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ADAPTIVE TESTING IN PHARMACEUTICAL EDUCATION: STRATEGIES AND BENEFITS

Topicality. This paper investigates the effectiveness of adaptive assessment in pharmaceutical education, aiming to enhance student's self-assessment and independent learning skills. Adaptive assessment, tailoring assessments to students' learning levels and offering personalized feedback, shows promise in evaluating pharmaceutical understanding and identifying areas needing attention. Through analyzing its impact, advantages, and limitations, this study provides insights into implementation and improvement.
The aim of the work. The aim of this research is to explore the implementation of adaptive testing methodologies within pharmaceutical education, focusing on the strategies employed and the potential benefits accrued.
Materials and methods of the study. Bibliographical, analytical and comparative, logical, generalization.
Research results and their discussion. Research has shown that adaptive testing in pharmaceutical education leads to increased student engagement. By tailoring the testing process to individual student needs and abilities, adaptive testing promotes active participation and motivation among learners. This is supported by studies that have observed higher levels of student interest and enthusiasm in courses where adaptive testing methods are implemented. his research summary provides an overview of the findings and discussions related to the implementation of adaptive testing in pharmaceutical education. It highlights the benefits of adaptive testing and emphasizes the importance of addressing challenges to maximize its effectiveness in educational practice.
Conclusions. Findings highlight increased student engagement, improved outcomes, and enhanced self-efficacy. Challenges include task disclosure risks and technical requirements. Recommendations address these challenges. Despite limited application in pharmacy education, adaptive assessment holds potential to personalize learning, improve outcomes, and boost student confidence.
Key words: new educational standard, adaptive testing, artificial intelligence, personalised feedback.

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АДАПТИВНЕ ТЕСТУВАННЯ У ФАРМАЦЕВТИЧНІЙ ОСВІТІ: СТРАТЕГІЇ ТА ПЕРЕВАГИ

Актуальність. У статті досліджується ефективність адаптивного оцінювання у фармацевтичній освіті з метою покращення навичок самооцінки та самостійного навчання студентів. Адаптивне оцінювання, пристосовуючи оцінювання до рівня навчання студентів і пропонуючи персоналізований зворотний зв'язок, є перспективним для оцінювання розуміння фармації та визначення галузей, які потребують уваги. Аналізуючи його вплив, переваги та обмеження, це дослідження дає розуміння впровадження та вдосконалення.

Мета дослідження – вивчити впровадження адаптивних методологій тестування в межах фармацевтичної освіти, зосереджуючись на використовуваних стратегіях і потенційних перевагах.

Матеріали та методи дослідження. Бібліографічний, аналітико-порівняльний, логічний, узагальнення.

Результати дослідження. Дослідження показали, що адаптивне тестування у фармацевтичній освіті сприяє підвищенню залученості студентів. Пристосовуючи процес тестування до індивідуальних потреб і здібностей студента, адаптивне тестування сприяє активній участі та мотивації серед учнів. Це підтверджено дослідженнями, у яких спостерігали вищий рівень інтересу та ентузіазму студентів до курсів, де реалізовано адаптивні методи тестування. Робота підкреслює переваги адаптивного тестування та наголошує на важливості розв'язання проблем для максимізації його ефективності в освітній практиці.

Висновки. Висновки підкреслюють посилення залученості студентів, покращення результатів і підвищення самоефективності. Проблеми містять ризики розкриття завдань і технічні вимоги. Рекомендації спрямовані на розв'язання цих проблем. Незважаючи на обмежене застосування у фармацевтичній освіті, адаптивне оцінювання має потенціал для персоналізації навчання, покращення результатів і підвищення впевненості студентів.

Ключові слова: новий освітній стандарт, адаптивне тестування, штучний інтелект, персоналізований зворотний зв'язок.

Actuality. Industrial Pharmacy for the second (master's) level of higher education, aimed at acquiring specialised conceptual knowledge, including modern scientific achievements in the field of professional activity of a pharmacist and requiring participants in the educational process to use the latest technologies and teaching methodologies. The Dep. In 2022, Ukraine approved a new educational standard in the specialty 226 "Pharm artment of Drug Chemistry and Drug Toxicology" of the Bogomolets National Medical University is constantly searching for and implementing the latest teaching methods and technologies and using modern resources and platforms.

Modern pharmaceutical education requires innovative approaches to assessment that meet the unique needs of students and ensure an effective learning process. Adaptive testing is an important tool that enables students not only to demonstrate their knowledge, but also to personalize their educational trajectory. In this context, it is worth exploring examples of adaptive assessment strategies implemented in pharmacy education and considering how they contribute to improving the quality of learning and developing professional competencies.

After graduation, pharmacists must be able to maintain and expand their practical knowledge through independent information seeking and continuing professional development. For self-education to be effective, it is necessary to know how to identify one's own educational needs, evaluate achievements, compare them with previous experience and the desired result. As pharmacy students are usually taught through traditional lectures, teachers lack the time and experience to develop students' self-assessment skills and implement self-directed learning strategies. The introduction of adaptive learning technologies in teaching contributes to the development of the above skills in students and does not require costly resources or time from teachers.

One of these technologies is adaptive assessment, which is a type of assessment that adapts to a student's level of learning and provides personalized feedback based on their performance. This technology allows measuring the level of understanding of pharmaceutical principles and identify areas that require more attention or practice. The use of adaptive assessment ensures more effective development of students and helps to create optimal conditions for their learning.

The aim of the work is to analyze the effectiveness of adaptive assessment technologies in pharmaceutical education for the development of students' self-assessment and independent learning skills. The main objectives are to determine the impact of adaptive assessment on students' learning, identify the advantages and disadvantages of this approach, and establish its potential for improving the quality of pharmacy education. The results of this study will contribute not only to understanding the effectiveness of adaptive methods in pharmacy education, but also to developing recommendations for their optimal implementation and further development.

Materials and methods of the study. Bibliographical, analytical and comparative, logical, generalization.

Literature review

Today, learning assessments are often automated, which makes it possible to store and analyse data on student achievement and create more appropriate tests to diagnose learning outcomes. This process of learning analytics involves collecting data, identifying hidden patterns that can lead to a more effective learning process,

and continuously improving assessment strategies. Learning analytics for adaptive assessment has clearly defined goals: it increases the efficiency and effectiveness of the learning process by adapting assessment materials to the real needs of students. Current research on assessment practices focuses on formative assessment, which provides feedback and is informative for learning analysts. The study by Tempelaar and colleagues (2015) shows that computer-based formative assessment has a high predictive potential. Adaptive assessment strategies can include multiple-choice tests, simulations, or case studies. Computer-based adaptive technologies include interactive elements that allow students to experiment, simulate or visualize solutions to professional problems. In addition, adaptive computer-based assessment can provide real-time data that can be used to adjust teaching strategies or curriculum to meet the needs of students and contemporary stakeholders.

Adaptive learning technology is also useful for pharmacy education, as it can meet the changing learning needs of students and the challenges of the healthcare system. The results of this empirical study demonstrate positive changes in the indicators of self-directed learning outcomes of future masters of pharmacy after the introduction of adaptive learning technology. The essence of assessment adaptation is that each subsequent question depends on the quality of the student's answer to the previous one, thus creating a personally adapted learning path. The level of difficulty of tasks is determined by the quality of previous answers: the more correct the answers, the greater the requirements for subsequent tasks, and vice versa. If a student finds it difficult, subsequent tasks will be simplified until he or she has mastered the required level of knowledge. Adaptive assessment tools are usually used for periodic monitoring or regular practice. After the monitoring is completed, the collected data is analyzed and the results are used to further adjust the curriculum and individual learning path of each student to optimize the learning process.

In the modern learning environment, three types of adaptive tests are used. The first type involves a task of medium difficulty, and depending on the student's success in completing it, the next task can be either simplified or complicated. The second type requires a bank of tasks divided into several levels of difficulty. Students complete the simplest task from the first level of difficulty, and upon successful completion, they are given a task from the highest level of difficulty. The third type involves an individual student choosing the level of difficulty from which he or she starts testing, and depending on his or her success, gradually moves on to

the next task, which may be either more or less difficult. In this case, the student can independently determine the path of testing, choosing the level that meets his or her own needs, abilities and knowledge.

We cannot but mention the impact of innovative technologies on the development of adaptive testing, namely artificial intelligence. The use of artificial intelligence allows you to create individualized tests that accurately reflect the level of knowledge and skills of each student, making the testing process more accurate and objective. However, the implementation of these systems requires significant resources and attention to academic integrity in the educational context.

Radkevych, a researcher of adaptive assessment strategies, lists the advantages of such testing. For example, it allows students to respond to the challenges of today without overwhelming them, as the complexity of each subsequent question corresponds to their current level of knowledge. This helps reduce stress during the assessment process and increases motivation to learn new knowledge.

Research results and their discussion. Adaptive testing is defined as an advanced assessment method where each task is structured based on the student's previous answers. Its importance lies in the development of personalized assessments that provide reliable indicators of academic performance, achievement of learning outcomes and individual learning support. By adapting the complexity of tasks and their content, adaptive tests become an integral part of the educational process.

We will give examples of adaptive assessment strategies that we used when teaching third-year students when considering the topic "Drugs that stimulate afferent nerve fiber receptors. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples".

1. Formative assessment to create a personalized learning path.

Prior to the lecture session on pharmaceutical chemistry, students take a multiple-choice test on the chemical, analytical and therapeutic classification of drugs. The adaptive strategy of this assignment is that, according to the results, students who answered most of the questions correctly could listen to the lecture. Students who had difficulties with certain categories of tasks were offered additional resources, such as video lectures or interactive exercises focused on basic questions on the lecture topic. Students had to complete these tasks before the lecture.

2. Adaptive simulation created in an online test environment.

Students participate in a simulated scenario of dispensing medicines in a pharmacy. If the student chooses the wrong medication, the simulation prompts them to review the relevant information about the medication before continuing. If the learner correctly explains the drug interactions to the patient, the simulation moves on to a more complex scenario involving multiple drugs.

3. Simulations with dynamic questions created in an online testing environment.

Students analyze a clinical case of a patient with a specific disease. Follow-up questions are adapted based on student responses: if a student is unable to identify the appropriate drug class, the next question may provide hints or suggest relevant learning materials. If the student correctly identifies the class of drugs, the next questions can focus on metabolism, side effects, or dosage.

4. Personalized feedback with learning analytics.

Students complete a midterm test covering various pharmaceutical calculations. The online assessment platform provides detailed feedback, not just a score. Students who make calculation errors receive specific guidance on the formula or concept they did not understand. Students who excel receive feedback that highlights their strengths and suggestions for further study of related topics.

These are just a few examples, and there are many possibilities. The key is to use technology to create assessments that dynamically adjust to individual learners' needs, providing targeted feedback and promoting personalized learning.

Based on the results of these strategies, we have identified the benefits of adaptive assessment:

− increased motivation and engagement of students in learning: due to its dynamic nature and personalized feedback, adaptive assessment makes the learning process more informative and engaging for students;

− improved learning outcomes: adaptive assessment methods allow students to focus on the topics they need and receive personalized help, leading to better learning;

− increasing students' self-efficacy: adaptive assessment allows students to track their progress and receive positive feedback, which helps them to identify their strengths and weaknesses.

Depending on the purpose of the test (e.g., at the beginning, middle, or end of the semester), it is important to choose the right strategy. To do this, we need to ask ourrselves the following questions: What are the learning needs of the students? Does the student's knowledge improve during the test (and not just be assessed)? Do we want to assess the components of the learner's knowledge or do we want to measure the progress of the learner's learning while taking the test?

One of the main limitations of adaptive assessment is the potential for disclosure of tasks, where students may share or memorize them, which calls into question the validity of the assessment. To minimize this risk, you need to create a bank of tests that can be randomly selected. For this purpose, we recommend using artificial intelligence, which can develop a large number of tasks.

An additional requirement for adaptive tests is the need for consecutive tests to be taken at intervals to allow for corrective action before retesting. In addition, it must be recognized that different aspects of the content being tested may be learned in any order over the course of a series of tests, and thus the assessment of outcomes may not reflect the quality of teaching for some students. All students learn the material differently, and therefore require a different number of questions in the test and, in some cases, different wording of the questions. Other challenges include the following:

− technical infrastructure: it is necessary to ensure that adaptive assessment tools are compatible with existing learning management systems;

− raising the level of educational digital competence of teachers: it is advisable to organize trainings for teachers on the use of adaptive assessment methods;

− time constraints: it is necessary to integrate adaptive assessment strategies into the existing curriculum in an effective and timely manner;

− data protection: secure practices for collecting and storing student assessment data should be implemented.

Although the ideas behind adaptive testing have been around since the early 1900s, examples of its use in pharmacy education are few and far between. Today, the development of software to deliver comprehensive tests that adapt in difficulty and content makes it easier to implement more personalized forms of summative assessment, and with it, more objective assessment and confidence that each student is achieving all the required learning outcomes, with individualized learning support and feedback where necessary. Adaptive assessment has significant potential to improve pharmacy education in particular. By personalizing the learning experience, such assessment helps students achieve better results, become more engaged in their studies and believe in their abilities.

Conclusion

Adaptive assessment strategies in pharmaceutical education not only open up new horizons for students, but also expand the possibilities of the educational process. The introduction of formative assessment

with a personalized learning path, adaptive modelling and simulations with dynamic questions allows students to focus on important aspects of the material and receive individual support. The resulting benefits, such as increased motivation, improved results and increased self-efficacy, demonstrate the importance and relevance of adaptive assessment in today's educational environment.

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