

Teacher motivation in engineering education

Tímea Bekk
Alba Regia Faculty
Óbuda University

Székesfehérvár, Hungary
bekk.timea@amk.uni-obuda.hu

Monika Pogatsnik
Alba Regia Faculty
Óbuda University

Székesfehérvár, Hungary
pogatsnik.monika@amk.uni-obuda.hu

Abstract—The quality and effectiveness of engineering education is closely linked to the professional commitment and motivation of teachers. The aim of this study is to explore the main factors influencing teacher motivation in the context of higher education engineering training, regarding the challenges and opportunities associated with the transformation of the role of teachers. Through a review of the literature, we analyzed domestic and international sources to identify the internal and external components of motivation and their impact on teaching performance, innovation, and student achievement. The study highlights that professional autonomy, positive feedback, a sense of purpose in teaching, and institutional support plays a key role in maintaining motivation. The study can contribute to the development of engineering education by providing guidance for the development of institutional strategies to support teacher motivation.

Keywords—engineering education, motivation of teachers, literature review, innovation, student achievement

I. INTRODUCTION

Technological advancements, particularly the rapid rise of artificial intelligence (AI) is fundamentally reshaping the landscape of education. As AI tools become increasingly integrated into teaching and learning environments, a key challenge emerges: how can educators not only keep pace with these changes but also ensure that students engage meaningfully with the learning process, rather than passively consuming AI-generated content?

In engineering education, where independent problem-solving and deep understanding are essential, it is especially important that students complete tasks autonomously and with comprehension. This depth of learning is closely tied to one of the most critical factors in education: motivation, which significantly influences both student and teacher performance [1]. A motivated teacher can inspire, guide, and support students effectively, while a lack of motivation can undermine the quality of instruction and diminish student engagement. An unmotivated educator is unable to foster a dynamic and responsive learning environment, which is particularly detrimental in a field as demanding and evolving as engineering.

With the rapid development of IT and AI technologies, it is essential that educators continuously develop their own professional competencies. However, regardless of age or experience, learning and development are only sustainable when driven by adequate internal or external motivation [2]. Therefore, understanding and supporting teacher motivation is a key element in maintaining the quality and relevance of engineering education in the 21st century.

II. THE CONCEPT AND TYPES OF TEACHER MOTIVATION

Motivation plays a key role in education, as it determines teachers' attitudes towards teaching, their professional

development, and their impact on students. Teacher motivation is the sum of internal and external factors that encourage teachers to perform their work actively, with commitment and effectively. Teacher motivation not only influences the quality of education, but also indirectly influences students' attitudes toward the subject and its effectiveness.

We distinguish between two basic types of motivation:

- **Internal motivation:** The instructor is driven by their own interests, values, professional curiosity, and desire for self-fulfillment. With this type of motivation, the instructor finds joy in teaching, sharing knowledge, and professional development. Intrinsic motivation is particularly important for long-term commitment and the development of creative, innovative teaching practices.
- **External motivation:** The teacher is motivated by external factors such as financial rewards, recognition, career opportunities, or institutional expectations. Although external motivation can contribute to performance, it is rarely sufficient on its own to maintain long-term professional commitment.

For effective teaching, it is important that educators have a balanced motivation, with internal motivation predominating. The emergence of artificial intelligence in education creates new challenges and opportunities, and adapting to these also requires motivation – both in terms of learning and in terms of renewing teaching methods.

III. MOTIVATION THEORIES

Motivational theories help us understand what internal and external factors motivate individuals to learn, work, and achieve self-actualization. In this study, we present four classic motivational theories that are relevant to the higher education environment, which we will later reflect on with reference to the literature.

A. Deci–Ryan theory (self-determination theory)

The self-determination theory (SDT) developed by Deci and Ryan [3] is based on the internal nature of human motivation and identifies three universal, innate psychological needs: competence, autonomy, and relatedness. According to the theory, we are motivated, productive, and satisfied when these needs are met.

- **Competence** refers to the need for individuals to be able to function effectively and efficiently in their environment.
- **Autonomy** expresses the desire for independence, i.e., the ability to act based on one's own decisions.
- **Relatedness** refers to the need for human relationships and belonging to a community.

The central tenet of the theory is that people are inherently motivated to develop, act independently, and form relationships. When these internal motivational factors are supported, for example, in a supportive educational environment, individuals are capable of higher levels of performance, creativity, and personal fulfillment.

Several international studies provide examples of this. For example, Taylor et al. [4] conducted a lengthy study examining the effect of different types of motivation on school performance. According to the results, intrinsic motivation was the only form of motivation that was consistently positively related to school performance, and intrinsic motivation reduced lack of motivation and increased active participation in the learning process. These results have been confirmed in different cultural contexts (e.g., Canada, Sweden).

In their 2016 article, Froiland & Worrell [5] examined a diverse high school sample (N = 1,575) where, according to their research, intrinsic motivation indirectly influenced academic performance through classroom engagement. The model explained 75% of the variance in classroom engagement and 33% of the variance in grade point average (GPA). The results were replicable across different ethnic groups (e.g., African American, Hispanic students), making them culturally reliable.

B. Herzberg's two-factor theory of motivation

Frederick Herzberg, an industrial psychologist, developed his two-factor theory of motivation in the 1950s [6] which is often referred to as the motivation-hygiene theory. The theory is based on the idea that employee satisfaction and motivation are influenced by two separate groups of factors: hygiene factors and motivational factors. According to Herzberg, these are not opposites but represent separate dimensions and have different effects on work performance.

Hygiene factors are basic conditions whose absence causes dissatisfaction, but whose presence alone does not motivate. These factors are related to the work environment, for example:

- working conditions,
- salary,
- job security,
- company regulations,
- relationships with managers and colleagues,
- status.

In higher education, these factors appear in the form of institutional infrastructure, stable employment, remuneration, and administrative support for teachers, for example. Although these do not directly encourage teaching creativity or commitment, their absence can cause significant frustration and burnout.

In contrast, motivational factors are those that elicit genuine internal satisfaction and commitment. These include, for example:

- recognition,
- performance,
- opportunities for advancement,
- responsibility,
- personal development,
- the content of the work.

In higher education, these factors are particularly important in maintaining the professional motivation of teachers. Teachers feel motivated when they consider their

work valuable, have opportunities for professional development, research, and publication, and are given autonomy in choosing teaching methods.

Herzberg's model is therefore well suited to examining teacher motivation, especially in an educational environment transformed by artificial intelligence, where the introduction of new technologies creates new challenges and opportunities. The use of AI tools, for example, can increase opportunities for responsibility and personal development, but it can also introduce new hygiene factors, such as data security or lack of technical support.

Herzberg's theory is based on the following assumptions:

- Motivation is not a one-dimensional process. Motivation does not simply work along the lines of reward or punishment, but as a complex, multi-factor system.
- Money alone is not enough for long-term motivation. Although salary is important, it cannot sustain internal commitment in the long term.
- There are basic and higher-order work-related needs. Employees seek not only security and stability, but also meaning, development, and recognition.
- People have an intrinsic need for growth and self-actualization. Learning, development, and responsibility serve as internal sources of motivation.
- Work must be more than just a means of earning money. Work becomes motivating when it provides meaning, purpose, and opportunity for the individual.

In their quantitative study, Ibrahim et al. [6] applied Herzberg's theory to examine motivation in language learning. The results show that authentic teaching materials, relevant tasks, and teacher recognition significantly increase student motivation, acting as motivators. In contrast, exams, homework, and a lack of teacher organization, as hygiene factors, cause dissatisfaction. The research confirms that the Herzberg model is well suited to understanding and developing student motivation in an educational setting.

In his study, Akdemir [7] examined the motivation of 463 teachers based on the components of Herzberg's theory. The results showed that teachers' motivation levels were above average, especially among female teachers. Interestingly, motivation did not depend on the type of school or the teachers' qualifications. The research supports the idea that Herzberg's internal and external motivational factors are well suited to measuring and interpreting teacher motivation.

Escollada [10] examined the effect of motivators (e.g., recognition, responsibility) and hygiene factors (e.g., salary, working conditions) on teacher satisfaction and performance among teachers in the Philippines. The results showed that motivators had a stronger influence on teacher satisfaction than hygiene factors. Teacher satisfaction had a positive effect on student performance and the quality of the learning environment. The research recommends supporting the professional development of teachers.

C. Application of Maslow's hierarchy of needs in higher education

In 1943, American psychologist Abraham Maslow published his theory of the hierarchy of needs [9] which became one of the fundamental models of motivation research. According to this theory, human needs are arranged

hierarchically, and an individual's behavior is motivated by their currently unmet needs. The most well-known representation of this model is Maslow's pyramid, which distinguishes between five levels, from basic physiological needs to self-actualization.

1. **Physiological needs:** The base of the pyramid consists of the basic needs necessary for survival: food, water, sleep, and health. In higher education, these factors indirectly influence students' learning ability, for example, a lack of proper nutrition, rest, and health can reduce concentration and performance.
2. **Safety needs:** The next level is the need for physical and psychological safety. For students, this can mean institutional stability, a predictable study system, financial security (scholarships, grants), and a supportive educational environment. For teachers, this includes job security, contractual conditions, and institutional support.
3. **Social needs:** Humans are social beings, so relationships, community experiences, and a sense of belonging are fundamental motivational factors. In higher education, this manifests itself in student communities, group work, mentoring programs, and teacher-student interactions. For teachers, belonging to professional communities, collaborating with colleagues, and a supportive atmosphere have a motivating effect.
4. **Need for recognition:** The fourth level is the need for self-esteem and social recognition. Students are more motivated when their performance is recognized, they receive feedback. For teachers, recognition can take the form of professional awards, publication opportunities, promotion, or positive student feedback.
5. **Self-actualization:** At the top of the pyramid is self-actualization, which is the individual's inner drive to develop their abilities and talents to the fullest. This is particularly important in higher education: students feel motivated when they have the opportunity for creative, independent thinking, research, and problem solving. For educators, self-actualization manifests itself in the freedom to teach, engage in research, and pursue professional development.

Maslow's theory is therefore well suited to education, particularly in understanding student and teacher motivation. AI-based educational environments create new opportunities for self-actualization, but they also pose challenges in maintaining lower-level needs such as security and social connections.

In her study, Nóra Katona [11] provides a theoretical synthesis of the motivational model of self-regulated learning, which is based on Maslow's theory of self-actualization. The author points out that personality development, value orientations, and intrinsic motivation play a key role in the learning process. The levels of Maslow's pyramid (physiological, safety, social, esteem, and self-actualization) have a complex effect on learning and teaching: higher-level motivations, such as self-actualization, are only activated when lower levels are satisfied. Teachers' motivational styles and goal orientations directly influence how they plan and evaluate learning processes, thereby also affecting student development.

In contrast, Gabriella Pusztai [12] examined the role of Maslow's pyramid of motivational factors in the professional activities of teachers in an empirical study. Based on the analysis of 24 teacher interviews, she concluded that intrinsic (internal) motivational factors (such as self-actualization, professional autonomy, and creativity) play a decisive role in making a teacher innovative. The needs associated with the higher levels of Maslow's pyramid, especially self-esteem and self-actualization, act as incentives for the development of educational innovations. Based on the interviews, teachers make effective professional decisions when their motivational base is stable and when they have opportunities for professional development and recognition. At the same time, some motivational factors can also act as obstacles, especially when lower-level needs, such as job security, are not satisfied.

D. McClelland's theory

In the 1960s, American psychologist David C. McClelland developed a theory of human motivational needs [13], according to which human behavior is determined by three learned motivational needs: the desire for achievement, relationships, and power. The basic premise of the theory is that these needs are not innate but develop through an individual's cultural environment and life experiences and can be measured and developed through targeted programs.

According to McClelland, all three needs are present in every person, but in different proportions, and the dominant need fundamentally determines an individual's behavior, decisions, and career choices.

1. **Need for Achievement (nAch):** Individuals with a dominant need for achievement are highly motivated to perform well. In higher education, these individuals perform well in independent research tasks and competitive situations and are motivated to excel in their work. They are characterized by:
 - seeking challenging tasks,
 - an attraction to measurable goals,
 - preferring personal responsibility,
 - need for feedback and success.
2. **Need for Affiliation (nAff):** For people of this type, establishing and maintaining social relationships is the most important thing. In higher education, these individuals work well in teams and project-based learning, and a supportive working environment is important to them. Their characteristics are:
 - desire to belong to a group,
 - search for acceptance,
 - avoidance of conflict,
 - preference for cooperation.
3. **Need for power (nPow):** These individuals are motivated to influence and control others. In higher education, these individuals often take on leadership roles in student organizations, mentoring programs, or later pursue leadership careers. Their characteristics include:
 - seeking leadership roles,
 - preferring decision-making situations,
 - need for status and recognition,
 - striving to increase organizational influence.

McClelland's theory is particularly useful in organizational practice, as it helps to map individuals' motivational profiles and thus tailor jobs, tasks, and development programs to them. Applied in higher education,

it can help identify the motivational types of teachers and students and optimize the learning environment.

The results of motivation research clearly show that there is no universal motivation model that can be applied in all situations. Individuals' motivation patterns vary significantly, influenced by personal characteristics, cultural background, and workplace environment. As a result, modern organizations are increasingly using complex and flexible motivational strategies that consider individuals' dominant needs, development directions, and the dynamics of the work environment. A personalized approach not only serves to increase performance but also contributes to the long-term maintenance of employee satisfaction and commitment.

In his empirical research, Ónodi [1] analyzed 3,305 student opinions from Corvinus University of Budapest between 2017 and 2023. The methodology of the study consisted of K-means cluster analysis, questionnaire-based data collection, and open-ended questions. The research focused on students' attitudes and motivation, with particular emphasis on how this influences their assessment of the subject taught by their instructors. Based on the results, internal motivational factors, such as the desire for knowledge and the need for development play a dominant role, but external reinforcements (e.g., recognition, grades) also have a significant impact. The research highlighted that teachers' motivation and methodological openness have a direct impact on student satisfaction, which in turn affects teacher performance evaluations. The motivational dimensions examined, performance, power (e.g., instructor influence, recognition), and affiliation (e.g., instructor-student relationship), are closely aligned with McClelland's three-need theory. The motivational profile of teachers can be interpreted along these three main motives, which significantly influence teaching effectiveness, willingness to innovate, and the quality of the learning environment.

The study by Rybníček, Bergner, and Gutschelhofer [14] involved 44 participants and aimed to validate McClelland's need theory in a modern work environment using a new neuropsychological methodological approach. During the study, participants received different types of rewards (e.g., high income, respectful leadership, prestigious company car) while their brain activity was measured using fMRI. The results showed that different rewards activated different areas of the brain, corresponding to the participants' dominant motivational needs. A close match between the reward and personal needs resulted in stronger neural activation in the reward system (e.g., putamen, caudate). The research confirmed that personalized motivational strategies can be more effective than uniform reward systems. Although the study did not specifically target educators, the results are directly applicable to the higher education setting. Teachers' motivational profiles, such as performance-oriented or relationship-oriented attitudes, can influence how they respond to different forms of recognition. The study supports the idea that professional feedback and development opportunities that match motivational needs can increase teacher commitment and performance.

IV. CHALLENGES AND MOTIVATIONAL FACTORS IN ENGINEERING EDUCATION

A. *Pedagogical and professional challenges of engineering education*

Engineering education holds a unique position within technical higher education, as it must simultaneously meet the demands of scientific rigor and practical relevance. The goal is not only to transmit theoretical knowledge but also to cultivate problem-solving abilities, systems thinking, and innovation skills.

Rapid technological advancements, particularly in areas such as artificial intelligence, automation, and digital design, pose continuous challenges for educators. Instructors must not only keep their professional expertise up to date but also adapt and evolve their teaching methodologies to align with the changing industrial landscape.

Project-based learning, laboratory work, and assignments rooted in real-world industrial problems play a central role in engineering education. These approaches not only help develop professional competencies but also enhance student motivation, especially when tasks are challenging and clearly connected to future workplace scenarios [15].

A major pedagogical challenge is the diversity in students' prior knowledge and learning experiences. While some arrive with strong foundations in mathematics and logical reasoning, others struggle with abstract thinking or technical language. Moreover, many students lack effective learning strategies, as their previous educational environments may not have required independent study, structured work habits, or deep conceptual understanding.

Supporting the development of these skills during university studies is essential. This requires intentional pedagogical support, differentiated instructional methods, and considerable patience from educators [16]. Addressing learning difficulties, sustaining motivation, and guiding individual learning paths are among the most complex tasks in engineering education. These responsibilities demand not only subject-matter expertise but also psychological insight and pedagogical sensitivity from instructors.

The role of teachers in engineering education has undergone significant changes in recent decades. Teachers are no longer just knowledge transferers, but also mentors, facilitators, and professional partners. The rise of digital tools, AI-based learning environments, and online platforms requires new competencies from teachers: technological proficiency, digital pedagogical sensitivity, and flexible learning organization skills.

B. *Motivational factors in engineering education*

Motivation plays a central role in the professional engagement of university instructors working in engineering education. In a constantly evolving technological environment, educators are expected to remain adaptable, innovative, and committed to both their academic discipline and their students. Their motivation is shaped by a combination of internal and external factors, which together influence their effectiveness, creativity, and long-term dedication.

Internal motivation, such as the pursuit of professional growth, the satisfaction of contributing to student development, and the personal fulfillment derived from

teaching, is essential for fostering innovation and resilience. At the same time, external motivators, including institutional recognition, access to research opportunities, and prospects for career advancement, also play a significant role in maintaining sustained engagement.

The motivational dynamics of engineering educators can be understood through McClelland's three-need theory [13], which identifies achievement, power, and affiliation as fundamental psychological needs. These needs are reflected in various aspects of academic life. Professional autonomy, for example, is a key motivational factor that allows educators to design their own teaching methods, select course content, and determine assessment strategies. This autonomy supports the need for achievement by enabling instructors to pursue excellence and implement their pedagogical vision. Recognition from students, colleagues, or institutional leadership reinforces the need for power by enhancing the educator's influence and status within the academic community.

Institutional support is also a decisive factor in shaping motivation. When universities provide access to modern infrastructure, professional development programs, and opportunities for research and innovation, they help satisfy both achievement and power needs. Such support encourages educators to experiment with new approaches, engage in continuous learning, and contribute to the advancement of educational practices. These opportunities also promote self-actualization, which is a deeper form of intrinsic motivation and a key element of long-term professional fulfillment.

Student feedback contributes significantly to teacher motivation. When feedback is constructive and focused on development, it offers valuable insights into the effectiveness of teaching and strengthens the sense of affiliation by fostering a feeling of connection and shared purpose. Furthermore, when educators witness the long-term impact of their work on students' professional growth and success, it reinforces the meaning of teaching and strengthens their professional identity.

In summary, the motivation of engineering educators is shaped by a complex interplay of personal aspirations, institutional conditions, and interpersonal relationships. Supporting these motivational factors is essential for fostering innovation, maintaining commitment, and ensuring the continued excellence of engineering education.

C. *Balancing Quality, Retention, and Evaluation in Higher Education*

University lecturers today work under considerable pressure, particularly due to the problem of student dropout rates in higher education institutions. The primary goal of lecturers is to minimize dropout rates while ensuring high-quality education and the transfer of relevant, applicable knowledge to students. Although the educational process is influenced by several other factors, this analysis does not discuss them in detail.

The system of performance-based evaluation of teachers has been at the center of higher education discourse since the early 2000s [1]. At the end of each semester, students are regularly asked to evaluate the work of their teachers. The questionnaires measure teacher performance on a scale of 1 to 5, where 1 is the lowest and 5 is the highest rating. However, this feedback mechanism can also be interpreted as a form of

external pressure on teachers, as the evaluations can affect their professional reputation and career advancement.

Lantos Ránki [17] points out that "students are happy to learn when teachers are happy to teach". This statement emphasizes that the motivation and professional satisfaction of teachers has a direct impact on students' willingness to learn. Encouraging teachers, especially in the direction of lifelong learning and methodological renewal, is essential for maintaining quality education. The attention and interest of students and effective cooperation between teachers and students are among the most important sources of teacher satisfaction.

The learning environment, the teaching methods used, the nature of the curriculum, and the personality of the teacher all play a key role in motivating students. At the same time, research also shows that student evaluations can be distorted, especially in cases where students are dissatisfied with their own performance or have not put enough energy into their studies yet still expect high scores. Therefore, student feedback should be treated with caution when evaluating instructor performance, considering the subjective factors that may distort the evaluation.

Another challenge for teachers is that the primary and secondary education system has undergone significant changes in recent years. Students entering higher education often come from difficult family backgrounds and have different skill sets than in the past. In addition, the number of students requiring special treatment is also increasing in higher education, which requires special attention from teachers. As a result, teachers need to pay increased attention to teaching learning techniques, such as developing note-taking skills. With the spread of the digital environment, reading comprehension problems are becoming more common, which are already being noticed in primary education and are being addressed with targeted programs.

V. CONCLUSIONS

The aim of our research was to explore the role of motivation in education, with particular emphasis on the higher education environment. Based on an analysis of previous studies, we examined internal and external motivational factors, as well as four classic motivational theories (Maslow, Herzberg, Deci-Ryan, McClelland), which we associated with relevant empirical and theoretical research.

Based on the results of the study, it can be concluded that both internal and external motivation are essential for educators to be able to perform their educational tasks in an authentic, up-to-date, and high-quality manner. The role of internal motivation is particularly important, as it ensures long-term commitment, professional development, and a willingness to innovate. Herzberg's two-factor model is still relevant today, as it points out that financial rewards alone are not sufficient to maintain long-term employee motivation and that work has a deeper, personal significance for the individual.

A lack of motivation can lead to burnout, which jeopardizes not only teaching performance but also, indirectly, student achievement. University management has recognized this risk, and in recent years there has been a growing number of institutional initiatives aimed at strengthening external motivational factors. These include forms of professional recognition, research and continuing education opportunities,

and institutional practices that support faculty autonomy. These initiatives contribute to ensuring that faculty members have an appropriate working environment that supports professional fulfillment and prevents burnout.

REFERENCES

- [1] A. Ónodi, Motiváció és teljesítményértékelés kapcsolata az egyetemi oktatásban, *Educatio*, vol. 33, no. 4, pp. 540–547, 2025.
- [2] M. Chrappán, “TÉR-figyelő rendszer. A teljesítményértékelés a felsőoktatási intézményekben,” in *Interdiszciplináris pedagógia a bizonytalanság korában. A XII. Kiss Árpád emlékkonferencia tanulmánykötete*, A. Buda and E. Kiss, Eds., pp. 55–70, 2022.
- [3] R. M. Ryan and E. L. Deci, “Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions,” *Contemporary Educational Psychology*, vol. 61, p. 101860, 2020.
- [4] G. Taylor, T. Jungert, G. A. Mageau, K. Schattke, H. Dedic, S. Rosenfield, and R. Koestner, “A self-determination theory approach to predicting school achievement over time: The unique role of intrinsic motivation,” *Contemporary Educational Psychology*, vol. 39, no. 4, pp. 342–358, 2014.
- [5] J. M. Froiland and F. C. Worrell, “Intrinsic motivation, learning goals, engagement, and achievement in a diverse high school,” *Psychology in the Schools*, vol. 53, no. 3, pp. 321–336, 2016.
- [6] F. Herzberg, B. Mausner, and B. B. Snyderman, *The Motivation to Work*, 2nd ed. New York, NY, USA: John Wiley & Sons, pp. 113–118. 1959.
- [7] I. W. Ibrahim, I. M. Ghazali, S. A. Syed, N. H. R. Abdullah, M. H. A. Hamid, and S. H. Aisyah, “Exploring motivation for learning using Herzberg's two factor theory,” *International Journal of Academic Research in Business and Social Sciences*, vol. 13, no. 3, pp. 1065–1083, 2023.
- [8] E. Akdemir, “The Determination of Teachers' Motivation Based on Herzberg's Motivation Theory,” *Turkish Online Journal of Educational Technology (TOJET)*, vol. 19, no. 4, pp. 89–101, 2020.
- [9] A. H. Maslow, “A theory of human motivation,” *Psychological Review*, vol. 50, no. 4, pp. 370–396, 1943.
- [10] M. T. Miah and M. J. Hasan, “Impact of Herzberg two-factor theory on teachers' job satisfaction: An implication to the private universities of Bangladesh,” *International Journal of Business and Management Research*, vol. 10, no. 1, pp. 1–5, 2022.
- [11] N. Katona, “Motiváció és önszabályozó tanulás,” **Pedagógusképzés**, vol. 7, no. 2–3, pp. 129–158, 2009.
- [12] Á. Hornyák and G. Pusztai, “Tanári motivációs faktorok szerepe az oktatási innovációk kidolgozásában,” in *Innováció az oktatásban – Projektkonferencia 2021 tanulmánykötet*, Debrecen, Hungary: Debreceni Egyetem, Nevelés- és Művelődéstudományi Intézet, pp. 133–144. 2021.
- [13] D. C. McClelland, *The Achievement Motive*. New York, NY, USA: Appleton-Century-Crofts, pp. 1–50, 1953.
- [14] R. Rybníček, S. Bergner, and A. Gutschelhofer, “How individual needs influence motivation effects: a neuroscientific study on McClelland's need theory,” *Review of Managerial Science*, vol. 13, no. 2, pp. 443–482, 2019.
- [15] L. Pálvölgyi, “Projektmenedzsment és projektpedagógia,” in **Hazai és külföldi modellek a projektoktatásban: Nemzetközi Tudományos Konferencia tanulmánykötete**, R. Bodáné Kendrovics, Ed. Budapest, Hungary: Óbudai Egyetem Rejtő Sándor Könyv- és Könyvtárművelődési Kar, 2018, pp. 1–20. R. Rybníček, S. Bergner, and A. Gutschelhofer, “How individual needs influence motivation effects: a neuroscientific study on McClelland's need theory,” *Review of Managerial Science*, vol. 13, no. 2, pp. 443–482, 2019.
- [16] M. A. AM, S. Hadi, E. Istiyono, and H. Retnawati, “Does Differentiated Instruction Affect Learning Outcome? Systematic Review and Meta-Analysis,” **Journal of Pedagogical Research**, vol. 7, no. 5, pp. 18–33, 2023.
- [17] J. Ránki Lantos, “A tanulók motiválása az élethosszig tartó tanulásra,” *Új Pedagógiai Szemle*, Oct. 2002. [Online]. Available: <https://folyoiratok.oh.gov.hu/uj-pedagogiai-szemle/a-tanulok-motivalasa-az-elethos-szig-tarto-tanulasra>