevance and necessity of learning methodology in contemporary higher education. The participants of the study were first- and second-year full-time students enrolled at the Alba Regia Faculty of Óbuda University. In total, 78 students completed the questionnaire via their mobile phones using the Google Forms application.

From the first-year cohort, 25 students were enrolled in Business and Management, 16 in Mechanical Engineering, 14 in Electrical Engineering, and 10 in Technical Management. Among the second-year students, only those from the Business and Management program participated, with a total of 13 respondents.

The questionnaire primarily focused on how the introduction of structured learning instruction influenced students' motivation to learn, the development of their time-management skills, and their capacity for conscious learning. The responses provided a realistic picture of students' learning methods, learning habits, and their adaptation to university life. Another central aim of the study was to assess whether the learning attitudes of first-year students could be influenced. The findings are expected to support educators in refining their pedagogical approaches, potentially adopting entirely new methods tailored to contemporary students, thereby assisting them in successfully becoming professional engineers.

The research was conducted in May 2025. Students had commenced their studies in the 2024/2025 academic year under the new “F” curriculum, which had been introduced in the preceding academic year. Data collection concentrated on full-time students, and the qualitative evaluation was developed based on the most relevant and frequently occurring responses.

The first section of the questionnaire focused primarily on time management strategies, as time allocation plays a pivotal role in the learning process. Effective scheduling and adherence to a well-structured timetable can significantly enhance learning efficiency. Figure 2 illustrates how students assessed their own time management strategies and the extent to which they considered them effective.

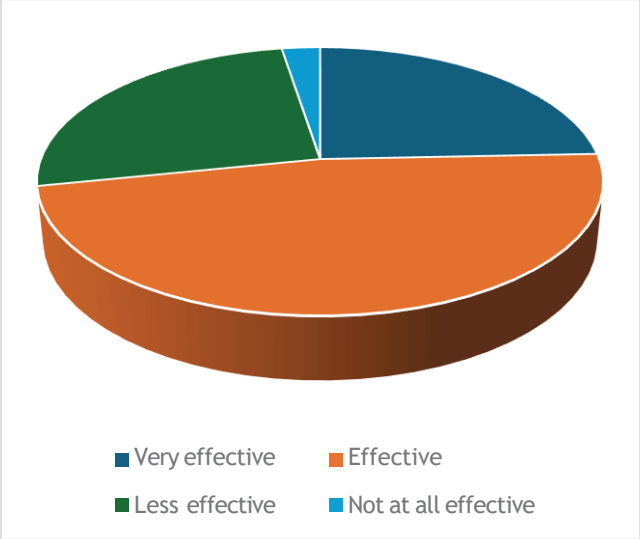

Fig.2. How effective do you feel your time management strategies are?

An additional key question concerned whether students employ time planning in their daily lives. The majority of respondents indicated that they make use of the calendar function on their mobile phones or record their daily tasks in a notebook, while some also rely on weekly and monthly planners. Only 9% of the respondents—equivalent to 7 students—reported that they do not use any form of time planner at all. Although this proportion cannot be considered unfavorable, there remains potential for improvement in order to make students' time management more structured and focused, as shown in Figure 3.

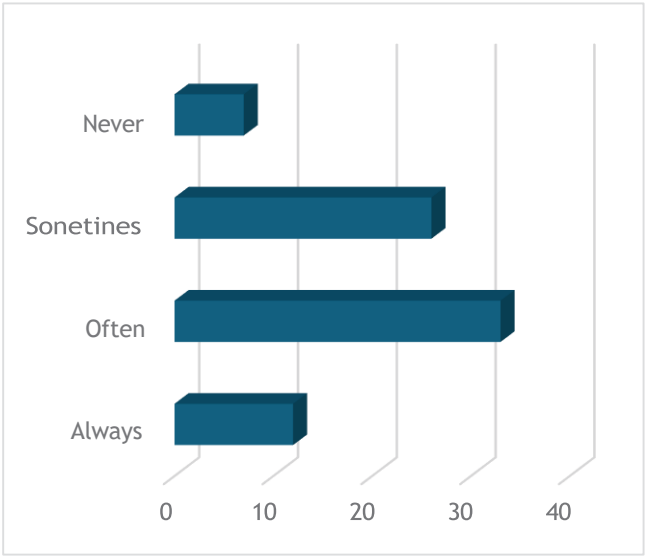

Fig.3. Do you use time planning regularly?

The next question in the study addressed how students implement time planning and what types of planners they use. Surprisingly, the use of digital planners was relatively low, with only 38.5% of respondents indicating that they rely on such tools. In the upcoming academic year, greater emphasis should be placed on this aspect within the section of learning methodology that highlights the importance of time management. As shown in Figure 4 for today's students, paying closer attention to the conscious allocation of time would be particularly beneficial.

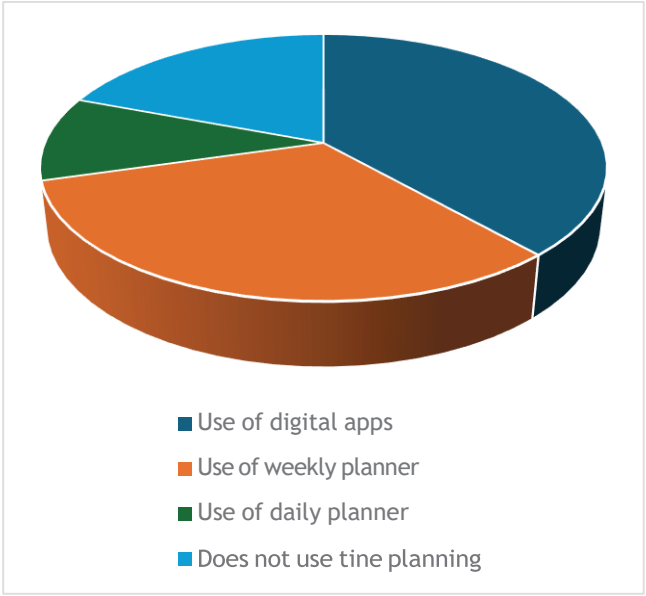

Fig.4. How do you implement time planning in your everyday life?

As expected, the responses to the question regarding students' perceived level of motivation in learning followed a predictable pattern. Assuming that the majority had chosen their field of study and higher education institution in line with their personal interests, it is unsurprising that most students reported being motivated to learn. Nevertheless, 12.8% of respondents indicated that they were either not motivated or only minimally motivated, as shown in Figure 5.

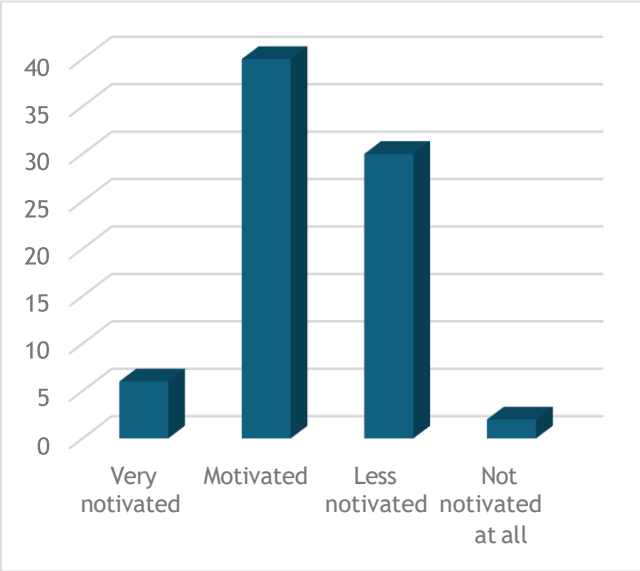

Fig.5. How motivated do you feel during your studies?

The final two questions of the questionnaire specifically addressed the place and role of the Learning Methodology course within the curriculum. One of the questions focused on the extent to which the methods and learning-support tools introduced in the course assisted students in adapting to the challenges of university life. As shown in Figure 6, in line with the initial hypothesis, the responses confirmed the value of introducing the course in the first year: according to the results, 75.6% of the participating students reported that these supportive elements had been of significant help to them.

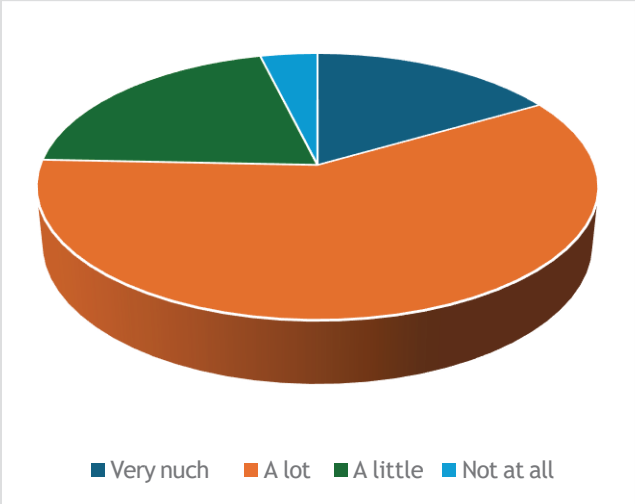

Fig.6. In your opinion, how much did the learning methodology course help you adapt to university challenges?

In another question, students were asked to evaluate the importance of incorporating learning methodology into university education. According to the responses, 27% consider it very important, 57.7% important, 11.5% less important, and 3.8% not important at all. Based on these results, it can be concluded that today's youth express a clear demand for learning-supportive methods to be addressed within the framework of formal coursework. They seek opportunities to improve their learning strategies, discuss potential challenges, and receive answers to their questions, as shown in Figure 7.

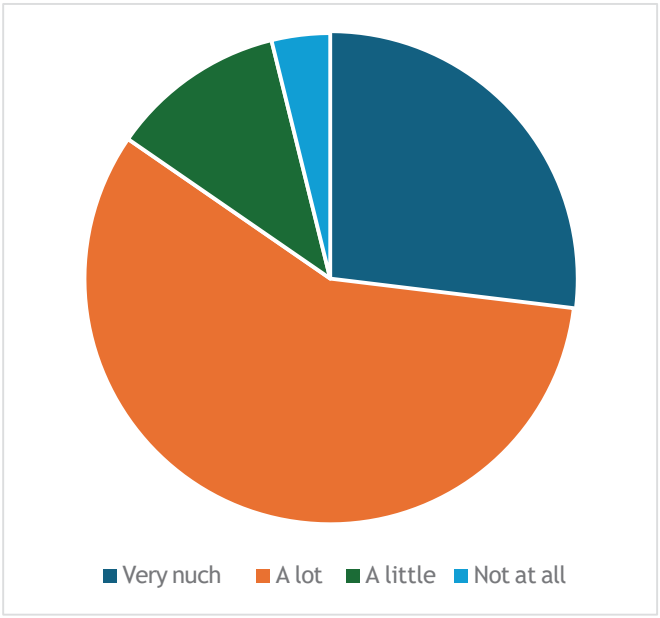

Fig. 7. How important do you think the presence of the Learning Methodology subject is in university education?

IV. Summary

This study focuses on the role of learning methodology in higher education, which is becoming increasingly significant in the educational landscape of the 21st century. Learning methodology supports autonomous learning, facilitates the organization and application of knowledge, and contributes to the development of self-regulated learning, critical thinking, and lifelong learning skills. The integration of digital tools and the enhancement of IT competencies are essential in modern learning environments, especially in light of future labor market challenges.

The study also explores the issue of motivation in detail. Intrinsic motivation—stemming from curiosity and the joy of learning—leads to more sustainable and profound knowledge acquisition. In contrast, extrinsic motivational factors such as grades, scholarships, teacher recognition, or future career prospects serve as effective short-term incentives, but they prove truly beneficial when they foster the development of intrinsic motivation. Due to career transitions, technological transformations, and automation, acquiring new skills has become vital for an increasing number of students, further emphasizing the importance of learning methodology.

Conscious learning is another key focus of the study. This competence encompasses the student's ability to reflect on their own learning processes, set goals, and independently regulate their learning strategies. Self-regulated learning is a cyclical process in which learners set objectives, plan their learning activities, apply appropriate cognitive and metacognitive strategies, and evaluate their own performance. Developing metacognitive skills not only enhances academic achievement but also contributes to students' self-confidence, problem-solving abilities, and lifelong learning capacity.

The study presents the VARK model of learning styles, which includes visual, auditory, reading/writing, and kinesthetic modalities. Visual learners benefit from graphical elements such as diagrams and charts. Auditory learners absorb information effectively through listening, such as lectures and discussions. Reading/writing learners prefer

textual information, taking notes and writing summaries. Kinesthetic learners acquire knowledge through movement and hands-on experiences, such as experimentation, modeling, or role-playing. Recognizing and applying individual learning preferences significantly increases learning efficiency.

In the quantitative phase of the study, a questionnaire survey was conducted among first- and second-year students of the Alba Regia Faculty at Óbuda University. The aim of the research was to explore the impact of the learning methodology course on students' motivation, time management habits, and adaptation to university life. Based on the responses, it can be concluded that the majority of students use time management tools and evaluate their impact on academic performance positively. Although the use of digital planners is still relatively low, it represents a promising area for future development. Most respondents feel motivated in their studies and consider the learning methodology course beneficial for adapting to the challenges of university life.

Overall, the study confirms that the application of learning methodology not only improves academic performance but also contributes to students' personal development, self-awareness, and the foundation of a successful professional career. For higher education institutions, this serves as a clear indication that the integration of learning-supportive methods and courses is not only useful but a necessary response to the educational challenges of the 21st century.

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