

# Exploration of Effective Interface between University Physics and Middle School Physics Teaching

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## Abstract

Physics, a basic natural science, studies the universal structure of matter, the interaction between objects, the general laws of motion, and also some of the ways of thinking and means used in the research process. Middle school physics is a basic course that exists in the general high school science field of study, and the university physics course is a required basic course for students of all majors in science and technology in higher education. This paper aims to solve the problem of the interface between university physics and middle school physics teaching, analyzes the background and significance of the effective interface between university physics and middle school physics, studies the current situation of middle school physics education and university physics education in China, discusses the differences between middle school physics and university physics teaching, and then proposes countermeasures on how to solve the effective interface between middle school physics and university physics teaching. The research methods of comparison, analysis, synthesis, induction and deduction are used to study the teaching of middle school and university physics in detail, so that the interface between university physics and middle school physics can be summarized in depth.

## Keywords

University Physics; Middle School Physics; Physics Teaching; Teaching Articulation; Teaching Content.

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## 1. Introduction

### 1.1 Background of the Study

The university physics course is for freshmen of science and technology in higher education, applicable to students of all majors, and the course offered is a fundamental course with the main content of physics fundamentals. There are many problems in secondary school physics education and university physics education. The main goal during middle school is the college entrance examination, so in the context of exam-oriented education, people are more concerned about how to get a good grade and how to improve the rate of students' advancement [1].

Middle school students entering university is an important turning point for a person. Middle school and university are two different stages with different learning tasks, different ways of thinking, different teaching goals and teaching contents, and there are also many differences between university physics teaching and middle school physics, and physics is more abstract and complex compared to other subjects, all these problems make students have certain discomfort, so students must adjust their learning style in time to adapt to the university teaching style.

### 1.2 Meaning of the Study

#### 1.2.1 Meaning for Physics Teachers

Both university and secondary school physics encompass force, heat, magnetism, light, and atomic physics, etc. Secondary school physics studies are relatively superficial, while university physics

studies deeper physical laws, so it has certain guiding significance for teachers to grasp and understand physics as a whole in depth. Nowadays, it is especially important for how to make the smooth transition from middle school students to university physics, which also requires teachers to be proficient in the interface of the physics knowledge system, so this study has far-reaching implications for physics teachers' teaching [2].

### 1.2.2 Meaning for University Students

University physics knowledge is the expansion and extension of middle school physics knowledge, which pays more attention to logic and pursues deeper understanding of concepts and phenomena, so it requires students to have strong logical thinking ability, deeper understanding and inquiry. In addition, university physics can explain higher-level physical phenomena, and physics is closely related to real life, so learning physics can also improve the divergent thinking, abstract thinking and logical thinking in college students' lives [3].

This logical thinking ability is very important, but this kind of thinking is not formed out of thin air, it needs a certain foundation, and the origin of this foundation lies in the interface point between middle school physics and university physics teaching, only by finding the interface point can we better understand the meaning of divergent thinking, by finding the similarities and differences between the two, establishing the interface between the two, and solving the knowledge of university physics with a better thinking than middle school physics.

## 2. Current Status of University Physics and Middle School Physics Education

### 2.1 Current Status of University Physics and Middle School Physics Education

The status quo of middle school physics teaching is very single and boring, doing problems, exams and promotion, which has become the biggest criterion for parents and teachers to measure a middle school student's ability. The general background of education today is exam-oriented education, and the method of teaching physics in middle school is to master all the physics knowledge learned, keep doing physics exercises, keep doing practice, keep taking exams, and the ultimate goal is to get a good score in the college entrance examination.

Quality education cultivates high quality talents with all-round development of morality, intellect, physique and aesthetics, and cultivates innovative talents, but in order to allocate scarce educational resources, test-based education has to be implemented, which puts middle school students under such pressure constantly.

### 2.2 The Current Situation of University Physics Education

In university education, education is shrunk and class hours are reduced. Nowadays, technology is developing rapidly, the demand of the talent market is increasing, and many new positions are appearing. In order to adapt to the current situation, cultivate useful talents and improve the employment rate of schools, therefore, universities offer a lot of highly practical courses, and students can choose their own elective courses according to their interests and future development direction. This situation increases the practicality, but the university curriculum is limited, and in order to offer these elective courses, the required courses will be reduced accordingly, so to a certain extent it causes the shrinkage of education. Although the elective courses increase the practicality, the traditional courses should not be neglected and the relationship between the two must be dealt with.

## 3. Differences between University Physics and Middle School Physics

### 3.1 Differences in Teaching Materials

One of the differences between secondary school physics and university physics teaching is the difference of teaching materials, secondary school physics teaching materials are relatively less content, and easy to understand, not much connection with various disciplines, and relatively less difficult. The depth and breadth of university textbooks is deeper than that of secondary school, and the connection between university physics and other disciplines is also great, especially with higher

mathematics. Some of the knowledge in university physics is too abstract and requires argumentation and solution, so the study of advanced mathematics is also a priority. University physics textbooks are generally straightforward, with few illustrations or introductions, and to a certain extent they are boring. The content of university textbooks is also more abstract than middle school physics, with strong divergent thinking. University physics textbooks focus on theoretical reasoning, argumentation, and summarization, with a wide range of knowledge, which can easily discourage students' learning initiative if they do not handle the relationship between middle school and university physics well. In conclusion, university physics is very different from secondary school physics in terms of teaching materials [4].

### **3.2 Differences in Teaching Methods and Means**

Middle school physics teaching is relatively easy, because there are fewer physics knowledge points in middle school and more class time, so teachers have time to explain physics knowledge in detail and systematically, and the relaxed learning atmosphere in middle school physics teaching gives students the opportunity to communicate with teachers and have physics self-study time in class. The teaching methods and methods of university physics are very different from those of middle school physics, because there is more teaching content and less class time. The teaching means is only multimedia explanation of physics knowledge points [5].

### **3.3 Psychological Differences in Learning**

During secondary school, students do exercises non-stop every day in order to take exams, and their psychology is in a tense and numb state; in university, these exams are almost non-existent, and only the final exams are required to take enough credits, which makes students produce a state of stagnation, especially in the relaxation period after the college entrance exams, and some college students psychologically produce the idea of liberation, facing the easy university life and squandering it freely. Especially the students with poor self-control are psychologically relaxed as never before, and they do not do their duty and responsibility as a student at all. The strict management in middle school contrasts with the relative freedom in university, which also makes some students overwhelmed [6].

## **4. How to Do the Bridging Teaching**

### **4.1 Emphasize the Teaching of Introductory Class**

The first class in university is the first step to effectively connect middle school physics with university physics. In the first class, the teacher should guide the students to adapt to the university study, tell them that there are many differences between middle school physics and university physics, including what they need to learn and how to learn physics, guide them to establish a correct view of learning, understand the learning objectives, teaching plans, examination methods of university, etc., so that the new students can change the concept that middle school physics is different from university physics, so that the new students can really understand the difference and significance, in addition, the teacher should introduce the advice and experience related to learning physics, so that the students can understand the similarities and differences of university learning through the previous introductory study and the teacher's explanation, and only by knowing the differences can they have a better understanding so that they can better deal with the effective connection between middle school physics and university physics [7].

### **4.2 Adjusting the Teaching Schedule**

In middle school, the teaching time is sufficient and the class time is relatively large, plus there is not much physics knowledge in middle school, so the teacher has time and energy to teach in detail, so the teaching progress is relatively slow and students feel relatively easy and receptive; in university, it is different, because the university has shorter school hours, less class time and relatively large amount of knowledge, which involves a wide range, so the teacher is required to teach at a relatively fast pace. For new students who have just entered university, the speed is too fast and difficult, and it

is easy for students to get bored, and this phenomenon not only makes teaching difficult but also discourages students' motivation [8]. Therefore, teachers should adjust the teaching pace appropriately to give students a buffer time to adapt to the university teaching.

### **4.3 Textbook Content**

Knowledge is coherent, university physics is the consolidation and enhancement of middle school physics, that is, the content of university physics is based on the content of middle school physics to start learning sublimation, but there are many phenomena that can not be explained with the knowledge of middle school physics, which shows the limitations of the content of the middle school physics textbook, thus starting the content of the university physics textbook. In this way, the teacher is required to have a systematic knowledge and understanding of middle school physics. The content of middle school physics textbook includes the most basic velocity, acceleration, force analysis, momentum, kinetic energy, work, etc., and the university continues to extend, it is worth mentioning that the teacher should know that the focus of the textbook is the new knowledge of university physics, so they must grasp the degree of review, talk about the key points, talk about the articulation point, not too much to explain the secondary school irrelevant physics knowledge, grasp the focus [9].

### **4.4 Learning New Things from the Past**

There are many differences between middle school physics teaching and university physics teaching in class and out of class. The purpose is to consolidate new knowledge by doing carefully selected physics exercises so that students can master the university physics methods as soon as possible. Given the different teaching methods of university physics, students are also required to develop the habit of pre-study in advance, which is the only way to adapt to the fast-paced learning process, and to make a good and effective connection between middle school physics and university physics through this learning method of learning from the past and knowing the new [10].

### **4.5 Cultivating Students' Self-learning Ability and Subjective Awareness of Learning**

The biggest difference between middle school physics and university physics is the subjective control of the individual, the teaching environment in middle school is very intense, before students have time to dominate their own learning life, teachers and parents have already made arrangements, university is different, university is mainly on their own, to develop a person's self-control, self-motivation, self-control, self-learning power and so on, physics learning requires the development of students' self-learning ability and the main consciousness of learning. In college, students need to consult their own materials to learn, and the pace of college classes is fast, so what they do not understand in class or have questions can be used to study in detail and organize important knowledge points, so that their knowledge in class can be consolidated and improved. The difference between university physics and middle school physics is the sequential nature of teaching. This requires students to study on their own through various reference books, learn what is not in the textbook, learn to summarize important knowledge points by themselves, form a complete knowledge system, and learn to integrate it. By cultivating their own self-learning ability and the main consciousness of learning, they can make a better and effective connection between secondary physics and university physics [11].

### **4.6 Using Multimedia Teaching Tools to Stimulate Students' Interest in Learning University Physics**

In the middle school physics classroom, teachers usually use more intuitive demonstration experiments in order to make students better understand physical phenomena and knowledge, but the university is different, class time is too tight, and multimedia is usually only used for lectures. Some of the university physics was already abstract and difficult to understand, and in the face of the changes in university physics teaching, many students still rely on the teaching mode of middle school, hoping to use something intuitive to solve complex physical phenomena. So for this situation, teachers should try to use multimedia teaching means to teach, multimedia is more intuitive, realistic, easy to learn to understand, with multimedia novel, advanced instead of middle school physics

teaching demonstration experiments, help students to build a systematic understanding of physics, so as to stimulate students' interest in learning, and middle school physics and university physics can get a better and effective interface.

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