ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202409_7(9).0031

# Research on the Practice of Personalized Education based on Problem-based Learning Model

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## Abstract

**In-depth discussion of the combination between the problem-based learning model and personalized education. It has been exposed to an objective and comprehensive review of the theoretical foundation and development status of problem-based learning and the meaning of the personalized education with problems in the process of its implementation. The article has designed the corresponding empirical research method in order to make the systematic and analytical educational practices based on problem-based learning in concrete educational contexts. In this way, certain data about the effects of personalized education are obtained and further critically discussed. The research results showed that problem-based learning can effectively facilitate the implementation of personalized education, while indicating existing problems and areas to be further developed in practice. This will provide theoretical support and practical guidance to the promotion of innovation of personalized teaching strategy. Finally, based on the summary of the unique value of the combination of problem-based learning and personalized education, the future research directions are clarified, which has practical significance for education reform.**

## Keywords

**Problem-based Learning; Personalized Education; Theory and Practice; Empirical Research.**

## 1. Introduction

Today, education has become one of the most focused fields in the world. Personalized education, as a new education mode, has been paid attention to and has received greater and greater attention from people. With the progress of society and technological development, now the traditional mode of "one rule fits all" education is no longer suitable for meeting the personalized needs of all kinds of students. Therefore, it is a hot topic to carry out personalized education practices based on problem learning models in the educational area. This implies that personalized education is focused on student interest, ability, and characteristic, making any student acquire the attention and support that he or she deserves.

With personalized education, it breaks the traditional teaching mode. It suggests that the student should be based on the problem-based learning model, with student participation and self-directed learning. In the problem-based learning model, the student selects the appropriate learning content and method according to his interest and actual situation, making the potential of students better developed. Regarding the practice of personalized education on one, it needs to be explored and practiced constantly by teachers; on the other hand, it requires the parents of the students to know and support. However, schools, families, and society play their respective roles in the education environment, and it is only through the effort of all parties to achieve the development goal of personalized learning, and provide every student a better development space.

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In a word, personalized education is the significant direction of educational reform, and research into the personalized education practice based on the problem-based learning mode is of critical theoretical and practical significance. To conduct a further theoretical research and exploration and innovation of teaching methods based on the actual situation in order to better promote the development of personalized education, as well as to offer students more diverse, personalized learning experience become the significance of research on personalized education practice based on the model of problem-based learning.

## 2. Overview of Problem based Learning Models

### 2.1. Theory of Problem based Learning Patterns

In actual research on personalized teaching practice, we adopt the problem-based learning model as the core of the education strategy based on critical thinking, which has become vital. In this model, the knowledge objectives of the problem will stimulate teachers who must take on the role of a designer, with the task of creating scenarios that will arouse the interest of the students to explore, then teacher representatives how to solve the problem. Upon this foundation, the students shall further advance with independent information inquiry to propose the hypothesis of problem solution, verification of hypothesis on the basis of properly designed experiments. This process is also reflected in the problem learning flowchart we developed, which allows us to trace the path of the student's learning clearly. When doing an experiment, the student should take a data and result description and study carefully. The analysis stage should be the key stage of improving the thinking ability of the student in order to be able to deepen the understanding and expand the relevant knowledge in the course of problem-solving specifically. At last, the students need to review the whole problem-based learning process, which is the key to the cognitive integration and experiential reflection.

We use quantitative research method to analyze the performance traits of students in different personalized learning mode. By setting up the test groups and control groups, measure of the application characteristics of the problem learning mode in different groups of students, the learning outcome changes caused by the different problem learning mode characteristics. When designing data and analyzing data, we also considered the variable impact of the diversity of student backgrounds to make sure that the result had wide range applications and robustness.

We will also apply the visual tools to the instructional design, like visually display the educational mode with the captions of "personalized learning modes." This figure shows the way that teachers design the teaching content and evaluation criteria based on the personalized needs of the students, as well as the optimization of the teaching methods upon the student's feedback. Through this visual approach, the research tends to reduce the cognitive burden of teachers in understanding and implementing the individualized teaching. Based on the methodology and the conclusion of the research, it can be said that the problem-based learning can have a substantial enhancement in the critical thinking and the problem-solving ability of students. The research results not only expand the theory of problem-based learning but put the specific strategies of practicing individualized teaching into the actual practice of primary and secondary schools and higher education teachers, with potential international influence behind and can promote academic community discussions about new teaching models.

### 2.2. Development Status of Current Problem based Learning Models

In the current research on the development of problem learning models, through in-depth analysis of the data in the historical development table of problem learning, clearly it can be noticed that after the first proposal of problem learning models in North America in the 1960s, this model has been applied widely and developed continuously in multiple regions around the

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world. The learning effect evaluation index can be seen since the first application of the model, and it is mainly employed in the field of medical education and exhibits 15% average improvement in clinical skills. After the time goes by, the problem learning pattern has been applied to different areas, including medicine and education, management, and even engineering education, which gradually forms the research pattern of interdisciplinary application.

The primary problem solvers in each period not only carried out localized research on the model to meet the teaching stock needs of their respective country or region but also systematically improved and deepened the theoretical basis, the effects of implementation, and the methods of teaching. For instance, Schmidt H.G. was aware of the effectiveness of problem-based learning methods through his being involved in empirical research in the 1970s, and his findings had a far-reaching impact on teaching methods. For research on problem-based learning models in the 21st century, it is mainly in how to integrate into knowledge construction, as described by Salvy J.R., and how to serve the development of 21st century skills, especially critical thinking and creativity, with an average of 23% improvement, which shows that the comprehensive abilities of students in the current problem-based learning model are developed more.

In fact, with the quick development of globalization and information technology, the problem-based learning model in the contemporary era is going beyond the traditional turfs of classrooms and is stepping toward new application areas such as interdisciplinary and distance education. The scopes of application and evaluation indexes are various, which also indicates the adaptability and flexibility of the various empirical researches based on the problem-based learning model. From the classification and comparison on the historical development table of problem-based learning data, it is not difficult to see that the problem-based learning model is gradually becoming an important educational model for cultivating students' 21st century skills. Finally, the improvement and perfection of the problem-based learning model are going to deeply affect academia and educational practice and is also going to offer systematic support to the thorough implementation of personalized education with a strong theoretical and practical basis.

## 3. Fundamentals of Personalized Education Theory

### 3.1. The Connotation of Personalized Education

In the course of practice research in personalized education, we all have implemented an algorithm framework to model student behaviors as guided by the inputs of student information, learning preferences, teaching content, and technical tools. One develops the personalized learning and teaching mode E{personalized} (x)= f (1 {student}) L{preferences}, M1 {content}, T {technology}) by using this model that optimizes the designing of personalized learning paths through a quantitative analysis of several student indicators. Produced with data from but not confined to characteristics about the learning styles, prior knowledge level, and feedback habit, massive amounts of data have been collected from educational platforms in regard to a wide area of students.

In order to give the students an individual, unique, and personal element, student groups are divided into different learning style groups from the students during the process of classification of the machine learning algorithms. We processed student feedback data to effectively join the learning path optimization under the supervised learning technique and model training in huge numbers of labeled training sample sets for efficiency and quality of learning.

This experimental design uses a strict cross-validating mechanism in the hope that the experiment results from the testing phase can be generalized to a more general population of

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students. We adopt a 5-fold cross-validation method in testing the accuracy and reliability of the learning model. Also, with the help of the time series analysis method, we will be able to confirm the validity of conducting our experiment in dynamic environments, which will make research results both practical and timely.

The development and validation of such models of personalized learning follow an iterative optimization strategy with the ultimate objective of its promotion in application in different disciplines, grades as well as cultural backgrounds. The performance of the groups of students in personalized teaching enabled the mode to be significantly better than in traditional mode of education, thus verifying its effectiveness.

In a nutshell, this research enriched the theory for personalized education and its potential effectiveness into practice through establishing and applying personalized learning models. This no doubt provides very abundant direction and reference for designs and implementations of personalized educational intervention strategies to be used in the future. Our research could be able to contribute broadly and exert profound impacts on the academic community and educational practice.

## 3.2. Practice and Challenges of Personalized Education

In the current practice of education, personalized educational practice is slowly coming to the front. It thrives on creating one-to-one teaching schedules that should match the personal particulars of various students. The effective process in an implementation study of personalized education and strategies for its challenges is mechanized on profound theoretical analysis and empirical research. The process of implementing individualized learning is studied by establishing a systematic methodological framework. The personal particulars of students, namely their cognitive level, interest preferences, and learning behavior patterns, are completely analyzed. According to this characteristic analysis, there was a development of a personalized teaching plan along with learning activities and many accompanying elements in the learning process so as to ensure maximum learning efficiency and the engagement of the learners.

In the process of implementation, the effectiveness of teaching is detected on time by various quantitative tools and qualitative observation means, so if the result is not ideal, the teaching strategy can be adjusted quickly; for the situation of ideal results, the implementation plan is consistently optimized and deepened. Finally, it evaluates the effectiveness of personalized education by systemic evaluation means to ensure that the realization of the teaching goal is effectively achieved.

Therefore, the solutions to all these associated challenges were suggested and integrated into this research to be available in a "Table of Challenges and Solutions for Personalized Education" in their most important links: from teachers' training to the processing of students' differentiation up to building the evaluation system. This table of partnership deems that a group cooperation as well as a project-based teaching method shall solve the problem of individual differences between students in developing their learning interest and sense of achievement. We would like to suggest that it would be better to hold a specialized training program for those teachers who are less experienced in teaching in a personalized way and also to introduce internationally advanced means for this purpose, in order to achieve higher teaching ability. Each challenge clearly has factors that influence it, corresponding solutions, expected outcomes that solving the problem would bring, the difficulty level of implementation, and success indicators.

In a word, the in-depth educational reform for personalized education is not a simple reform in the teaching model. This study gave the concreteness of frame in practice and provided support in implementation to eliminate difficulties so that the concept of personalized education can be

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effectively done at all effective levels to enhance equity and quality of education and emancipate the potentials of each student.

# 4. Empirical Research Analysis

## 4.1. Research Method Design

The research design accompanying the flowchart's guiding principles acts as a check for the accuracy of the research direction and systematicity of the research activities in developing personalized educational practices of problem-based learning models. From the establishment of the research question, it will immediately enter the design of the research program, which has been the core task within the framework, that being the establishment of a specific framework and an operational model for research. In this regard, the research program, through its careful design, adopts a parallel approach to quantitative and qualitative research. Quantitative research quantifies the changes in student learning through the model's implementation large-scale questionnaire survey and the analysis of grade data, while qualitative research conducts a follow-up inquiry into individual differences and coping strategies through interviews and analyzed cases. The two research approaches are integrated to comprehensively examine the supportive role of problem-based learning models in personalized education.

Implementation of classes in the Learning Platform plays a profound role in the collection of data. It allows the sorting out of the specific application of the plan for the implementation of personalized teaching whereby the raw data is filtered and classified through dynamic tracking online and real-time recording offline. During the data analysis process, there will be a need for the aid of SPSS software and the Nvivo coding technology in help for the statistical analysis of the quantitative data and thematic coding of the qualitative data so as to have accuracy and depth of the results.

Further combine regression analysis, analysis of variance, and other methods to carry out in-depth mining of data, explore the specific effects of different individual characteristics and learning environments on learning outcomes, as well as the interaction between these influencing factors and personalized learning strategies. Based on the above, the research hypothesis will be demonstrated, and the effectiveness of the problem-based learning mode in personalized educational practice is verified. All research processes have strictly followed academic norms, with rigorous logic, ensuring the originality and profoundness of the research. At the same time, such research results can provide solid theoretical support and an empirical basis for educational practice. The results of the research will be disseminated, seeking to increase the attention and depth of the scholars in this field of study, both at home and abroad.

## 4.2. Practical Research Results and Discussions

During the practical researching stage, it conducted a case-control analysis between the traditional teaching method and Problem Based Learning (PBL) mode. A comparison of the different grades from junior high to senior high school is based on their subject performance data, which was collected to evaluate the educational effects of the teaching mode quantitatively. Importantly, the paired sample t-tests and the Cohen's d-effect analysis are going to strive to compare the test results of the two teaching modes strictly.

The experiment selected mathematics, science, and Chinese language as experimental subjects from six high schools, embracing a total of 1200 students. The research design conformed to excellent practices in the processing of education, retaining parallelism between the control and experimental groups during implementation as much as possible. The control group continued to adopt the traditional teaching mode, while the experimental group totally changed

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to PBL mode. The teaching experiment lasted for two semesters, ensuring a sufficient time span to observe the long-term teaching effects.

Performance data of the experiment and control groups, collected towards the end of the teaching cycle, was instrumental in forming a research data analysis table that highlights key comparison dimensions such as knowledge understanding, problem-solving ability, innovative thinking, and learning motivation. According to the records taken, SPSS software was used for statistical analysis of student scores in these dimensions under different teaching modes, revealing statistically significant differences between the two methods. The results indicate that in the PBL teaching mode, students demonstrated significant improvement in knowledge understanding and problem-solving abilities, along with enhanced learning motivation, self-efficacy, and teamwork skills. These improvements were proven statistically significant through significance testing. Additionally, the effect size data showed that the PBL model had a substantial impact on students' learning attitudes and abilities, confirming that the PBL education model offers significant educational benefits.

The teaching satisfaction survey involves the general satisfaction with the courses and the teaching satisfaction of the teachers after the implementation of the PBL teaching model. Teaching satisfaction, that is, the satisfaction through feedback received by the teachers, is positively related to the learning effect of students. That is to say, if tutors realize and are satisfied with the adopted teaching mode, the teaching potential of the students is more likely to be stimulated.

Data deepens such a dimension of research results on personalized educational practices, as it emerged from the table of the practical research data analysis. Among these dimensions, the PBL model is significantly superior to the traditional model in developing students' innovative ability, independent learning ability, and depth of thinking. The PBL mode has a very good technical operational path when these sets of dimensions are taken into consideration and emulated as the core contents of future educational reform. It was further established in the research that the PBL model can substantially enhance students' learning motivation, improve students' confidence, and adapt to the learning environment. Therefore, the practice of personalized education under the mode of problem learning has practical values and background application in the empirical study to provide a scientific basis for the transformation of the future educational model.

## 5. Conclusion

Thus, it can be concluded that personalized educational practice based on problem-based learning models has a remarkably promotional effect on learning outcomes for students. In this practice, the student can choose their preferable way of learning, depending on their interests and abilities, to gain better learning outcomes. Compared to traditional methods, personalized education raises interest in learning and develops creativity and problem-solving abilities.

Personalized education can also stimulate student interest and initiative, making them take a greater interest in class activities and learning processes. Students can improve their learning outcomes and motivation as they use their strengths, develop their interest in learning, and engage actively in the learning process by making autonomous selections of learning content and methods.

In conclusion, the personalized educational practices, under the problem-based learning paradigms, promote positively the learning outcomes of the students. Personalized education can meet the required students' study requirements well, cultivate their innovative and problem-solving competence, and promote enthusiasm for learning and initiative. Thus, there are sufficient reasons for believing that such personalized models of education will be widely used and enhanced in the future for education and teaching.

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## References

[1] KJDK, Qiu Hao, Practice and Exploration of Problem oriented Teaching Combined with Smart Classroom Mode in the Course of "Introduction to Underground Foundation Engineering" [J], 43 (2022) No.18, p.111-113.

[2] XDZYJY, Li Ying, Three Rings and Four Guides: Research on the Construction and Practice of Personalized Online Learning Mode of Secondary Vocational Mathematics Based on "Internet plus" [J], (2020) No.18, p.199-201.

[3] JSJYLT, Zhao Yanliang, Xue Zhengbin. Challenges and coping strategies of personalized education for primary and secondary school teachers [J]. 32 (2019) No.2, p.37-40.

[4] SXDSJ (DX), Shao Liwu, Research on Problem based Learning in High School Mathematics Situational Teaching Model [J]. 77 (2020) No.1, p.77-78.

[5] Shi Xiaoyong, Research and Practice on Mobile Teaching of Junior High School Biology Based on H5 Platform (Master's, Ludong University, 2019), pp. 63-65.

[6] Yu Jia, Research on STEM Education and Teaching Model Based on Deep Learning Theory (Master's, Jiangxi Normal University, 2020), pages 31-32.

[7] Chen Bingyan, Practical Research on High School Chemistry Stage Review Course Based on Flipped Classroom (Master's, Fujian Normal University, 2019), pp. 10-14.