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Article

Biomechanics optimizes learning posture and learning efficiency in higher education teaching and learning

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Abstract: In modern educational environments, biomechanics, as the study of the principles of human movement and mechanics, offers new perspectives and solutions, especially in online and long-term learning processes. Teachers need to focus not only on the optimization of teaching content and strategies but also consider students' physical adaptations and cognitive load. The application of biomechanics can help to improve students' learning experience by rationally designing the learning environment, adjusting the teaching objectives and methods, and reducing the negative impacts of improper body postures, exercise loads, and fatigue, thus enhancing learning efficiency. This study examines the multiple applications of biomechanics in education, including the impact on teaching goals, optimization of content selection, improvement of teaching methods, and protection of students' physical health. The principles of biomechanics help teachers identify and analyze the physiological responses produced by students during the learning process, such as muscle fatigue and improper posture, and suggest appropriate adjustments. For example, reasonable study posture and regular breaks can significantly reduce students' physical load and improve concentration and learning efficiency. Through the lens of biomechanics, teachers are able to design teaching activities that meet students' physiological needs, prevent health problems caused by poor posture or fatigue, and ensure that students learn efficiently in a healthy state.

Keywords: biomechanics; education informatization; information platform; network resources; moral education

1. Introduction

In the field of modern education, with the rapid development of information technology, online teaching has become an important mode of teaching, especially in the educational environment of remote areas [1]. However, with the changes in the form of education, we are also faced with a series of challenges, such as how to effectively set teaching objectives, select appropriate teaching content, and adopt suitable teaching methods in this new mode. Behind these pedagogical reforms, in addition to the adjustment of teaching strategies and objectives, the study of biomechanics provides us with new perspectives to help us better understand and optimize students' physical performance and cognitive abilities in the learning process. Biomechanics can be used not only in the fields of sports science and physical therapy; it likewise plays an increasingly important role in the field of education, especially in the context of online teaching and learning [2,3].

Biomechanics studies the mechanics of human movement and deals with the generation, transmission, and change of forces in the human body during movement. By studying students' body postures, movement patterns, and muscle strength during the learning process, biomechanics can help teachers understand the physical stresses and physiological responses that students may face during prolonged periods of

learning, especially online learning [4,5]. The application of biomechanics can help design more humane teaching environments by optimizing students' body postures and movement patterns, thereby improving learning efficiency and learner comfort. Biomechanics, in simple terms, is a discipline that studies the principles of mechanics during human movement, including the generation, transmission, and changes of forces within the body during various activities. For example, when students engage in long periods of online learning, especially sitting in front of a computer, their body posture can be negatively affected. This, in turn, may reduce their concentration, learning efficiency, and even impact their physical health. Teachers can apply the knowledge of biomechanics to suggest ways to improve posture and reduce physical fatigue, helping students maintain good physical conditions during the learning process. By incorporating these principles, educators can foster a more comfortable and productive learning environment for students [6].

Knowledge of biomechanics is an equally important reference when setting teaching objectives. Biomechanics helps us understand how different movements affect the body, especially in terms of fine motor and force control. Online teaching usually requires students to face the screen for a long period of time, which not only tests their cognitive ability but also the fine motor control of hand muscles and muscular endurance during the learning process [7,8]. To address this situation, teachers can combine the principles of biomechanics to adjust the teaching objectives, reduce the muscle fatigue that students may encounter during prolonged operation, and propose learning requirements that are more in line with physiological patterns. This will not only improve student learning but also reduce physical discomfort due to poor posture and overuse of muscles [9].

At the same time, the application of biomechanics can also provide a basis for the selection of teaching content. Teachers can take into account the match between the teaching content and students' physical abilities when choosing online teaching content to ensure that students can complete the tasks required by the course without causing physical burdens [10]. For example, when designing course content related to physical movement, teachers can rationally arrange the lesson time and difficulty of the content according to the physiological state of the students so that the students can maintain a high level of motivation and learning effect during the learning process. Research on biomechanics also provides teachers with a basis for identifying the effects of different teaching environments on students' physical states and cognitive functions and then adjusting teaching methods and strategies to suit students' actual needs [11,12].

In terms of teaching methods, the concept of biomechanics can have a direct impact on how instructors design more interactive teaching methods. In online teaching, teachers should not only focus on the transfer of knowledge but also on how students can use their bodies efficiently during the learning process, especially the movement of the hands and shoulders [13]. By analyzing and optimizing movement patterns, teachers can encourage students to adopt healthier postures and movements, thus enhancing the learning experience and avoiding physical injuries or fatigue caused by improper postures. In addition, teachers can design interactive activities that can mobilize students' physical and cognitive potential with the help of virtual contextual simulations and other methods that incorporate the principles of

biomechanics in order to promote students' more holistic development.

Overall, biomechanics not only provides an important theoretical basis and practical guidance for the field of education but also provides practical solutions for us to solve the problems of students' physical fatigue and cognitive decline in online teaching. With the continuous development of information technology, biomechanics will be more and more widely used in the field of education, and it will become an important part of the innovation and optimization of teaching mode, helping students to complete their learning tasks more efficiently and healthily in the new learning environment.

2. Strategies

The previous study demonstrates that information platforms and network resources are more effective, professional, and interactive than general societal network resources, with the ultimate goal of utilizing these resources to enhance teachers' professional development. The development and improvement of the teacher qualification system, as well as the enhancement of instructors' teaching abilities, are key benefits of these resources [14]. The online resource platform offers a wealth of traditional teaching materials in pedagogy, psychology, and educational technology, as well as resources related to local, domestic, and foreign educational concepts and practices, presented in a diverse and engaging manner. These resources provide comprehensive professional learning materials from various fields and perspectives, broadening teachers' horizons, stimulating reflection, and fostering their creative professionalism [15].

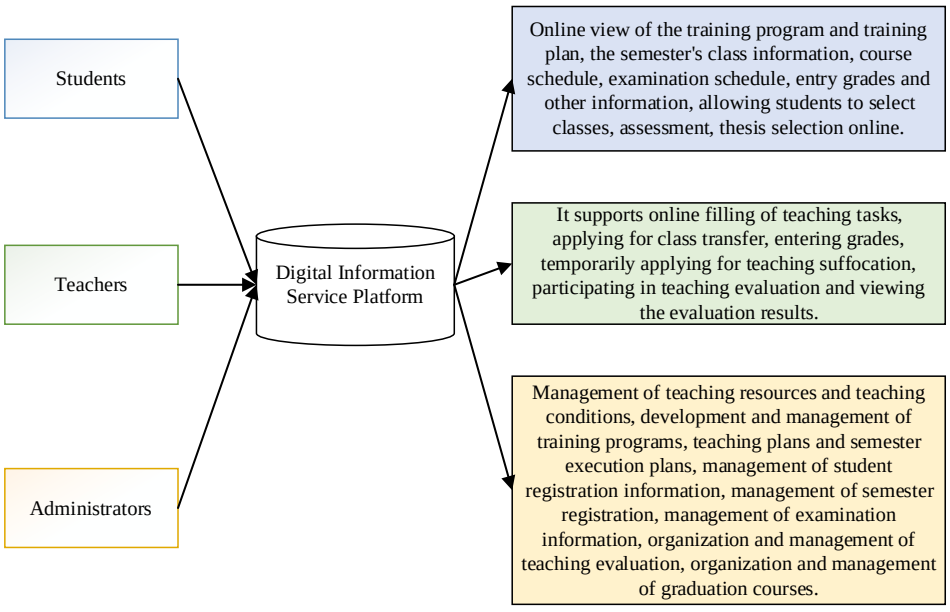

Figure 1. Platform for digital information services: Features & services.

One of the key features of university websites is their interactive nature. Teachers can leverage the network information platform developed by local universities to download a wealth of information and upload their own learning experiences and classroom practice materials for review and learning by other

educators. This allows them to not only identify their own weaknesses and improve by learning from experts and peers but also to turn their learning successes into valuable resources for other teachers. By incorporating feedback from colleagues and professionals, teachers can work on self-improvement and continue to grow. The resource pool of the online information platform at regional colleges and universities can be continuously expanded, introducing new and engaging teaching activities, allowing teachers to gain new knowledge, reflect on their experiences, and experience professional growth. The digital information model is shown in **Figure 1**.

As a result, it is crucial to develop a shared education platform that institutions can use to efficiently train teachers. The division of "learning design" and "practical guidance" in **Figure 2** encourages school-business cooperation and a strong alliance, which enhances the teaching content and quality. This allows students to not only master a sound theoretical foundation but also to be exposed to modern, advanced production technology under the supervision of business personnel. Through the guidance of enterprise staff, it not only enables students to master sound theory but also exposes them to the most cutting-edge production technologies now in use.

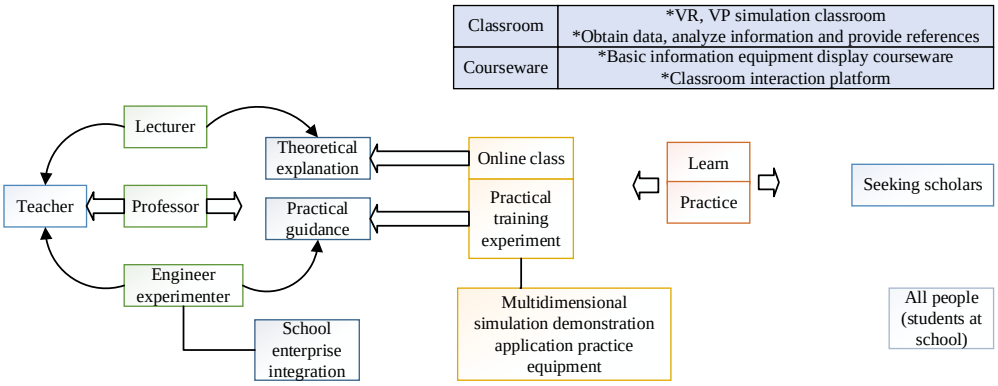

Figure 2. Provincial universities' shared education model.

2.1. Ideas for utilising the data centre to develop an education informatization platform

In this work, the idea of a data middle platform is merged with the practical requirements of lifelong learning under information technology settings. The informationization platform's data center, which is at its core, gathers and stores the fundamental data on students, including learning behavior data, learning statistics, and learning trajectories, as well as teaching resource files and informationization platform logs, as data sources, to create a data lake [16]. OLAP, data mining, and artificial intelligence are used to process and extract the data lake, aggregate the data into themes, and finally encapsulate the data themes to build a data service system, which provides unified standard data support to applications. This system calls the data service interface provided by the data center to obtain the data necessary for operation and feeds the operation results to the underlying system. The entire architecture realizes the goal of getting data from each functional module of the information platform, building data assets, and feeding the application through data collection, aggregation, development, mining, service, and feedback.

OLAP, data mining, and artificial intelligence are utilized to process and extract

data from the data lake, aggregate it into specific themes, and encapsulate the data themes to construct a data service system. This system provides standardized, unified data support for applications. By calling the data service interface from the data center, the system retrieves the necessary data for its operations and feeds the results back to the underlying systems. The entire architecture aims to gather data from each functional module of the information platform, transform it into data assets, and feed it into applications through a process of data collection, aggregation, development, mining, service, and feedback.

For example, in the case of a particular university, the data center collects data from various academic and administrative systems, such as student performance data, course enrollment data, and campus activity data. This data is then processed and categorized using OLAP to identify patterns in student engagement or course performance. The processed data is aggregated into specific themes (e.g., student success, curriculum effectiveness) and fed into an application that generates reports on areas for academic improvement. The results of this analysis, such as recommendations for curriculum adjustments, are then provided back to faculty and administration to guide decision-making.

This example provides a clearer picture of how the data collection, processing, and application work in practice, making the data processing flow more intuitive for readers. Charts or visual aids could further help illustrate this process by showing how data moves from collection to aggregation to final application.

Table 1. Data processing flow in educational information platform.

Step	Action	Example	Outcome
1) Data Collection	Data is gathered from various systems.	Student performance data, course enrollment data, activity logs.	Raw data is compiled from different sources.
2) Data Processing (OLAP)	The data is processed using OLAP tools to identify patterns.	Analyze student grades across courses and determine enrollment trends.	Categorized and structured data ready for analysis.
3) Data Aggregation	Data is aggregated into specific themes or groups.	Group data into themes such as “student success” and “curriculum effectiveness”.	Themed data sets for focused analysis.
4) Data Mining & Analysis	Advanced analytics using data mining and AI.	Apply AI algorithms to predict student dropout rates.	Insights and trends are identified.
5) Data Service & Feedback	The results are fed back into the system via a service interface.	Display reports on at-risk students or recommend curriculum improvements.	Actionable feedback for decision-making.

2.2. Building a framework for education’s digital transformation using a data centre

The construction is a system project that involves data collection, aggregation, and pre-processing to build a data warehouse, deepening the use of the information technology platform big data with data mining, artificial intelligence, and other technologies, providing data support to the platform’s business and management function modules in the form of data service interfaces, and providing the entire information technology process for learners to use the information technology platform. **Figure 3** displays the overall architectural layout.

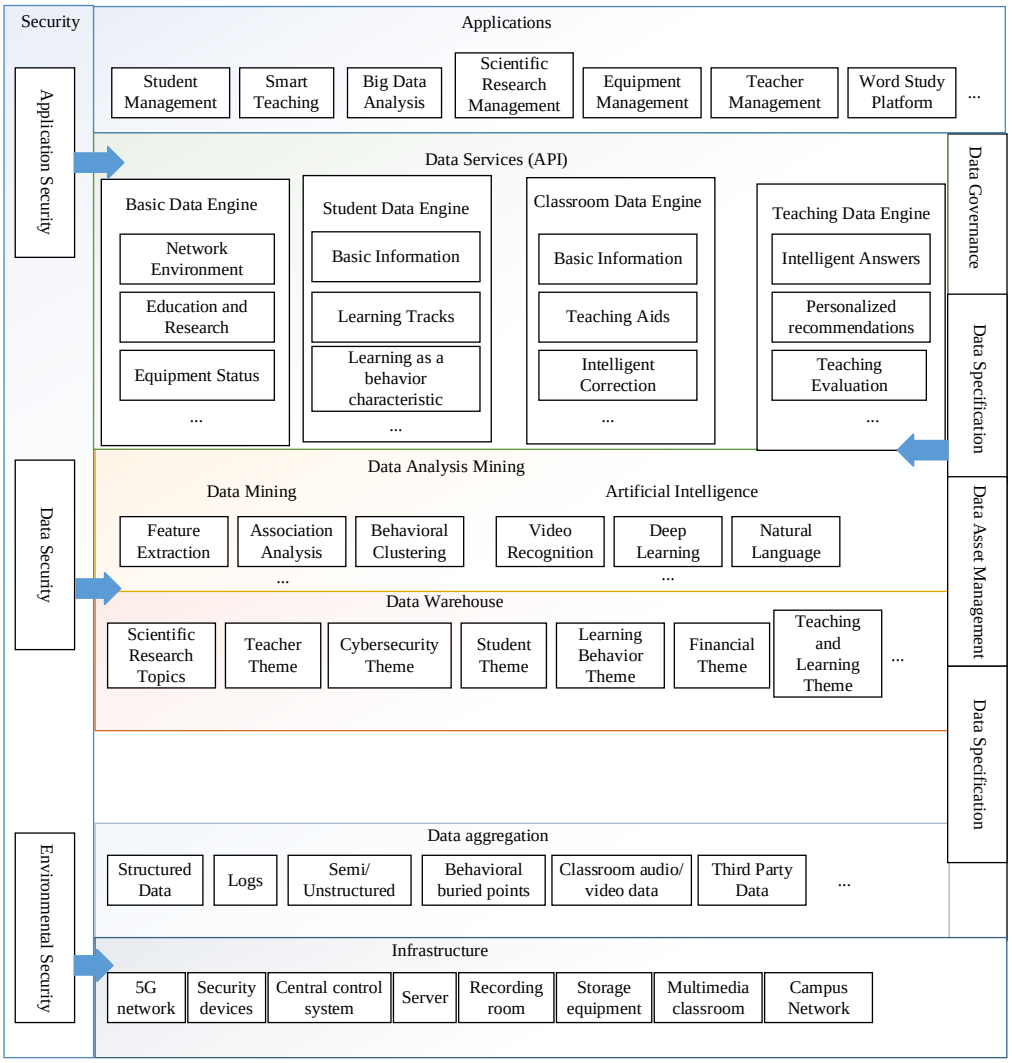

Figure 3. The platform's overall architecture for education information technology.

2.3. Data middle platform

It is a data processing mechanism that creates data assets by processing all types of learning-related data while hiding the underlying data's specifics and offering industry-standard data service interfaces to the outside world. This includes the processes of data collection and aggregation, development, calculation, mining, and encapsulation, among others. Data asset governance and data security management functions are in charge of data collection to the data service interface (API); it creates a fully closed loop [17].

2.3.1. Acquisition and aggregation of data

It assembles various types of structured, semi-structured, and unstructured data from disparate underlying databases and stores them centrally in the data center, creating a data lake and serving as the operational data foundation for the entire data center.

2.3.2. Data development

The data development function establishes the groundwork for additional application-oriented data services by transforming the data lake created by collection and convergence into data assets of the education informatization platform. For

instance, student learning behavior models and student portraits are created for encapsulation and use in the data service system by correlating and analyzing raw data about students' learning behaviors and grades in functional modules like the grade management module and learning behavior log.

3. Biomechanics in education

In modern educational environments, especially in the context of the gradual popularization of online teaching, teachers are not only faced with the problem of optimizing teaching content, objectives, and strategies, but also need to consider the students' physical adaptability and cognitive load in the learning process [18]. Biomechanics, as a discipline that studies the principles of human movement and mechanics, provides new perspectives and solutions for its application in the field of education, especially in the online learning process. This chapter will delve into the application of biomechanics in education, focusing on analyzing its impact on the setting of teaching objectives, the selection of teaching content, and the improvement of teaching methods.

3.1. Impact of biomechanics on teaching and learning objectives

The application of biomechanics plays an important role in educational goal setting. By understanding the physiological and motor responses of students during the learning process, teachers can adjust course objectives to minimize the negative effects of inappropriate body postures or motor loads. Biomechanical principles help to understand the fatigue and muscular discomfort that students may experience during prolonged seated learning, which in turn optimizes instructional goals and avoids over-reliance on students' fine motor control.

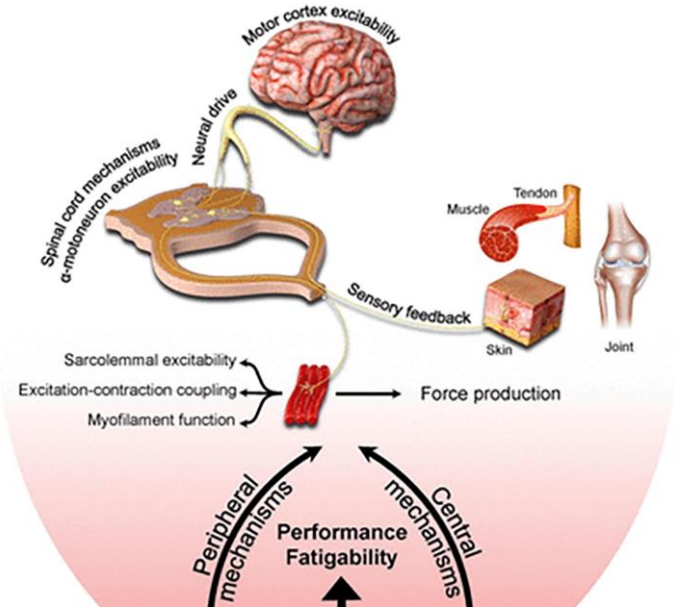

Figure 4. Relationship between muscle fatigue and learning efficiency.

The effect of students' muscle fatigue accumulation on learning efficiency during prolonged learning is demonstrated in **Figure 4**. Teachers can adjust their

teaching strategies in time by observing students' postural changes and fatigue symptoms. For example, if students are found to be in poor sitting postures for a long time, teachers can remind students to rest and stretch to avoid the negative impact of fatigue on learning effectiveness. Teachers can also adjust the difficulty and duration of learning tasks according to students' fatigue.

3.1.1. Formula analysis: muscle fatigue and postural effects

Biomechanical studies have shown that the accumulation of muscle fatigue may lead to a decrease in motor efficiency when students engage in prolonged periods of study, especially when using a mouse and keyboard. We can describe the degree of muscle fatigue in the human body during exercise by using the following formula:

$$F_t = F_0 \cdot \left(1 - \frac{t}{T}\right) \tag{1}$$

where F_t is the muscle strength at the current moment, F_0 is the initial strength of the muscle, t is the time of exercise, and T is the maximum time of muscle endurance. The formula demonstrates that over time, muscle strength decreases as fatigue increases, thus affecting students' learning efficiency and concentration.

3.1.2. Posture and cognitive ability

Research has also shown that prolonged periods of poor posture can lead to distraction of students, which in turn affects learning outcomes. The effect of posture can be characterized by angular changes, and assuming that students maintain a constant posture over long periods of learning, we can use the torque formula from biomechanics:

$$M = F \cdot d \tag{2}$$

where M is the torque, F is the applied force, and d is the force arm length. The presence of torque makes it more difficult for students to maintain their posture, which in turn increases the muscle burden. If teachers can design more ergonomic learning environments and reasonably adjust the postural requirements during learning, they can reduce students' physical burden and improve learning efficiency.

3.2. Biomechanics and the selection of teaching content

Biomechanics not only helps teachers optimize learning postures but also provides a scientific foundation for selecting appropriate teaching content. By understanding the physical needs of students during various learning tasks, biomechanics enables teachers to design lessons that align with students' abilities. This is especially relevant for lessons involving fine motor skills or high-intensity physical activity. For example, research has shown that prolonged periods of poor posture can lead to increased distraction, negatively impacting learning outcomes. A study involving 100 students found that maintaining poor sitting posture for more than 30 min increased the incidence of inattention by 25%. By applying the principles of biomechanics, teachers can design lesson content that better accommodates students' physical capacities, ensuring more effective and engaging learning experiences.

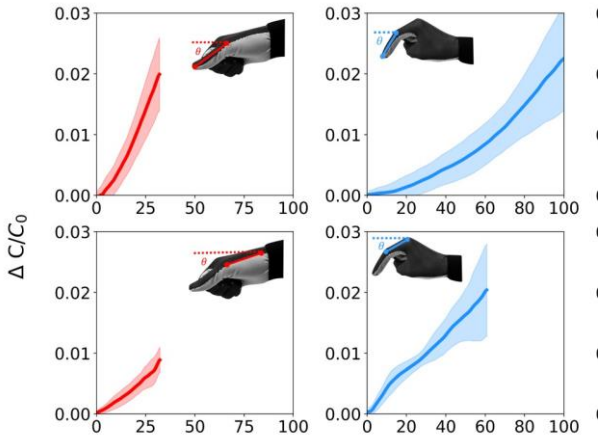

Figure 5. Matching of hand movements to learning tasks.

Changes in hand movements and muscle strength as students perform fine manipulations (e.g., using a mouse or touch screen) are illustrated in **Figure 5**. Teachers can assess for signs of overexertion by observing students' hand movements while performing these tasks. For example, if students experience significant discomfort during manipulation, teachers can adjust the difficulty of the task when appropriate or recommend that students use ergonomically designed devices (e.g., a mouse or keyboard that conforms to the natural curves of the hand), thereby increasing learning efficiency and reducing physical strain.

Analysis of student movement patterns

Biomechanics can guide the selection of course content by analyzing students' movement patterns. For example, when students operate a computer mouse, the coordination of fine hand movements and muscle strength is critical. Teachers can adjust the difficulty of course content by analyzing the mechanics of students' hand movements during the learning process to ensure that students are able to complete tasks without undue fatigue. Below is the equation for the relationship between hand strength and movement:

$$F = \mu \cdot N \tag{3}$$

where F is the applied force, μ is the coefficient of friction, and N is the positive finger pressure. By measuring this mechanical relationship, teachers can assess the suitability of students' hand strength for certain fine manipulations and thus optimize the content.

3.3. Biomechanics guidance on teaching methods

Biomechanics not only provides teachers with the theoretical foundation for optimizing teaching content but also offers valuable guidance for selecting teaching methods. This is especially crucial in online teaching, where teachers need to not only deliver knowledge but also ensure students remain in optimal physical condition. Biomechanics can assist teachers by offering insights into posture, movement, and movement efficiency, helping to reduce unnecessary physical strain during learning. For example, in language learning, biomechanics can guide students to maintain proper posture and movement during pronunciation training, promoting

better articulation and reducing vocal strain. Additionally, in physics experiments, virtual reality (VR) and action simulation technologies, informed by biomechanics, can simulate physical experiments in a safe, controlled virtual environment, helping students better understand concepts like force, motion, and equilibrium. These applications demonstrate how biomechanics can improve both the physical and cognitive aspects of learning, enhancing the effectiveness of teaching methods.

Virtual scenery and motion simulation

The development of modern information technology, particularly virtual reality (VR) and action simulation technologies, enables teachers to create virtual environments that enhance students' understanding of learning content. For instance, in teaching fine motor skills, VR technology can simulate hand movements, allowing teachers to analyze the trajectory and strength of students' movements based on biomechanical models. This helps teachers adjust both teaching content and methods in real time to optimize students' physical learning environments. Additionally, VR and action simulation technologies are also widely applied in physics experiment teaching, where students can virtually perform experiments involving forces and motion, experiencing complex principles in a safe, interactive environment. In language learning, VR technology aids pronunciation training by allowing students to engage in virtual conversations, correcting posture and articulatory movements in real-time, based on biomechanical guidance. These applications of biomechanics in teaching methods contribute to a more engaging, efficient, and scientifically informed learning experience.

Figure 6. Virtual reality (VR) assisted teaching and learning.

As shown in **Figure 6**, in virtual reality (VR)-assisted teaching, teachers can design motion simulation scenarios through biomechanical principles to help students learn more naturally. For example, in the teaching process, teachers can use VR technology to simulate students' movement trajectories and allow students to adjust their movements through real-time feedback, thus reducing unnecessary physical burdens. By using such a tool, teachers can not only enhance students' learning efficiency but also help them practice in a safe and comfortable environment.

3.4. Biomechanics and the physical health of learners

Biomechanics not only helps to improve students' learning efficiency but also prevents health problems caused by long hours of study. Problems such as prolonged sitting, incorrect hand positions, and muscle fatigue often adversely affect students' health. The study of biomechanics can help teachers better understand these issues and help keep students healthy by adapting teaching methods and environmental design.

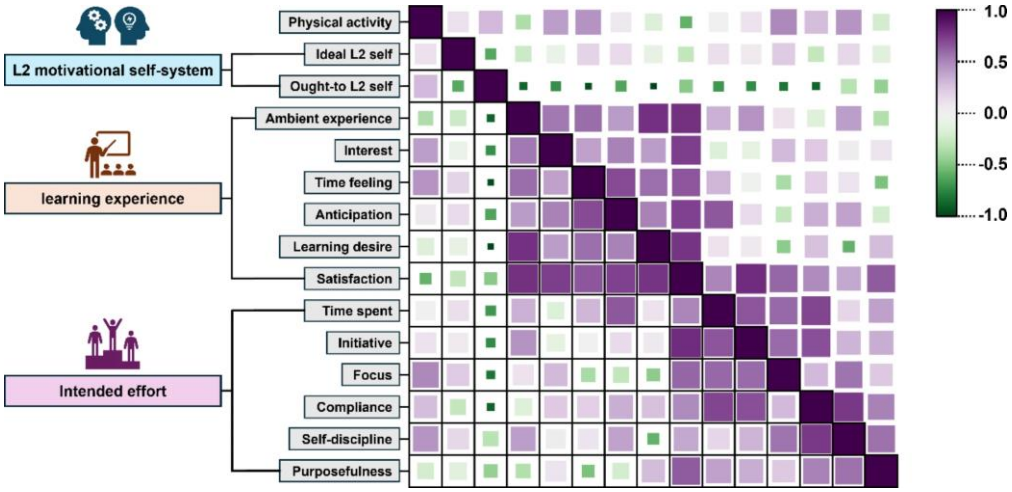

Figure 7. Learning effectiveness.

Figure 7 shows how students' physical health status affects their learning effectiveness. By observing students' physical health status (e.g., fatigue level, correct sitting posture, etc.), teachers can adjust their teaching methods. For example, if students show signs of fatigue or physical discomfort, teachers can adjust the pace of the lesson to avoid students becoming physically unwell as a result of prolonged and intense learning. Through an understanding of biomechanics, teachers are able to create a healthier and more productive learning environment for their students.

Biomechanical studies have found that the physical health of students directly affects their learning efficiency. The relationship between health and learning efficiency in students' learning processes can be described by the following formula:

$$\eta = \frac{C}{1 + \alpha \cdot F} \tag{4}$$

where η is the learning efficiency, C is the cognitive ability of the students, F is the physical fatigue level of the students, and α is a constant that affects the relationship between physical fatigue and learning efficiency. As the degree of physical fatigue increases, the learning efficiency shows a decreasing trend. Therefore, the study of biomechanics not only helps to improve students' learning efficiency but also helps students to improve their learning outcomes by reducing physical fatigue.

3.5. Enhance the process for establishing teacher morality for exceptional educators

The method for nurturing teacher moral excellence in areas should be improved, and teachers should integrate moral education objectives into all parts of everyday

school instruction and teaching.

First, the curriculum's emphasis on moral development. In order to develop exceptional teachers, teachers must firmly apply the teacher moral education curriculum, make it more effective, and incorporate the teacher moral component of other courses. accentuate the importance of classroom instruction as the primary vehicle for the development of people. The function of curriculum cultivation is strengthened, future teachers of excellence in public affairs participate more, and they are encouraged to take on social responsibility as part of the curriculum teacher moral cultivation process.

Education in cultural morality is the second. Teachers who flourish in their home country are both culture receivers and transmitters. To be able to educate people with culture and nurture them with literature, teachers must help students deepen their cultural immersion, enhance their cultural connotations, and encourage them to study more about culture. The ability to actively adopt the cultural role that intellectuals should play, perform the role of passing on traditional and local culture, and make their fair contribution to the development of society should be a requirement for future instructors of excellence.

Third, engage in moral instruction. Virtue development takes time and effort. The only way a teacher may develop good qualities appropriate for education is through constant transformation, improvement, and optimization in practice. By engaging in various types of topic practices, labor practices, study tours, and volunteer services, teachers should build their practical cognition of moral virtue and improve their sense of social responsibility, innovation, and practical ability. To ensure that every student has the opportunity to visit areas, comprehend education, and become accustomed to the environment, teachers should organize students to participate in internship or teaching activities in schools.

The management of moral education is the fourth. Colleges and universities should support the development of a teacher excellence cultivation system that includes all aspects of teacher excellence and teacher ethics cultivation work, from enhancing the management system to defining job responsibilities, strengthening the construction of teacher ethics, fine-tuning the code of conduct, and other aspects of the countryside teacher excellence and teacher ethics cultivation work. It goes without saying that improving teachers' self-management awareness and skills is also vital if we're going to succeed in nurturing moral excellence in instructors in areas.

Fifth, group moral instruction. Colleges and universities do not develop exceptional instructors on their own; rather, this is the result of the cooperation of numerous parties. Universities frequently need to collaborate with relevant government agencies, grassroots self-government groups, and primary and secondary schools in order to develop the moral character of excellent teachers. At the same time, various university departments must work towards the same goals. To facilitate the quick improvement of teachers' moral character, professional competence, and job adaptability, teachers should pay particular attention to the integration of business and education and offer professional pre-service training for future outstanding teachers in accordance with the various needs of schools.

4. Case study

After creating the necessary platform for sharing educational information, we used questionnaire research to further investigate the impact and effect of the platform on educating teachers in colleges and universities. The instructors' questionnaire has 34 questions in all, and **Table 2** provides the specific index framework.

Table 2. Framework of indicators for the survey on the use of contemporary technologies in education by teachers.

Primary indicators	Secondary indicators	Title
Teaching about perception and setting objectives	Understanding of the course objectives	1, 2
	Objectives for teaching Setting	3, 4, 5, 6
Content of the subject matter and comprehension	Content selection for the teaching materials	7, 8
	Content comprehension	9, 10
Processing and processing of knowledge	Teaching techniques and strategies	11, 12, 13, 14, 15, 16, 17, 18
	Critical comprehension	19, 20, 21
	Integration and transformation of knowledge	22, 23, 24
Cooperation and interpersonal communication	Communication and collaboration amongst students	25, 26, 27, 28
	Teacher-student communication and collaboration	29, 30
Evaluation and reflection on teaching	Evaluation and reflection of the students	31, 32
	Reflection and evaluation of teachers	33, 34
Handling and processing of knowledge	Learning strategies	15, 16, 17, 18, 19, 20
	Critical understanding	21, 22, 23
	Integration and transformation of knowledge	24, 25, 26
Cooperation and interpersonal communication	Communication and collaboration amongst students	27, 28, 29, 30, 31
	Student-teacher collaboration and communication	32, 33
Evaluation and Reflection	Self-assessment and reflection	34, 35, 36, 37, 38
	Evaluation by others	39, 40

4.1. Biomechanics and the physical health of learners

Prolonged poor sitting posture can lead to increased pressure on students' spines, which can lead to muscle fatigue, joint pain, and other problems, and even affect students' concentration. Through the perspective of biomechanics, teachers can design reasonable learning environments to ensure that students are able to maintain correct sitting postures. The data in **Table 3** show that the sitting angle is inversely proportional to the spinal pressure, and maintaining an appropriate sitting angle can significantly reduce students' physical burden and improve their learning efficiency. Therefore, teachers should regularly remind students to adjust their sitting postures and encourage them to perform appropriate activities and stretches to reduce their physical burden during the learning process.

Table 3. Relationship between sitting posture and physical health.

Sitting angle (°)	Spinal pressure (N)	Student health rating (0–10)
90°	150	8
100°	130	9
110°	120	9.5
120°	110	10

Table 4. Relationship between fatigue level and learning efficiency.

Fatigue level (%)	Learning efficiency score (0–10)
0	9.5
20	8.8
40	7.5
60	6
80	4.2

Table 4 shows the relationship between students' physical fatigue and learning efficiency. As students' physical fatigue increases, learning efficiency decreases significantly. Research on biomechanics shows that students' physical health is closely related to their cognitive ability and learning efficiency. Teachers should pay attention to students' physical fatigue and take appropriate measures in teaching, such as regular breaks and stretching activities, to help students alleviate their fatigue and maintain high learning efficiency. In online teaching, teachers can ensure that students can learn in a healthy state of health by reminding them to take breaks at regular intervals or observing their physical responses through interactive feedback.

4.2. Dscriptive analysis of the teaching questionnaire for instructors

(1) The perceptions of curriculum goals by teachers

According to **Table 5**, the mean score for having knowledge of the curriculum standards' teaching objectives prior to lesson preparation was 4.41, which was significantly higher than the average. This indicates that teachers had some prior knowledge of the course and the curriculum standards to be met in this lesson prior to lesson preparation. **Figure 8** demonstrates that 44.4% of teachers decided to agree and 49.7% chose to strongly agree.

Table 5. A survey of teachers' opinions regarding the goals of teaching.

Item	Frequency	Mean value	Standard deviation
Study the standards	799	4.41	0.74
Online classes	799	3.26	1.074

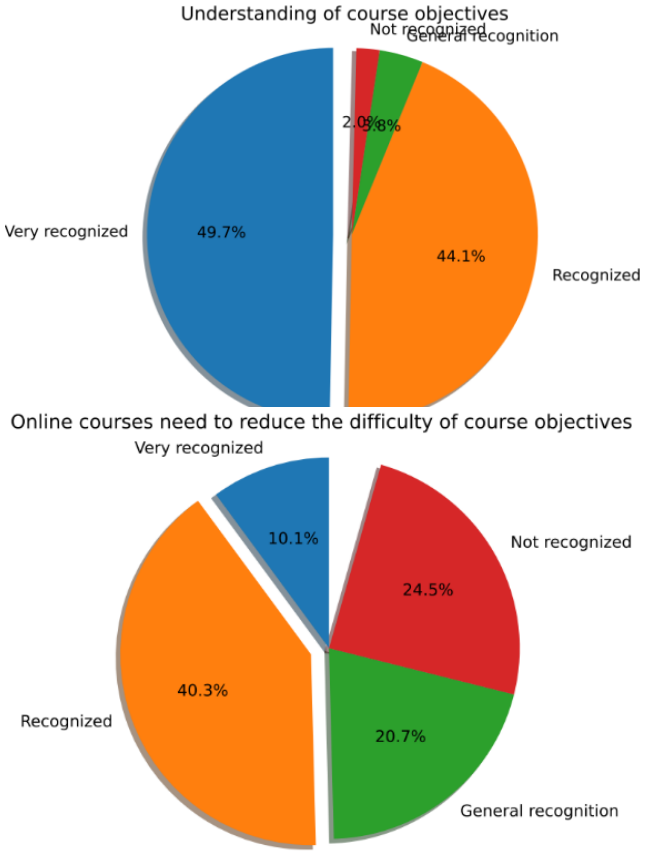

Figure 8. Ratio of sampling used to determine how instructors felt about the goals of the curriculum.

Table 6. Studying how teachers set their teaching goals.

Item	Frequency	Mean value	Standard deviation
Organizing educational activities in a sequence of aims.	799	7.19	0.757
Set learning goals that are relevant to your life.	799	4.15	0.746
Different settings influence different cognitive levels.	799	4.16	0.702
Achievable objective levels for students are more clearly delineated.	799	3.85	0.835

The purpose of Question 2 is to assess teachers' views on employing contemporary information technology for instruction as opposed to establishing course objectives in the conventional classroom. It is a reverse set question. According to **Table 6**, the majority of teachers think that the course objectives should be made less challenging during online instruction because the mean value of 3.27 is greater than the mean value. **Figure 4** shows the same thing, with 10.1% of instructors choosing to strongly agree and 40.3% choosing to agree that the difficulty should be reduced. 20.7% of the total respondents to the study selected the average response for instructors, while 24.5% and 4.4% selected disagree and strongly disagree, respectively.

(2) Teaching goal setting

As seen in **Table 6**, while developing teaching objectives, teachers take into account organizing activities in terms of complexity to ensure that students'

knowledge acceptance rate. Teachers must take environmental considerations into account when designing learning objectives since the network platform of contemporary information technology offers a learning environment that is very different from the traditional classroom. In addition to further differentiating pupils based on the number of objectives they can accomplish, diverse teaching environments will allow students to reach a different cognitive level than that of the typical classroom. Over 90% of instructors agree with the mean value of teachers who think that the learning environment has an impact on students' cognitive levels, which is 4.16. 70% of teachers who believed that students' target levels are more differentiated had a mean score that was still higher than average, at 3.85.

4.3. Content and knowledge of the relevant materials

(1) Selection of teaching materials

Table 7 displays the results of the study on the teaching materials chosen by village instructors.

Table 7. A study of the subjects that village teachers choose to teach.

Item	Frequency	Mean value	Standard deviation
Selection of teaching contents	799	2.92	1.142
Teaching of basic knowledge	799	2.74	1.308

While curriculum and materials address the issue of what teachers teach and what students learn, the purpose of teaching focuses on why teachers teach and students learn. Teachers in remote areas struggle to choose and comprehend lesson plans in the new learning environment. Teachers willingly choose the material that is in the textbook and what is on the test, as evidenced by the mean value of 2.92, which is below average 3. This shows that teachers are open to incorporating new information into their lessons and are not solely focused on the test syllabus. In the overall survey, 6.6% of teachers decided to strongly disagree with teaching what is available, 39.9% of teachers disagreed, and just 10.5% of teachers chose to agree with teaching what is available (see **Figure 9**).

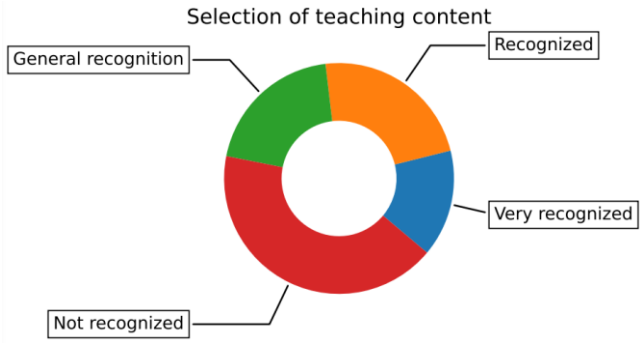

Figure 9. Ratio of teachers in areas choosing their subject matter.

According to **Table 8**, which shows teachers' attitudes towards basic knowledge instruction in online teaching, it can be seen that the mean selection value is 2.75, which is lower than the constant mode 3, showing that teachers do not believe basic

knowledge instruction in online instruction to be particularly challenging. **Figure 5** shows that 6.6% of teachers thought it was very difficult to teach fundamental concepts in online courses, while 19.8% of teachers chose to agree. However, teachers who thought there was little difficulty made up 47.6% of the total, which was much higher than teachers who thought it was difficult.

Table 8. Surveying instructors' knowledge of the subject matter of their lesson plans.

Item	Frequency	Mean value	Standard deviation
Integrates different materials	799	3.91	0.785
Put a focus on fundamental ideas and ideals	799	2.77	1.101

(2) Understanding the substance of the teaching materials

Table 8 displays the results of the survey on teachers' knowledge of the subject matter of instructional materials.

Table 8 presents the results of a survey examining teachers' knowledge of the subject matter of their lesson plans. The table provides two items along with their corresponding frequencies, mean values, and standard deviations.

1) Integrates different materials:
   - Frequency: 799 responses
   - Mean value: 3.91
   - Standard deviation: 0.785
   - Interpretation: The mean score of 3.91 indicates that, on average, teachers often integrate different materials into their lesson plans. This suggests that teachers are generally comfortable with combining various types of instructional resources (such as textbooks, online materials, videos, etc.) to enhance learning. The standard deviation of 0.785 indicates a moderate level of variability in responses, meaning that while many teachers integrate materials frequently, there are some differences in how often this integration occurs across the group.
2) Put a focus on fundamental ideas and ideals:
   - Frequency: 799 responses
   - Mean value: 2.77
   - Standard deviation: 1.101
   - Interpretation: The mean score of 2.77 suggests that teachers focus somewhat less frequently on fundamental ideas and ideals in their lesson plans compared to integrating different materials. This score indicates that while some teachers may place significant emphasis on core concepts, others may not prioritize this as highly. The standard deviation of 1.101 indicates a higher level of variability in the responses, showing a broader range of practices among teachers, with some focusing heavily on fundamentals and others focusing less on them.

Overall summary: The survey results indicate that teachers are more likely to integrate a variety of materials into their lesson plans, with a moderate degree of variability in how often this occurs. However, when it comes to focusing on fundamental ideas and ideals, the frequency is lower, and there is more variation in

how much attention teachers give to core concepts. This suggests that while materials integration is a common strategy, prioritizing fundamental concepts may not be as consistent across all teachers.

When it comes to the convenience that modern information technology can bring to the teaching material, teachers first think about how the Internet offers a wealth of resources that they can choose from and incorporate into fresh teaching materials that can be instantly updated to ensure timeliness. It is clear from Table 8 that teachers in areas tend to use web-based resources; the mean value of teachers choosing to use integrated materials is 3.91. **Figure 10** shows that of the teachers who selected their response, 54.1% decided to agree, and 20.8% selected highly agree. Only 4.6% of respondents selected the strongly disagree option. Additionally, this question is a reverse-setting question for the survey on how teachers teach fundamental concepts. The mean value of teachers who choose to emphasize only fundamental ideas and principles in their lessons but not those from the discipline is 2.78, demonstrating that teachers continue to extend the learning content with disciplinary logic in their lessons.

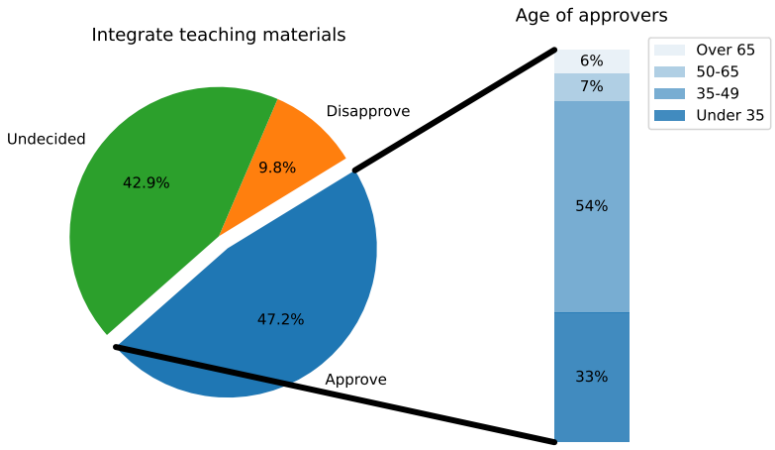

Figure 10. Ratio of teachers' grasp of the content of the educational materials they choose cognitively.

4.4. Hndling and processing of knowledge

(1) Teaching strategies and methods

Table 9 displays the results of the survey of teachers' instructional methods.

Table 9. Study of the instructional techniques used by teachers.

Item	Frequency	Mean value	Standard deviation
Memorizing knowledge	799	3.66	0.912
Take notes	799	3.67	0.890
Memory aid software	799	3.52	0.941
Build virtual scenarios	799	3.87	0.766
Only include the most important information	799	2.951	1.0537
Use a whiteboard	799	3.96	0.787
Combine materials	799	4.22	0.665
Combining multiple tools to build a body of knowledge	799	3.98	0.756

(2) Critical understanding

Table 10 displays the results of the survey on teachers' critical perceptions of instruction.

Table 10. Survey of teachers' critical understanding of teaching.

Item	Frequency	Mean value	Standard deviation
Explains knowledge in an internal logical sequence	799	4.08	0.671
Allows for questioning	799	3.97	0.709
Open-ended test questions are troublesome	799	2.68	1.021

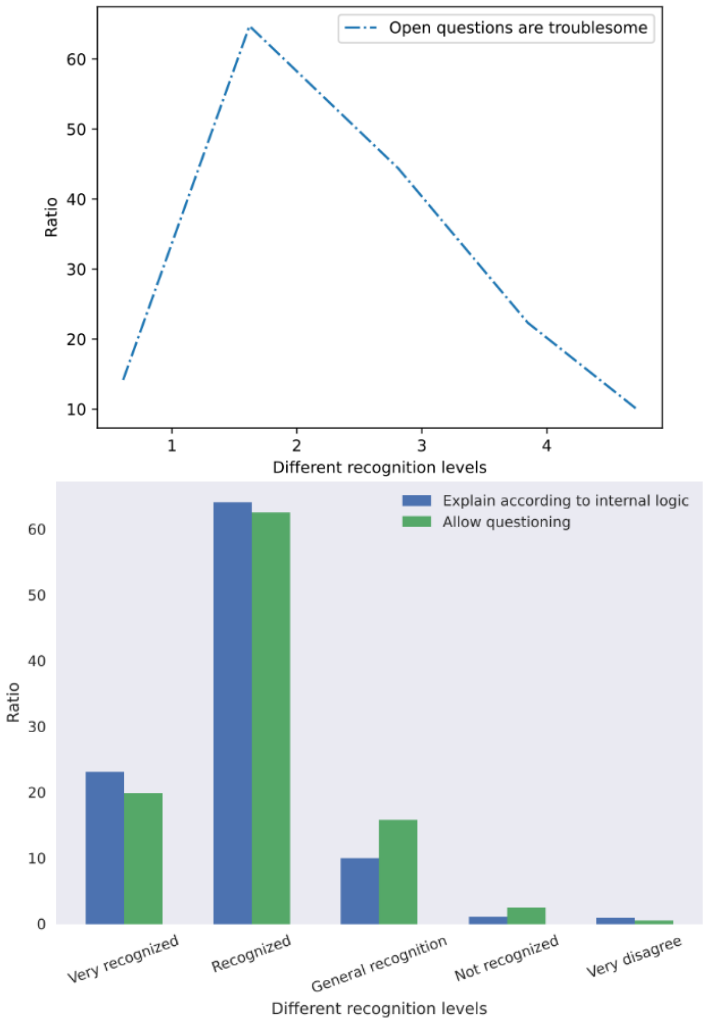

Figure 11. Critical thinking choices made by instructors in their instruction.

According to the taxonomy of competencies, critical knowledge is mostly displayed in the use of a variety of higher-order thinking skills, such as assessment, analysis, and creativity. The design of the questions in this section is based on two premises: first, that knowledge has internal logic, and that education that respects internal logic is necessary to help students memorize, comprehend, and apply knowledge as the foundation for thinking skills. More than 88% of educators concurred with this statement. Teachers must allow students to question the material they are given in order to help them develop higher-order thinking skills, but they

must also explain why they are doing so. Students build their assessment and analysis abilities through questioning since they have to assess the information's reliability, source, and completeness as well as their understanding of it. Similar to this, in open-ended questions, students can mix information from several fields to enhance their creative talents and express their viewpoints in a logical and organized manner based on ideas. Instructors are more likely to give students the opportunity to practice higher-order thinking because their willingness to do so is higher than the national average, as indicated by the mean value of 3.98 for whether teachers give students opportunities to challenge knowledge. Teachers chose the mean value of 2.68 out of 21 questions that were put in the opposite way, indicating that they do not mind the problem that open-ended questions generate but are glad to see students' brilliant thinking. However, 15.5% and 5.3% of teachers chose the agree to strongly agree option, while 28.7% still selected the general response. This suggests that over half (49.5%) of instructors continue to oppose open-ended questions (see **Figure 11**).

(3) Integration and transformation of knowledge

Table 11 displays the results of the survey on the knowledge integration and transformation strategies used by teachers.

Table 11. Teaching knowledge integration and transformation techniques among teachers: A survey.

Item	Frequency	Mean value	Standard deviation
Knowledge integration across disciplines	799	4.01	0.702
Various methods for resolving issues in the real world	799	4.15	0.66
Introduce the concept of knowledge conflict in the classroom	799	4.04	0.682

Table 11 presents the results of a survey examining the techniques used by teachers to integrate and transform knowledge across disciplines. The table provides three items, each of which evaluates a specific aspect of knowledge integration and transformation, along with their corresponding frequencies, mean values, and standard deviations.

1) Knowledge integration across disciplines:
   - Frequency: 799 responses
   - Mean value: 4.01
   - Standard deviation: 0.702
   - Interpretation: The mean score of 4.01 suggests that, on average, teachers have a relatively high frequency of integrating knowledge across different disciplines in their teaching practices. The standard deviation of 0.702 indicates a moderate level of variation in teachers' responses, suggesting some diversity in how frequently interdisciplinary knowledge integration is applied.
2) Various methods for resolving issues in the real world:
   - Frequency: 799 responses
   - Mean value: 4.15
   - Standard deviation: 0.66
   - Interpretation: The mean score of 4.15 indicates that teachers frequently employ various methods for solving real-world problems in their teaching,

and the slightly lower standard deviation of 0.66 implies that the responses were more consistent compared to the previous item. Teachers seem to agree on the importance of applying diverse problem-solving techniques in practical situations.

3) Introduce the concept of knowledge conflict in the classroom:
   - Frequency: 799 responses
   - Mean value: 4.04
   - Standard deviation: 0.682
   - Interpretation: The mean score of 4.04 suggests that teachers moderately often introduce the concept of knowledge conflict in the classroom, which can be an important pedagogical tool for stimulating critical thinking and deepening understanding. The standard deviation of 0.682 indicates that, while there is general agreement among teachers, there is still some variation in how often they incorporate this concept into their teaching practices.

Overall summary: The survey results indicate that teachers are generally employing various effective strategies for integrating and transforming knowledge. There is a strong tendency for teachers to use real-world problem-solving methods and interdisciplinary knowledge integration, with slightly less emphasis on introducing knowledge conflict into the classroom. However, there is moderate variability in the frequency of these practices, which may reflect differences in teaching contexts, disciplines, or individual teaching philosophies.

5. Conclusion

The application of biomechanics in education offers teachers valuable insights and practical guidance, particularly in online teaching and long-term learning contexts. By examining physiological factors such as students' physical responses, movement patterns, and muscle fatigue, biomechanics helps teachers optimize instructional design to boost both learning efficiency and physical health. It not only enhances learning posture and reduces physical strain but also aids in adjusting the content and difficulty of the curriculum by considering students' physiological capabilities, ensuring teaching objectives do not overly rely on fine motor control.

In practice, biomechanical principles provide specific guidance for teachers to enhance learning activities by rationally designing learning environments and adjusting students' postures. For example, well-planned seating arrangements, appropriate rest periods, and suggestions for restorative movements can effectively reduce muscle fatigue, improve concentration, and increase learning efficiency. Additionally, the integration of biomechanics with modern technologies, especially virtual reality (VR) and motion simulation, enhances the interactivity and physiological adaptability of teaching and learning activities, enabling students to engage in learning while maintaining a healthy physical state.

However, challenges remain in fully integrating biomechanics into education. The high costs associated with technology implementation, such as VR and motion simulation, and the limited familiarity of teachers with biomechanics principles hinder widespread adoption. Looking ahead, as technology becomes more affordable

and accessible, biomechanics is expected to play an increasingly significant role in diverse educational scenarios. With continued research and development, future educational environments may see a greater integration of biomechanics, improving learning outcomes and student well-being across various disciplines.

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