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Review of Evidence-based Education in China

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Abstract. The present invention discloses a cathode frame of an electrostatic precipitator, comprising a rectangular frame composed of four horizontal bars and five vertical bars; The horizontal and vertical bars are perpendicular to each other and located in the same plane, and four horizontal bars are arranged parallel to each other, while five vertical bars are arranged parallel to each other; Four horizontal bars divide the longitudinal length of the rectangular box into three equal parts, five vertical bars divide the transverse length of the rectangular box into 2:1:1:2, and one of the vertical bars is located on the vertical centerline of the rectangular box; The upper section of the two outermost vertical rods on the rectangular frame is a reinforced vertical rod, and there are two horizontal through-holes on the reinforced vertical rod for installing the cathode frame support. The cathode frame of the electrostatic precipitator has a simple structure and convenient assembly, which can effectively prevent the cathode frame of the electrostatic precipitator from bending, deformation, or even sliding and collapsing from the overall cathode support, greatly improving the safety and stability of the operation of the electrostatic precipitator.

Keywords: Electrostatic precipitator; Cathode frame; Anti bending deformation; Anti slip collapse; high safety and stability.

1. Introduction

In the development of education and teaching research, teaching empiricism, authoritarianism, and subjective teaching have led to educational practice lagging behind academic research, and the application of educational research results has not been paid enough attention. In view of this situation, the concept of evidence-based education with evidence-based teaching and research as its main forms began to appear.

2. The Concept and Subject of Evidence-based Teaching

2.1 The concept of evidence-based teaching

In the research, evidence-based teaching can be considered as an evidence-based teaching method [1][2], a teaching form [3], or a mode of teaching practice[4], which integrates [3] teachers' personal professional wisdom based on external research [4], and reliable and rigorous teach evidence [1][2]. Under the support of the teaching situation [5], the teaching decision is finally made. Although scholars have subtle differences in the specific definition of evidence-based teaching, they generally agree that evidence-based teaching is a teaching method based on evidence [6]. It is important to use the highest level, reliable, rigorous highly relevant, sufficient, authentic, and scientific "best evidence" for teaching [5][7]. It can be seen that the development of evidence-based teaching cannot be separated from the effective integration of teaching subjects, teachers' personal professional experience and evidence, and the support of teaching situations.

2.2 Evidence-based teaching subject

In the past, teaching was usually regarded as a process that only included teachers and students, but some scholars thought that educational researchers and administrators should also be included.

First, educators (teachers). It implements teaching according to the best teaching evidence and follows the evidence-based practice framework to ensure the effectiveness of teaching intervention.

Second, the educated start learning based on learning evidence, that is, students. In evidence-based teaching, the educated are no longer passive objects, and they have the right to make practical

decisions with teachers based on their own heterogeneity [6]. In order to maximize their own interests and truly teach students in accordance with their aptitude and individualized learning from their own interests [8].

The third is educating researchers. With their profound academic background, innovative ability, and professional skills, they provide high-quality teaching evidence through scientific research and help to achieve the best teaching practice [8][9].

Fourthly, it is education managers (including policymakers and administrators). They are responsible for coordinating resources from all sides, formulating educational guidelines and standards, and establishing and maintaining evidence databases to ensure the smooth progress of evidence-based teaching practice. In addition, they also need to supervise and evaluate the teaching practice and find and correct the behavior that deviates from the principle of evidence-based teaching in time [8].

To sum up, evidence-based teaching is not limited to the interaction between educators and learners but involves all relevant subjects of educational practice. In addition to educating researchers managers, parents, and society [3]. All of them should participate in and fully interact with each other, perform their duties, and work together to reshape the new pattern of teaching practice [8][11].

3. Teachers' Personal Professional Experience and Evidence-based Evidence

3.1 Teachers' personal professional experience

In the traditional teaching mode, teaching mainly depends on teachers' personal experience, which is often influenced by teachers' existing concepts, presuppositions, and existing knowledge. This may lead to over-emphasis on teachers' leading role, neglect of students' actual needs, and over-reliance on experience rather than scientific evidence in teaching decision-making [5].

For evidence-based teaching, teachers' personal professional experience not only refers to teachers' professional quality and practical experience gained in front-line classroom teaching [3][6] but also lies in teachers' scientific research ability and practical knowledge gained by a two-way interaction between scientific research results and teaching practice [12]. In particular, teachers' experience is also manifested in teaching tact, that is, experienced teachers can dig deep into the educational value of knowledge and its teaching evidence with keen observation and reflective consciousness, and combine these values with personal feelings and understanding to skillfully integrate them into educational behavior, thus improving teaching effect [13].

3.2 "Evidence-based" evidence

3.2.1 Follow

"Follow(循)" can mean the verb "follow" and the noun "cycle". When it is used as a verb, it takes evidence as the basis, consciously uses evidence as an auxiliary tool, and pays attention to the extreme "evidence-only theory" quagmire. When it is used as a noun, it is important to realize the two-way circulation of evidence and teaching. Evidence-based teaching is not a one-way linear development model, but a two-way circular interactive system linking specific educational phenomena with students' development. The more basic explanation is the meaning of "seeking evidence" [4].

3.2.2 Evidence

Evidence is the core and the biggest feature of evidence-based teaching practice. However, not all evidence can be used as evidence for evidence-based teaching.

Whitehurst of the U.S. Department of Education once divided the research evidence into six grades from high to low. The more scientific and authentic the evidence, the higher the level of evidence that can effectively solve practical problems. In the field of domestic education, some scholars emphasize that evidence should have two attributes: internal authenticity and external validity. Internal authenticity means that research evidence needs to be accurately captured and specific problems in practice need to be solved. External validity focuses on the applicability and transferability of this

evidence when they are extended from an experimental environment to a daily teaching situation. In the end, evidence-based teaching pursues the highest-level research evidence that is highly matched with the problems to be solved, that is, "the best evidence" [3].

In practice, the best evidence depends on the joint efforts of all teaching subjects. It is generally believed that it can be divided into two categories: the first is the existing evidence, that is, the existing research results and documents that can provide the scientific basis for teachers' educational and teaching decisions and have been verified by scientific research. Second, the evidence that needs to be re-established, that is, the existing evidence is insufficient, doubtful, or uncertain, or the new situation discovered through practice cannot be solved by the existing evidence, which needs to be re-experimented, studied, and explored [6]. More detailed evidence classification is even more controversial, such as documentary evidence and pre-test evidence [13]; policy, classroom, teaching process (result, process, ethics), classroom culture, subject, culture, time sequence, situation [9], and so on.

4. Teaching Situation

Because evidence-based teaching needs a corresponding cultural booster to break the long-standing empirical atmosphere and promote the substantive development of educational practice [10]. Therefore, in addition to the teaching subject, teachers' personal professional experience, and "evidence-based" evidence as the core elements, there is also a teaching background that cannot be ignored, that is, the support system of the cultural field. This system mainly involves the time and space conditions on which teaching activities depend, the overall atmosphere in the field, and the diverse cultures and complex relationship networks integrated into it [3][9].

Based on the above analysis, evidence-based teaching mainly lies in the positive improvement of evidence for teaching and abandons the subjective teaching paradigm that relies solely on teachers' personal experience. For teachers, this mechanism is helpful in enhancing the accuracy and practical effect of teaching and overcoming the limitations brought by the traditional teaching mode, which relies on experience and subjective judgment. As far as the growth and development of students are concerned, it also has a positive role in promoting [5]. For the development and growth of students, teaching can be combined with students' unique personalities and actual situations [6], and it is helpful to cultivate students' consciousness and ability to seek truth [2].

5. The Practical Path of Evidence-based Teaching

The research shows that a practical strategy is developed around the classroom, covering "before, during and after class" [14][15], which provides a practical way for evidence-based teaching.

5.1 Before class: Focusing on raising questions, obtaining and screening evidence

5.1.1 Raising questions

The first is to find the problems that need to be solved [16]; the second is to clarify the goal. Before the start of teaching practice, the school should set up an evidence-based teaching team, work together to establish teaching objectives, arrange relevant training, ensure the implementation of the teaching plan, and comprehensively evaluate the overall teaching plan [17]. Teachers should be based on the curriculum standards, teaching materials, and learning situation [18] and analyze the teaching content and structure in the educational situation, so as to establish and plan the expected teaching objectives. On this basis, teachers should design pre-class teaching strategies, mainly based on scientific evidence, supplemented by quasi-scientific evidence and practical experience [19].

5.1.2 Obtaining evidence

The first is to obtain first-hand teaching materials close to the actual learning situation [20]. Based on the goal of the problem to be solved put forward in the previous link, collect the evidence of pre-test teaching with targeted and effective methods, such as questionnaire survey and student

interview [13]. The second is to analyze the academic situation and find the common difficulties and solutions of students [13]. The third is to refer to the literature evidence to see if there is a guide to solve this problem [1] to achieve the initial and effective integration of the best research evidence, professional knowledge, and student characteristics [19].

5.1.3 Screening evidence

Mainly to integrate and analyze the evidence. The first is to start with the source, and scope[11], and test evidence from different angles, such as process and result [13]. Based on the evidence level, teaching wisdom, educational problems, and training objectives [20], the next is to evaluate the scientificity and validity of the evidence[13], correctness and usefulness [16], carefully screen out the best evidence that matches the different academic situation and teaching situation, form diversified "optimal teaching strategies", and provide verified, rich and efficient evidence materials for the next round of evidence-based teaching [13] to promote the accumulation of teaching cases or practical experience of specific teaching content.

5.2 During class: Focusing on the application of evidence

The first is the teaching plan. It is important to implement intervention teaching [16] to form the best evidence [13] in the teaching process design or activity plan design. Second, in the process of teaching implementation, teachers should actively adapt to students' learning needs, flexibly adjust teaching plans, and even observe the actual situation in the classroom [21], collecting and organizing students' learning data. The third is immediate analysis and evaluation. Relevant research evidence and real-time evidence that is difficult to evaluate in a single class can seek the help of the lesson preparation team [22] so as to dynamically adjust the curriculum plan in time, teaching design, and teaching activities in time [17] and continuously promote students' learning and the generation of evidence-based teaching decisions [19].

5.3 After class: Reflecting on the evidence

Teachers need to synthesize all kinds of evidence before, during, and after class, such as students' homework completion, creative works, learning experience, and exchange interview records, as an important basis for after-class reflection [21]. At the same time, teachers should discuss, analyze, reflect, and summarize the selection and application of teaching strategies in combination with curriculum standards, research results, and immediate classroom feedback [19]. In addition, based on scientific guidance and evidence of students' learning effectiveness, teachers will make new teaching decisions [23]. As the core participants of evidence-based teaching, students should actively participate in the design, implementation, and feedback of evaluation activities, find their own advantages and shortcomings through self-evaluation and mutual evaluation, and put forward constructive suggestions to promote mutual learning [24].

6. The Achievements and Problems of Evidence-based Education Research in China

6.1 The achieved results

6.1.1 Diverse research perspective

The research perspectives of evidence-based teaching are diverse, and gradually expand from medicine to pedagogy, psychology, sociology, and other disciplines, providing rich support for the theoretical development and practical promotion of evidence-based teaching. For example, Wu Mengyu, Wu Meiyun, and Li Xiaoyan studied the influence of evidence-based teaching on value identity from a psychological perspective [25]. Dou Ying discussed the influence of evidence-based teaching on social work [26].

6.1.2 Various research methods

Evidence-based teaching generally uses research methods such as comparison, questionnaire, case study, observation, and literature research. With the development of modern information technology and the construction of the platform, emerging technology-driven methods are available, such as learning analysis or artificial intelligence-assisted research. According to the research problems and actual conditions, researchers choose appropriate methods to guide and promote evidence-based teaching research.

6.2 Existing problems

6.2.1 The imbalance of study structure

By reading and studying the literature, it can be found that the proportion of subject education and teaching research in the literature on evidence-based education in China is much higher than that of applied research, among which medical research, educational theory, and management are the main research objects, while specific subject research is relatively neglected.

6.2.2 The uneven coverage of study sections

At present, the research on higher education is concentrated, the research on primary and secondary education disciplines and special, and pre-school education fields is less concerned and the literature is relatively scarce.

6.2.3 Limitations of research methods

It is difficult to evaluate the sustainable effect of teaching intervention because of insufficient educational experiment methods, low proportion of empirical research, and lack of long-term follow-up.

6.2.4 The related research on evidence-based teaching of modern technology empowerment needs to be supplemented.

7. Future Research Prospects

First, it is necessary to optimize the research structure, balance the proportion of basic research and applied research, increase the proportion of primary and secondary education research, gradually shift the research focus, from macro-theoretical research to micro-classroom research, and carry out interdisciplinary integration.

Second, it is important to strengthen the educational research of each academic period and support the study of the educational balance of each academic period; promote the scientific and professional implementation of the cooperative relationship between university researchers and practitioners in primary and secondary schools, and realize the real integration of educational theory and practice [27].

Third, it is important to attach importance to scientific experiments, establish a standardized process of educational research methods, and provide excellent empirical evidence to promote the application and development of educational decision-making in China [28] to develop research tools adapted to the educational situation in China.

Fourth, the application of science and technology will become more and more important in modern teaching. In the trend of high-quality development of big data-enabled education, we will continue to strengthen the integration of modern educational technology and teaching, and at the same time establish an intelligent education research platform to realize real-time data collection and analysis, continuously dig deep into the value of educational big data, turn “data” into “evidence”, and then promote personalized learning research supported by intelligent technology.

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