

THE ROLE OF LECTURERS IN INNOVATING TEACHING METHODS FOR BASIC SCIENCES IN HIGHER EDUCATION

Nguyen Thi Hong, Le Thanh The

School of Foreign Language, Thai Nguyen University, Thai Nguyen, Vietnam

ABSTRACT

In the context of a rapidly transforming higher education system focused on developing students' competencies and adapting to the Fourth Industrial Revolution, innovation in teaching methods for basic science subjects has become essential. Basic science subjects play a fundamental role in university curricula, yet teaching practices reveal limitations in teaching methods, assessment methods, and student engagement. This paper focuses on analyzing the role of lecturers in the innovation of teaching methods for basic science subjects in higher education. The research clarifies the shift in lecturers' roles from knowledge transmitters to organizers, guides, and inspirers of learning; their role in selecting and implementing modern teaching methods; the innovation of assessment activities oriented towards competency development; and their role in guiding and supporting students throughout their learning process. Based on this, the article affirms that lecturers are the key factor determining the effectiveness of teaching innovation and proposes directions for improving the professional, pedagogical, and technological application capabilities of lecturers, contributing to improving the quality of university education in the current period.

Keyword: *University lecturers; innovation in teaching methods; basic science; higher education; development of learners' competencies.*

1. INTRODUCTION

In the context of globalization and the ongoing Fourth Industrial Revolution, higher education faces the urgent need for comprehensive innovation to meet the demand for high-quality human resource development for society. The rapid development of science and technology, especially artificial intelligence, big data, and online learning platforms, has fundamentally changed the way people access knowledge and learn. This poses a major challenge for higher education institutions in transforming from a traditional training model to a modern, learner-centered training model that develops competence and creative thinking [1].

In the university training system, basic science subjects such as Mathematics, Physics, Chemistry, Biology, and Informatics play a foundational role, providing the theoretical basis and scientific thinking methods for learners. However, in reality, teaching these subjects at many universities still heavily emphasizes one-way knowledge transmission, focusing on memorizing formulas and theories, while not adequately encouraging

independent thinking, problem-solving, and the application of knowledge to practice. This leads to a lack of student interest in learning, low academic results, and failure to meet the demands of the modern labor market.

Therefore, reforming teaching methods for basic science subjects has become an essential requirement in the process of higher education reform. This reform process should not only focus on applying information technology or using active teaching methods, but also require a comprehensive change in thinking, approach, and the role of lecturers. While previously lecturers were primarily knowledge transmitters, in the current context, they need to become organizers, guides, supporters, and facilitators of student learning activities. This role transformation is crucial to the effectiveness of the teaching method innovation process [2].

In addition, the requirements for ensuring training quality, educational accreditation, and international integration also put great pressure on university lecturers. Lecturers not only need to have solid professional competence but also need to be proficient in modern teaching methods, know how to design active learning activities,

innovate forms of testing and evaluation, and at the same time have the ability to inspire and motivate students to learn. In today's open and flexible learning environment, the role of lecturers is becoming increasingly diverse and complex, requiring rapid adaptation to changes in education and technology [3].

Based on these practical requirements, studying the role of lecturers in innovating teaching methods for basic science subjects in higher education is of great importance both theoretically and practically. This study contributes to clarifying the necessary transformations in teaching activities, identifying new tasks and responsibilities of lecturers, and thereby proposing solutions to improve the effectiveness of teaching basic science subjects, meeting the goal of training high-quality human resources in the current period.

2. CONTENT

2.1. Transforming the role of lecturers in teaching basic sciences

The rapid development of science and technology and profound changes in human resource training requirements have fundamentally altered the way teaching and learning are organized in higher education. In this context, the role of lecturers in teaching basic science subjects is no longer limited to the traditional transmission of knowledge, but is shifting towards diversification of functions, a learner-centered approach, and a focus on developing comprehensive competencies. This transformation is a key factor determining the quality and effectiveness of the teaching methodology reform process.

Previously, in the traditional teaching model, lecturers were often seen as the primary source of knowledge, playing a central role in the classroom, while students mainly received knowledge passively. This approach was particularly prevalent in teaching basic science subjects, where learning content was often abstract, formulaic, and full of theoretical concepts. However, this model reveals many limitations when students have difficulty understanding the nature of the problem in depth, lack the ability to apply knowledge to practice, and have few opportunities to develop critical and creative thinking [4].

In the modern education trend, lecturers need to shift from the role of "transmitter" to the role of

"organizer and orienter of learning activities". This requires lecturers not only to be proficient in their subject matter but also to have the ability to design a positive learning environment in which students are encouraged to actively explore, discover, and build knowledge. For basic science subjects, this change is especially important because the nature of science is a process of discovery and logical thinking. When lecturers create problem situations, open problems, or simulation experiments, students will be placed in the role of researchers, thereby developing their scientific thinking and problem-solving abilities.

In addition, the role of academic advisors of lecturers is increasingly valued. In a flexible learning environment, with the support of online learning management systems and abundant digital resources, students have many opportunities to access knowledge outside the classroom. Lecturers are no longer the sole providers of learning content, but become guides on how to learn, how to choose appropriate materials, how to plan effective learning, and how to self-assess their own progress. This helps to develop self-learning ability – a core competency for learners in a lifelong learning society [5].

In addition, lecturers in teaching basic sciences also play the role of connecting theory and practice. One of the reasons students lack interest in basic science subjects is because they do not yet see the meaning and application of the knowledge. When lecturers proactively incorporate practical examples, problems related to their major, or small application projects, students will better understand the value of the subject for their future careers. Through this, the learning process becomes meaningful and fosters intrinsic motivation.

The shift in the role of lecturers is also reflected in increased cooperation and interaction with students. In the modern classroom, lecturers need to create an open environment, encouraging discussion, questioning, and scientific debate. Listening to students' opinions, respecting differences in problem-solving approaches, and providing timely support will contribute to building positive learning relationships, thereby enhancing the effectiveness of knowledge acquisition.

It can be affirmed that the shift in the role of lecturers in teaching basic science subjects is an

essential requirement in the process of reforming higher education. Lecturers are not only transmitters of knowledge but also designers of learning activities, mentors, connectors of knowledge with practice, and agents promoting the holistic development of learners. This transformation forms the foundation for the effective implementation of modern teaching methods, contributing to improved training quality in the current context.

2.2. Lecturers and the selection and implementation of modern teaching methods

Innovating teaching methods is one of the key focuses of current higher education reform, with lecturers playing a decisive role in selecting and implementing modern teaching methods that suit the training objectives and specific characteristics of basic science subjects. Unlike traditional teaching models that rely primarily on lectures, modern teaching methods aim to foster student initiative and creativity, develop critical thinking skills, and enable the application of knowledge to solve practical problems. Therefore, the choice of teaching methods is not only a matter of pedagogical technique but also reflects the innovative thinking and professional competence of lecturers.

In teaching basic science subjects, the learning content is often highly abstract and requires rigorous logical thinking. This necessitates lecturers to flexibly combine various teaching methods to help students access knowledge effectively. Methods such as problem-solving teaching, project-based learning, flipped classroom, and cooperative learning have been proven to be suitable for developing scientific thinking skills. However, for these methods to be effective, lecturers need to understand the nature of each method, identify specific learning objectives, and design learning activities appropriate to the students' level [6].

Besides choosing methods, lecturers also play a central role in organizing and implementing the teaching process. In the modern classroom, lecturers are no longer "monologues" on the podium but become facilitators of learning activities. The design of lectures needs to focus on interaction between lecturers and students, between students and students, as well as between students and digital learning resources. In particular, the support of information

technology and online learning platforms has opened up many opportunities to innovate the way teaching is organized. Instructors can utilize learning management systems, video lectures, experiment simulation software, or online assessment tools to enhance the visual and flexible nature of the learning process.

Another crucial element in implementing modern teaching methods is the ability to personalize the learning process. University students differ in their knowledge backgrounds, learning styles, and learning pace. Instructors need to know how to design diverse learning tasks, provide varying levels of challenge, and offer timely support to students facing difficulties. This ensures that all students have the opportunity to access and master fundamental scientific knowledge while maximizing their individual potential.

Furthermore, selecting and implementing modern teaching methods requires instructors to continuously improve and update their professional knowledge and pedagogical skills. The rapid development of educational science and teaching technology leads to constant innovation in teaching methods. Lecturers need to proactively participate in training courses, professional seminars, and research advanced teaching models in and outside the country to improve their capacity in designing and organizing teaching. This is a necessary condition to ensure that the innovation process is not just formal but actually creates a change in the quality of students' learning.

It can be affirmed that lecturers are key factors in selecting and implementing modern teaching methods in basic science subjects. The success of the innovation process in teaching methods largely depends on the innovative thinking, pedagogical competence, and ability to apply technology of lecturers. When lecturers truly master and effectively apply modern teaching methods, the learning process will become lively, attractive, and meaningful, contributing to improving the quality of university education in the current period [7].

2.3. The role of lecturers in reforming testing and evaluation.

Assessment is an important step in the teaching process, playing a role in guiding learning content, teaching methods, and students' learning motivation. In the context of higher education

reform towards developing learners' competencies, assessment activities are no longer just aimed at measuring the level of knowledge memorization, but need to reflect students' ability to think, apply, and solve problems. This transformation poses an urgent requirement for lecturers to innovate assessment methods, especially in teaching basic science subjects [8].

In the traditional model, assessment usually focuses on written tests, multiple-choice tests, or calculation exercises, mainly measuring the ability to reproduce knowledge and apply formulas. Although this form is still necessary to assess the foundation of scientific knowledge, overuse will lead to students learning superficially, memorizing mechanically, and lacking the ability to apply creatively. Therefore, instructors need to shift from evaluating "final results" to evaluating "the learning process," harmoniously combining summative and ongoing assessments to create a comprehensive picture of students' learning abilities.

The role of instructors is clearly demonstrated in designing assessment systems that align with the learning objectives of basic science subjects. This requires instructors to clearly define the learning outcomes in terms of knowledge, skills, and scientific thinking abilities, thereby developing diverse assessment tools such as open-ended assignments, laboratory reports, small projects, group presentations, or learning journals. These assessment methods give students the opportunity to demonstrate their analytical skills, logical reasoning, and application of knowledge to practical situations, rather than simply solving problems according to pre-existing templates.

Besides designing assessment tools, instructors also play a crucial role in organizing and conducting assessments in a fair, transparent, and supportive manner. Assessment in modern education is not only aimed at grading but also at providing timely feedback to help students recognize their strengths and weaknesses and adjust their learning methods. Therefore, instructors need to focus on constructive feedback, pointing out the causes of errors and suggesting ways to correct them. This is a key factor in helping students continuously progress in the process of learning basic science subjects which have many closely related foundational knowledge.

The development of information technology also opens up many opportunities to innovate testing and assessment. Instructors can apply online testing systems, smart question banks, automatic grading software or learning data analysis tools to monitor students' learning progress. The use of technology not only enhances the objectivity and accuracy of assessment but also helps instructors promptly identify common difficulties of students to adjust the content and teaching methods accordingly [9].

Furthermore, instructors should encourage student participation in the assessment process through self-assessment and peer assessment. When students are guided on how to self-assess their learning outcomes or provide feedback to their classmates, they will develop critical thinking skills and a sense of responsibility towards their learning. This is especially significant in teaching basic sciences, where a deep understanding of the problem's nature is more important than simply finding the correct answer.

It can be seen that reforming assessment in basic science subjects is not just about changing the form of exams, but a comprehensive shift in assessment thinking. Instructors play a central role in designing, organizing, and implementing the assessment process in a way that develops competencies, ensures fairness and objectivity, and promotes student progress. When assessment is reformed in the right direction, it will become a powerful driving force contributing to improving the quality of teaching and learning in higher education today.

2.4. The role of instructors in inspiring and guiding learning

In the context of higher education shifting from a content-based approach to a competency-based approach, the role of lecturers extends beyond simply organizing and managing learning activities to include the crucial task of inspiring and guiding students' learning. Especially for fundamental science subjects, often perceived as dry, abstract, and demanding of logical thinking, fostering student interest and building sustainable motivation becomes a decisive factor in educational effectiveness.

Inspiring students in teaching is not simply about creating a lively classroom atmosphere, but about the lecturer's ability to make knowledge

meaningful to learners. When lecturers demonstrate passion for the subject, present knowledge clearly and coherently, and connect it to practical issues, students will perceive the value of fundamental science for their lives and future careers. From then on, the subject was no longer a mandatory requirement in the training program but became a necessary knowledge foundation for self-development and adaptation to the modern labor environment [10].

In addition, lecturers play an important role in guiding students' learning methods and strategies. University students, especially first-year students, often have difficulty transitioning from passive learning in high school to an autonomous learning environment in university. In teaching basic science subjects, if not properly guided, students can easily fall into the situation of rote memorization of formulas, lack understanding of the essence, or become disoriented in the large amount of knowledge. Lecturers need to guide students on how to read scientific documents, how to take effective notes, how to solve problems using analytical thinking, as well as how to self-assess their level of understanding. This is an important foundation for forming self-learning and lifelong learning abilities.

The inspiring role of instructors is also demonstrated in creating a positive and humane learning environment. A classroom where students are encouraged to ask questions, their opinions are respected, and they are not afraid of making mistakes will foster a spirit of scientific exploration. When instructors listen, encourage, and provide timely support, students will feel more confident in approaching difficult content and be ready to overcome academic challenges.

Furthermore, instructors also act as career guides by helping students understand the role of basic science subjects in their chosen field. Introducing practical applications of mathematics, physics, chemistry, or computer science in specific professions will help students understand that foundational knowledge is the "key" to accessing specialized subjects and developing a sustainable career. This is especially important given that many students tend to underestimate basic science subjects because they do not see a direct connection to their future jobs.

It can be affirmed that lecturers play an irreplaceable role in inspiring and guiding

students' learning in the teaching of basic science subjects. When lecturers harmoniously combine professional competence, pedagogical skills, and dedication to their students, they not only help students acquire knowledge effectively but also ignite a love for science, a spirit of self-learning, and a desire to conquer knowledge. This is a crucial foundation contributing to improving the quality of training and meeting the requirements of higher education reform in the current period.

3. CONCLUSION

Innovating teaching methods for basic science subjects in higher education is an essential requirement to meet the development of science and technology and the need for training high-quality human resources. In this process, lecturers play a central role and are decisive in the effectiveness of the innovation. The shift from knowledge transmitters to organizers, guides, and inspirers has profoundly changed the nature of teaching and learning. The selection and implementation of modern teaching methods, innovative assessment and evaluation, and student learning orientation all depend on the professional competence, pedagogical skills, and innovative spirit of the lecturers. When lecturers truly master their new role, students will develop comprehensively in scientific thinking, self-learning abilities, and the ability to apply knowledge to practice. Therefore, investing in improving the quality of the teaching staff is the core solution to enhancing the quality of basic science education in higher education today.

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