

# Teaching Evaluation of Medical Physics Based on the Theory of Multiple Intelligences

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**Abstract:** The theory of multiple intelligences was put forward by Howard Gardner, a psychology development scientist at the school of education of Harvard University. The theory of multiple intelligences has a wide range of positive effects in the theory and practice of educational reform. It breaks through the traditional concept of teaching evaluation and provides important enlightenment and promotion for the teaching evaluation of medical physics. Medical physics is an interdisciplinary subject formed by the combination of modern physics and medicine, which provides medical students with systematic physical knowledge and research methods. According to the theory of multiple intelligence, combined with the actual situation of medical physics teaching, to promote the overall development of students as the goal, to achieve multiple evaluations.

## 1. Introduction

To meet the requirements of new medical construction, the teaching evaluation of medical physics not only emphasizes the mastery of students' physical knowledge, but also emphasizes the cultivation of students' innovative thinking and ability, so as to promote students' all-round development and make students become excellent medical talents with high medical ethics, strong ability and courage to innovate. The educational evaluation of the theory of multiple intelligences focuses on the following points: the multi angle of evaluation; the growth of students in different stages; the reflection of teaching information; the equal importance of formal and informal evaluation; students are active self-evaluators. [1] We can use the theory of Multiple Intelligences for reference to discuss the teaching evaluation of medical physics.

## 2. The theory of multiple intelligence and Its Enlightenment to the teaching evaluation of Medical Physics

In 1983, Howard Gardner, a professor of psychology at Harvard University, first proposed multiple intelligences in the book the structure of intelligence, which was perfected in the book "rebuilding multiple intelligences" published in 1999. He believes that human intelligence is diverse, including at least nine kinds of intelligence, such as language intelligence, mathematical logic intelligence, visual space intelligence, body movement intelligence, music intelligence, interpersonal communication intelligence, introspection intelligence, natural exploration intelligence and existence intelligence. [2] The theory of multiple intelligences has a wide range of positive effects in the theory and practice of American education reform, and has been recognized in China. It has made many breakthroughs in traditional teaching evaluation concepts, and has provided important inspiration and promotion for the teaching evaluation of medical physics.

### 2.1. Diversified evaluation content

Under the influence of the traditional intelligence theory, the physics course overemphasizes the cultivation of mathematical logic ability, which has great one sidedness and limitation. The theory of multiple intelligences emphasizes that human intelligence is multiple, and each kind of

intelligence has an irreplaceable role. The teaching content should be designed in a targeted way to help students find the strengths and weaknesses of individual intelligence, so that they can clearly understand the structure of their own intelligence, make full use of the advantages of intelligence in medical physics learning, cultivate multiple intelligence, and improve the understanding and mastery of theoretical knowledge of the subject. [3]

## **2.2. Pay attention to formative evaluation**

The traditional evaluation of medical physics students' learning emphasizes a standard to measure the degree of students' attainment. The evaluation methods are mainly the various types of small tests designed by teachers themselves and the standardized tests at the end of the term, which are not conducive to the cultivation of students' innovative spirit and practical ability. According to Gardner, intelligence is an individual's ability to solve practical problems. Learning is conducted in relevant situations, and evaluation is meaningful only in similar situations. Therefore, we should attach importance to formative evaluation, evaluate students' ability to solve problems in real teaching situations, and promote students' development.

## **2.3. Diversified evaluation subjects**

The current teaching evaluation of medical physics does not pay enough attention to the diversification of the evaluation subjects, and the academic performance of the course cannot fairly evaluate the comprehensive quality of students. The theory of multiple intelligences emphasizes that self-examination and interpersonal intelligence are indispensable parts of human intelligence structure. Students' self-evaluation and mutual evaluation, teachers and teams are all involved in the evaluation, which can better reflect the real level of students' learning and development, and better play the function of evaluation in stimulating, regulating and developing students' learning.

## **3. Teaching evaluation design of medical physics based on the theory of Multiple Intelligences**

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### **3.1. Design principles**

The techniques and methods provided by physics have been widely used in modern basic medicine and clinical practice of medicine, which promotes the rapid development of modern medicine. [4] Medical physics is an interdisciplinary subject combining physics with medicine, which provides medical students with systematic physics knowledge and research methods. Inspired and guided by the theory of multiple intelligences, the design of teaching evaluation of medical physics should not only follow the general principles of objectivity, integrity, scientificity, guidance and development of teaching evaluation, but also take promoting the overall development of students as the goal to realize multiple evaluation.

Under the guidance of the theory of multiple intelligences, the design principle of teaching evaluation of medical physics advocates that the evaluation should be based on students, not cantered on the classroom and books. It should not only reflect the common characteristics of students, but also care about the individuality. It is emphasized that evaluation should not only focus on the acquisition of knowledge, but also on students' emotions, attitudes, values and basic skills in interpersonal relationships, self-awareness, natural observation and self-survival. It

emphasizes the evaluation of students with a dynamic and developmental perspective. [5] We should pay attention to the authenticity of the evaluation of students' learning, combine the in class and out of class, integrate the periodic evaluation with the daily behavior investigation, objectively evaluate the real intelligence of students, increase their learning confidence and strengthen their learning motivation. [6]

### 3.2. Evaluation standard design

The evaluation practice of medical physics is closely related to content standard, course standard, behavior standard and lifelong learning standard. [7] According to the theory of multiple intelligences, combined with the actual situation of medical physics teaching, especially the requirements of the curriculum standard, taking the chapter of "fluid movement" as an example, the evaluation standard system is constructed to carry out multiple evaluation design. [8]

Evaluation of language intelligence. Physics has a unique language, including physical concepts, physical symbols, physical laws, physical formulas, physical images and physical models. Through the study of this chapter, we can use the standard physical language to accurately express the related concepts of fluid movement, describe the laws of fluid movement, explain the phenomena, etc.

The evaluation of mathematical logic intelligence. It is the ability to effectively use numbers and reasoning, and it is the most important and critical intelligence of students' sustainable development. The evaluation can be carried out from the following aspects, the formula can be derived independently, and the mathematical model of fluid motion law can be established. Be able to use mathematics to solve fluid problems. Learn how to use the easiest method to solve problems flexibly. Actively summarize the deduction, induction, analogy and other methods contained in the knowledge of this chapter, and effectively use these methods for learning.

Evaluation of visual spatial intelligence. Students can accurately feel the visual space, show what they perceive, and learn to think in observation. The ideal fluid model and blood circulation model were established according to the properties of the fluid. Observe and distinguish the steady flow state of ideal fluid and the flow state of viscous fluid, and express them vividly. Good at picture thinking, can draw the mind map and problem solving flow chart of this chapter.

Evaluation of musical intelligence. Students are sensitive to the ability of tone, melody, rhythm and timbre. Students can distinguish between regular signal and noise, so as to understand the principle of clinical auscultation to distinguish whether blood flow and respiration are normal. Experience the scientific beauty of physics.

Evaluation of body movement intelligence. The ability to use the whole body to express thoughts and feelings, and to use both hands to produce or transform things nimbly. Can successfully complete the experiment, have good operating skills and the ability to deal with emergencies. It can verify and explore Bernoulli equation and Poiseuille's law through experiments, and promote and consolidate theoretical knowledge learning. Be able to show physics learning activities correctly.

Evaluation of interpersonal intelligence. Ability to effectively understand and interact with others. Students can communicate well with others about their understanding of this chapter. Actively participate in the discussion of the important and difficult points in this chapter. Teachers raise questions or students raise questions in the discussion area. Students discuss and study together, and correctly express the ideas, methods and results of solving problems.

The evaluation of introspective intelligence. Students' ability to know, see and reflect on themselves. Establish long-term and stage learning objectives and give feedback and summary in time. Students have a clear understanding of their intellectual strengths in physics learning and can make use of them. Be good at dialectical thinking from both sides, and think whether we can achieve the same goal through other methods. Be able to reflect on the influence of their own and others' behaviors on the environment on the basis of physical knowledge learning.

Evaluation of natural exploration intelligence. Be able to observe the physical phenomena in life carefully. Be able to complete the inquiry experiment independently. Students can combine the knowledge of physics with medicine, and link it with practical life, social development, environmental protection and other issues.

## Conclusion

In the process of evaluation, the multiple evaluation modes of teacher evaluation, student evaluation, student mutual evaluation and group evaluation are adopted. Parents and other teachers can also be invited to participate in the evaluation process, so as to make the evaluation subject diversified and the evaluation will be more authentic and effective. [9]Make full use of various evaluation forms, online and offline evaluation, qualitative evaluation and quantitative evaluation, process evaluation and summative evaluation. [10]

Based on the theory of multiple intelligences, combined with the intelligent characteristics of students in the learning process to design the evaluation content, not only to provide timely feedback for the effective teaching of teachers, but also conducive to the meaningful and efficient learning of students.

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## References

- [1]. Chen Limei, Wang Chunxiang, Guan Xiaoyan and Wang Yuexin. (2012) Evaluation Methods of Students' Capacity in University Physics Teaching. The Guide of Science & Education, 26, 19-19.
- [2]. Wang Hongping, Cao Haihui and Chen shaohua. (2019) TSAES Preceptorship Based on Multiple Intelligences Theory. China Higher Medical Education, 8, 90-91.
- [3]. Li Jianshe. (2013) Design of Evaluation Content of Physics Experimental Teaching Based on Multiple Intelligence Theory. Experimental Technology and Management, 7, 143-146.
- [4]. Wang Jianru, Zhang Yumin. (2018) Clinical Thinking Cultivation of Medical Students in Medical Physics Teaching. China Higher Medical Education, 9, 738-740.
- [5]. Luan Zhaohui, Wang Fei and Lu Shijie. (2015) The Enlightenment of Multiple Intelligence Evaluation on the Evaluation of Physical Experiment Teaching. Heilongjiang Education (Higher Educational Research and Evaluation), 1, 58-59.
- [6]. Wang Baozhu, Liu Cuixiang, Zeng Cheng and Zhang Nannan . (2020) Research of Blended Learning Mode and Evaluation Method Based on New Engineering Education. China Modern Educational Equipment, 7, 39-42.
- [7]. Zhang Pengcheng, Wu Jing. (2006) Constructing the Assessment Criteria for Enhancing Students' Development in Medical Physics Study. Researches in Medical Education, 6, 522-523.
- [8]. Wang Xiaoling. (2015) A Multi -dimensional Evaluation System of College English Based on the Theory of Multiple Intelligence. Journal of Hubei Correspondence University, 16, 157-159.
- [9]. Sun Yang, Wu Boyan, Liang Ying, Wang Yanjie, Xu Fang and Li Mingzhu. (2017) Construction of Evaluation System of Medical Genetics Teaching under the Guidance of Multiple Intelligence Theory. Heilongjiang Medical Journal, 12, 1228-1229.
- [10]. Li Li, Chen Junhong and Zhang Ge . (2019) The Training Mode of Normal Education Talents from the Perspective of Multiple Intelligence Theory. Journal of Kaifeng Institute of Education, 8, 183-184.