

# A Review of the Implementation of Differentiated Instruction in Different Majors of Higher Education Classrooms

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## Abstract

Individual differences are increasingly being considered by the government, teachers, and parents. Due to the large class size, traditional teaching methods are too monotonous, and teachers often pay less attention to students' learning interests and motivation. Differentiated instruction was a personalized approach to teaching that takes into account students' personalities and caters to their individual learning needs, thereby promoting each student's full development based on their original abilities. While there have been sufficient systematic studies on differentiated instruction in primary, middle, and high schools, there is absent systematic analytical summaries of the results of the different specializations of the University. This study adopts a literature review method to analyze the research status of differentiated instruction from the perspectives of language course, STEM course (Science, Technology, Engineer and Mathematics), and physical education. It focuses on implementation strategies as well as approaches used for implementation along with the effects of differentiated instruction methods across various specialties. Finally, this paper summarizes the variations found in different major-specific researches and provides suggestions for future research directions.

**Keywords:** Differentiated Instruction, Higher Education, Major, Implementation

## Introduction

In the environment of class teaching system, learners are often regarded as homogeneous groups without differences, and each learner's learning pace, preparation, learning style, learning interest and other aspects are different. As a result, the traditional form of classroom

instruction seriously neglects individual differences in learners and is not equitable. Teachers' design of teaching approaches that respect students' differences and cater to their different requirements and learning preferences plays a key role in enhancing academic performance. Differentiated instruction is an instructional approach that realizes various needs of students and meets their needs via a variety of strategic challenges. It has become the consensus of teachers to respect students' differences and meet students' needs. The adoption of differentiated teaching combines a variety of methods, principles, organizations, teaching, and assessments to enable educators to move away from traditional ways of teaching. Differentiated teaching by modifying curriculum, teaching methods, learning activities, and assessments to maximize learning outcomes. Differentiated Instruction (DI) has been widely studied and applied over the years (Ziernwald, 2022; Hu, 2024). However, since research on differentiated instruction has primarily applied it to the K-12 level. Therefore, this study systematically summarizes the literature related to the application of differentiated instruction in different majors in higher education.

This paper reviews the major research efforts in differentiated instruction carried out by scholars, mainly introduces the connotation, core characteristics, teaching methods and effects of different professional types of differentiated instruction. This study could furnish a better learning architecture for educators to address the varying student demand. Hopefully, more and more educators can pay attention to differentiated instruction, and more education researchers can devote themselves to the research of differentiated instruction, so as to realize the ideal situation of "educational equity" as soon as possible.

In addition, this study enriches the discourse on differentiated instruction by adding new insights into the specific ways in which differentiated instruction strategies can be implemented in different majors and their impact on students. It encourages the pursue higher progression of teaching strategy and benefits to respond the challenges in education and achieve a more equitable educational environment.

### **Implementation methods and effects of differentiated instruction in universities**

As times have evolved, the college student population is a great deal of variation in terms of knowledge base and family background. It adds even more sophistication to the procedure of education and learning for teachers, who demand to recognize that each student is unique. Developing instructional strategies that fulfill of different needs and knowledge levels of students provides flexibility in providing a variety of learning opportunities(Martin, 2014). Additionally, That's crucial for educators to teach more engaging content for students and personalized learning experiences in addition to imparting knowledge(Polly, 2014). This study focuses on two differentiated teaching methods that are mainly used in higher education are adaptive teaching and flipped teaching respectively.

#### **Adaptive Teaching**

Adaptive learning as an innovative and transformative approach to higher education through personalization and improving the quality of the educational experience. Adaptive teaching is an instructional approach that meets the diverse characteristics and needs of students by changing how, and what, is taught. Has a powerful pedagogical function because it provides learning experiences in view ofthe student's experience in the classroom, increases student participation, and improves student achievement. The main methods of adaptive teaching

include 1. designing adaptive teaching for individual differences that have a significant impact on students, 2. adapting teaching for homogeneous groups of students, and 3. developing learning programs to accommodate the different needs of students, which provides students with enough learning activities and units to move to the next unit only if they reach a level of mastery, which leads to a higher-quality learning to meet the differences in the students' acquisition of better academic performance (Soofi, 2019). The more learning materials are meet the cognitive needs and cognitive capacity of students. Its teaching potential is then more effective and accurate. For instance, in learning the concept of modules, if students with a higher level of knowledge receive a large number of the teaching activity is not suitable for students levels, students achievement will be disappointing. (Holmes, 2018).

Adaptive learning, which provides educational according to students' current level of knowledge, understanding and problem-solving skills have been increasing in addressing remedial instruction (Johnson and Samora, 2016) Teachers generally agree that adaptive teaching methods enhance student learning, but research on implementing adaptive learning methods in college classrooms remains limited. The use of adaptive technology is promising. Findings from the research suggest that adaptive teaching improves student learning and contributes to the sustainability of higher education (Lin et al., 2016). In a study by Foshee et al. (2016), research worker investigated utilizing adaptive learning environments in college higher mathematics class tutoring. The results of the study show that students' academic performance and efficiency in solving higher mathematics class problems increased significantly after adaptive instruction, suggesting that adaptive instruction can contribute to instructional success. The results of the study also revealed that students' level of academic completion influenced their ability to overcome math barriers deficits and the results suggest that when adaptive learning environments are wholehearted, they were able to reduce students' math flaws.

### **Flipped Teaching**

Flipped teaching changes the location of learning (the classroom) and getting homework done (the home). In flipped teaching class, students in the English Teaching Center gain knowledge by watching videos for online education at home that relate to the course content and practicing verbal skill by doing exercises or activities in the classroom. Since students are in the classroom when practicing language skills, teachers can provide direct and effective guidance and assistance, and this teaching method can effectively improve students' learning efficiency. According to Bishop (2013), the process of implementing the flipped classroom as an individualized teaching methodology usually consists of two basic portions: (i) students are engaged in classroom content outside the classroom through online videos, lectures, etc., and (ii) students are engaged in interactive classroom learning activities with personalized instruction provided by the instructor. When applying this instructional design to the classroom, the teacher assigns digitized learning materials to students before class using electronic technology such as web-based instruction, video instruction, etc. Students are asked to train their learning and respond to the given materials before the class.

One effective strategy for maximizing active learning methods in the classroom and providing personalized support to students is to "flip" the classroom. Flipped classrooms are often associated with the provision of course materials, usually in the form of video lectures for extracurricular activities in which students participate, which allow classroom time to be

redirected to student-centered collaborative learning activities. Flipped classrooms are usually associated with the delivery of course materials, often in the form of electronic technology combined with videos or lectures that engage students outside of the classroom, thereby redirecting classroom time to collaborative, student-centered learning activities.

Using inversions in biology classrooms in higher education, the flipped classroom pedagogy has yielded positive results, such as some authors suggesting that the pedagogy enhances students' metacognition and collaborative learning, and improves student achievement, while others suggest that there was no difference in the results between the control group, which implemented traditional teaching, and the experimental group, which implemented flipped teaching methods (Yong et al., 2015). Previous research has shown that flipped teaching is effective in increasing students' classroom engagement and boosting their motivation (Strayer, 2012; Wang, An, & Wright, 2018). In preparation for classroom participation, learners can be better engaged in interactive classroom activities, which can improve the learning effect of student learning and higher level of train of thought in students. This will further improve student learning by enhancing student participation (Adnan, 2017; Chen Xie et al., 2017b).

### **Introduction of DI application in colleges and universities**

#### *Application of Di in second language learning in colleges and universities*

Growing globalization, languages has led to the necessity of development in the increasingly demanding multicultural environment of learning a second language. Traditional writing methods are not effective in maintaining or improving the learning interest of English learners, especially place the teacher at the center of authority in the classroom (Buitrago, 2018). In the traditional teaching design of language courses, the purpose of teaching usually includes vocabulary mastery, the use of grammar, writing, to improve students' language skills. However, there is no way for students to learn English well by teaching only through these simple steps in the traditional classroom. With guidance from the teacher, language learning requires frequent practice and cannot be mastered within a very short time frame. Thus, language learners may face challenges when confronted with language learning including a lack of basic language skills (grammar, syntax, and vocabulary), weak language organization, and more severe writing anxiety (Fareed, 2016). And negativity is a common problem during the course of language acquisition. To ensure that students motivated and engaged and improve their language skills, researchers have explored innovative teaching methods.

Kosareva's (2021), study for the use of adaptive teaching based on the Ispring platform in Russian classes in higher education Russian as a foreign language (L2) examined the pedagogical effects of the experimental group of adaptive teaching and regular teaching for both groups of students. The results of research indicated that Pupils in the experimental group improved their competence after adaptive teaching on the basis of an online learning platform, however, there was no significant improvement in the students' competence using the traditional classroom program. Students in the adaptive teaching experiment group proved to learn Russian significantly longer and perform better. It was noted that the adaptive learning features of the iSpring platform helped to encourage students to learn better and faster, thus improving their performance. This evidence suggests that adaptive teaching is more effective than traditional teaching (Kosareva, 2021). Wu (2019), investigated the effects of flipped learning on students' English writing ability and students' negative emotions, and

the results showed that flipped learning was effective in improving students' motivation and academic performance. This paper examines how a grammar course design affects students' attitudes towards learning grammar and the effectiveness of this design in terms of final exam results. The grammar course design is used to distinguish the teaching content of students and adapt to each student's learning standards. The results of the study showed that this instructional strategy significantly improved students' academic performance.

#### *Application of Di in College Sports Courses*

For the past few years due to the expansion of colleges and universities, the number of college students has doubled, and the differences in physical fitness and sports skills of students have been increasing. Therefore traditional physical education is facing a great challenge. Traditional physical education teaching mostly adopts the one-way information transmission mode of "teachers speak, students listen, students practice, and teachers guidance". Teachers are the givers and students are the passive recipients of education and instruction. This kind of traditional teaching thought and mode is convenient.

Management and organization of teaching, however, has suppressed the enthusiasm of some students to a large extent. In this regard, physical education teachers must provide learning opportunities tailored to each student's skills and abilities. People have long recognized that PE possesses a complex learning environment with learners at different levels of development; learners at different stages of their current learning; and learners who are diverse and different. Therefore, in light of these complexities, and in order to achieve equitable education in physical education and greater student development, physical education teachers provide students with a customized curriculum based on student differences. Individualized programs can enhance student performance, motivation and enjoyment of physical education practice (Whipp, 2012).

Du's findings were that after a four-month experiment with differentiated instruction, a significant difference in skill scores emerged between the experimental and control groups, and that students who received differentiated instruction scored higher on average than the other group. This shows that the difference teaching method has a significant effect on the improvement of students' volleyball skill level, and students' self-efficacy has also been significantly improved (Du, 2007). Choi (2011) studies show that student-centered continuous development programs can significantly grow in the development of key attributes of student physical literacy.

#### *Application of Di in Science STEM Classes*

The main problem in higher education today is the decline in the number of graduates in science, technology, engineering and mathematics (STEM) subjects (Barral, 2018). STEM educators face a challenging task to not only rethink their teaching methods, To ensure that students persist and succeed in their subjects, and to do so in a way that promotes diversity (Barral, 2018).

In higher education's basic teaching programs on the science, technology, engineering and mathematics (STEM) majors, mathematics coursework is usually included because these majors require a lot of computation and mathematics is one of the core courses in these majors. The lack of math skills among STEM majors is reported to be the most important

reason why approximately 30% of engineering students fail to complete their degree (Bakri, 2020). Researchers have found that students have difficulty graphically interpreting derivatives on straight lines or complex curves, calculating the slope of tangents from graphs, and lack the ability to visualize functional conceptual images. Derivative interval information and critical points on cognitive associative graphs (Barral, 2018). In the past decade, the biological education research community has identified a number of evidence-based teaching practices.

To overcome this perception gap, Barral (2018), developed an innovative board game called Graphic Jigsaw (GP). This is a learner-centred intervention with a visual and practical approach. Its purpose is to serve as a manipulator to help students understand algebraic, symbolic and graphical representations of functions under derivative applications and to form corresponding procedural and conceptual knowledge. The course covers several basic topics in calculus, including calculations of limits and continuity of functions, calculations of derivatives and integrals, and use of derivatives and definite integrals. ANCOVA tests showed a significant difference in pretest and posttest achievement for solving polynomial functions ( $F(1,81) = 12.182, p = 0.001$ ). Liu (2017) researched the influence of adaptive learning teaching on access to pharmacy professional degree programs providing remedial guidance in biology, chemistry, mathematics, and information literacy. The results show that the adaptive learning intervention can help solve the gap in chemistry knowledge and significantly reduce the anxiety of mathematics learning. Due to time factors and some design flaws, this can lead to a lack of success for students in other majors. These findings emphasize the significance of design in adaptive learning. Adaptive Teaching and Learning through Implementation in Engineering Mathematics Courses, students who use and do not use tutorials are compared. Quantitative and qualitative data analysis identified implication incorporating adaptive tutoring in a blended learning environment, 58% of students attended tutoring and 74% completed tutoring. Ninety-eight percent of participants reported an increase in confidence and understanding. A comparison of test results showed that students who accepted coaching had significantly higher median scores higher than for students who did not receive counseling (Weltman, 2018).

### **Conclusion**

The study found that differentiated instruction in physical education majors, language majors, and STEM majors in college education can significantly improve student achievement, cognition, and motivation. Therefore, educators should find and take care of learners' differences from the perspective of "based on differences, using differences and developing differences". According to the different foundation and level of students, differentiated instruction methods are provided for different students to promote the knowledge construction of different students. This helps students to reach their maximum potential and achieve maximum progress in their current level. It also aims to make education more equitable.

The study also found that the differentiated instruction implementation strategies of different majors are different. Because different majors have different characteristics and teaching methods. In language class, strategies should be formulated according to students' different language bases and anxiety levels to alleviate students' emotions and improve their learning motivation and academic performance (Liu, 2017). In the relatively complex physical

education classroom teaching environment, sports literacy can be implemented through student-centered teaching methods and curricula in specific sports contexts, thereby improving students' sports literacy, sports performance and self-efficacy (Whipp, 2012). In STEM classrooms, students' learning success is largely due to cognitive gaps. According to the specific problems, the corresponding solutions are given. Therefore, when designing differentiated instruction strategies and implementing them in the classroom, educators should combine with the professional characteristics of the professors and make timely adjustments to avoid blindly copying the existing strategies. The design of differentiated instruction strategies according to the characteristics of different majors is helpful for students to better improve their ability in this major, and it is also helpful for teachers to implement it. All in all, the research systematically summarizes the characteristics and effects of differentiated instruction in different majors of colleges and universities. The results show that differential teaching is a teaching strategy that can improve students' achievement and perception, and the differential teaching strategies of different disciplines have different and distinct characteristics. Therefore, in the implementation of differentiated instruction in colleges and universities, we should design teaching methods suitable for the major and students' level according to the characteristics of specific disciplines and different needs of students. This study establishes a set of theoretical support for the implementation of differential teaching in different majors in universities. More in-depth, systematic and perfect summary and finally form a set of teaching methods that can be widely used, so that each learner can get the best personalized development.

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