Research on Evidence-based Differentiated Instruction of NCOs

Guqing Liu[1]*, Deqiang Ding[1], Jinzhi Ran[1], Qingsong Xie[1], Tao Wang[1]

[1]*The School of Information and Communication, National University of Defense Technology, Wuhan, 430030, China*
**Corresponding author. Email: liuguqing123@126.com*

Abstract

There is a problem in NCOs instruction that the teaching effect is poor due to the diversity of students' background, so differentiated instruction is introduced. It is well known that the key to successful differentiated instruction lies in sound decision making, such as reasonable grouping and appropriate teaching strategies. Therefore, evidence-based differentiated instruction is proposed to achieve the best combination of teacher experience and instructional evidence which can provide data to support the placement assessment and diagnostic assessment of differentiated instruction, thus helping teachers to make scientifically decisions. There are two kinds of instructional evidence, the first is the traditional data from the literature, questionnaires, examinations, etc., and the second is the so-called intelligent evidence collected from rain classrooms, intelligent classrooms and simulation training platforms. Especially deep neural network technology is used in simulation training platforms to recommend personalized learning resources for students. Based on the above evidence, differentiated instructional practices in NCOs were conducted. Firstly, differentiated teaching objectives and teaching contents are determined; then coarse- and fine-granularity differentiated teaching are combined to carry out individualized instruction on the basis of gradated instruction; finally, a fair and reasonable summative examination are realized through graded tests. To verify the effectiveness of the method, a randomized controlled experiment was conducted, and the results showed that evidence-based differentiated instruction can effectively improve student performance.

Keywords: *Differentiated Instruction, Evidence-based Teaching, Non-commissioned Officers (NCOs) Instruction*

1 INTRODUCTION

Differential teaching is an ancient teaching method, which can teach students in accordance with their aptitude to a certain extent. It is often used in subject education in primary and secondary schools, as well as courses in undergraduate education, such as English teaching.

NCOs training is an important part of professional education in military academies. However, the teaching effectiveness of NCOs is generally low compared with other teaching levels. One of the main reasons for this is the lack of teaching content and methods that correspond to the diverse knowledge base and different work experiences of NCOs. Naturally, differentiated instruction is proposed to solve the problem. However, there are many problems to be solved in practice, for example, how to differentiate students? Are the same training objectives applied to different students? How to ensure that the differentiated approach is effective? Therefore, inspired by evidence-based teaching, we propose the idea of differentiated instruction based on evidence, which can well combine teachers' experience and teaching evidence, so as to improve the effectiveness of NCOs' teaching.

2 WHAT IS THE EVIDENCE

David Hargreaves first proposed the concept of evidence-based teaching. He believed that teachers should make teaching decisions based on evidence like doctors [14]. In 2009, Geoff Petty published the book *Evidence-based Teaching* and conducted a systematic study [8]. On this basis, Cui further points out that evidence-based teaching organically integrates the personalized experience of teachers, the objective situation of students, and the contextual nature of the teaching process [1].

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what is the evidence that supports teaching?

Whitehurst classified the evidence according to the rigor of the research methods, and he divided the research evidence into six levels from high to low: randomized controlled trials, quasi-experiment, Pre-Post comparison, Correlational studies, Case studies [13]. From sources of evidence, it is divided into two categories: first is extant evidence, which comes from literature on education; Second is re-established evidence that is collected by teachers [2]. Zheng proposed that teachers should use modern information technology to collect evidence for teaching [15].

Therefore, in order to support differentiated instruction, we consider two kinds of evidence, the first is the traditional data from the literature, questionnaires, examinations, etc., and the second is the so-called intelligent data collected from rain classrooms, intelligent classrooms and simulation training platforms. The evidence can provide data for placement assessment that helps to group reasonably and diagnostic assessment that helps to formulate teaching strategies, as shown in Figure 1.

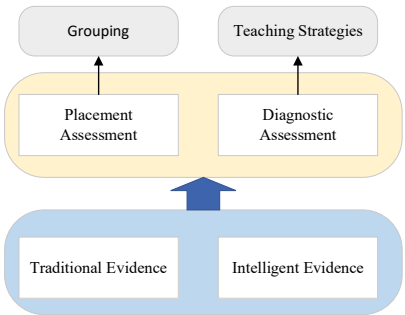

Figure 1: classification of evidence.

2.1 Traditional evidence

Traditional evidence includes two types, one is derived from the research literature; and the other is collected by teachers themselves. The former provides theoretical support for differentiated instruction, and the latter helps teachers make reasonable instructional decision.

2.1.1 Evidence from the literature

It is believed that differentiated instruction is the optimal solution to the increasing diversity of student backgrounds [10]

According to John Whitburn, flexible grouping is an effective teaching strategy for teachers to achieve differentiation in the classroom, which allows students full of differences to learn from each other in heterogeneous or homogeneous groups, allowing each student to make different levels of progress [12]. This grouping method is also evidenced in mathematics teaching, where different forms of grouping influence students' academic performance [4]; Process evaluation is also considered to be a part of teaching that cannot be ignored, which enables students to understand their current level and the need to continue to learn relevant knowledge that they have not yet firmly mastered [6]; Teachers' experience, attitude, motivation, awareness and preparation for differentiated instruction affect effectiveness in differentiated instruction [5]. Also, external factors such as class size, teachers' availability to prepare and implement differentiated instruction, cooperation among teachers and support of school leaders for differentiated instruction can influence teaching practices [3] [9]. And with the development of modern information technology, teachers should redesign differentiated instruction from a smart teaching perspective [7].

2.1.2 Evidence collected by teachers

To provide the evidence needed for differentiated instruction, teachers typically collect data including but not limited to: interactive exercises, observation data, survey data, standardized tests, assignments, student self-reported data, and so on. These data can be classified into two categories: some student data are relatively stable and some change more rapidly. For example, data of students' perceptual style, cognitive style, and interest in learning, obtained through questionnaires or other means, are relatively stable; achievement scores obtained through tests during the learning process develop and change over time.

2.2 Intelligent evidence

It is important in differentiated instruction to make accurate decision based on data, especially learning data of students. From Rain Classroom and Smart Classroom, a large amount of learning data can be collected to assist teachers in decision-making. In addition, in order to better match students' needs for adaptive learning, we have developed simulation training platform which uses deep neural networks to realize intelligent recommendation of learning resources. The functional of the simulation training platform is shown in Figure 2.

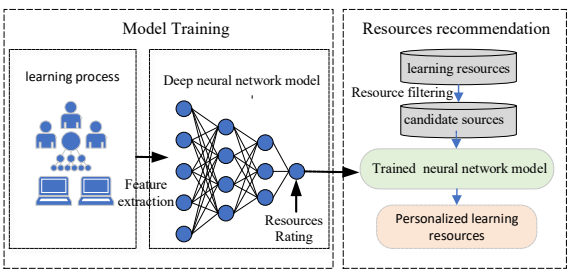

Figure 2: functional of the simulation training platform.

3 HOW TO DO EVIDENCE-BASED DIFFERENTIATED INSTRUCTION

In order to implement evidence-based differentiated teaching, the evidence required for each teaching stage is given, as shown in Figure 3.

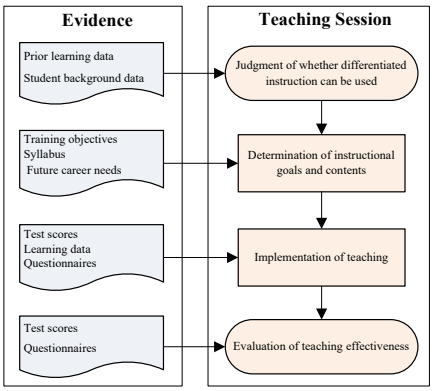

Figure 3: Evidence required for each teaching session.

3.1 Judgment of whether differentiated instruction can be used

When teachers wish to enhance the effectiveness of teaching through differentiated instruction, they first need to determine whether the target population is suitable for differentiated instruction. To do so, teachers need to collect previous learning data and student background data of the course and analyze them to determine whether students have diverse characteristics and to exclude other distracting items such as teaching quality to clarify that the main factor affecting teaching effectiveness is the failure to teach to the students' needs, and only in this case is differentiated instruction appropriate.

3.2 Determination of instructional goals and teaching contents

The determination of instructional goals has been a controversial issue in differentiated instruction. In many cases, the goals are the same for different students, and differentiation is only reflected in the teaching methods, when teachers hope to achieve the same level of learning through flexible teaching strategies. However, in some cases, the goal of differentiation is to maximize students' potential, and it is not appropriate to set the same goals for students of different abilities. Therefore, teachers need to gather evidence in order to set reasonable instructional goals. In many cases, the content of teaching will be adjusted for different audiences, especially when the objectives are different and differentiation must be achieved.

3.3 Implementation of teaching

Two core issues need to be addressed in the implementation of differentiated instruction: how to group students? what teaching methods should be used for different groupings?

Differentiated grouping can be divided into overt gradation and covert gradation in terms of whether students can perceive the presence of differentiation. overt gradation tends to discourage students' motivation, so covert gradation was proposed to avoid the Negative Effects of Labelling on Education of overt gradation [11]. In terms of granularity, differentiated grouping can be divided into coarse-granularity differentiation, which can be understood as traditional differentiated class teaching, and fine-granularity differentiation, which is a useful complement to the former. To support grouping, a series of assessments need to be designed to provide evidence, which we call placement assessments.

With reasonable stratification, different teaching strategies need to be applied to different students in terms of learning time, pace and motivation. In order to determine whether the teaching strategies are effective, it is also necessary to design corresponding assessment items, which we call diagnostic assessments.

3.4 Evaluation of teaching effectiveness

Assessment of teaching effectiveness is important for differentiated instruction to form a complete closed loop. This assessment includes the evaluation of teachers and the evaluation of students. The former can be achieved in the form of questionnaires, while the latter is the traditional sense of summative assessment. Evaluation of teachers can constitute positive feedback to the teaching process and help teachers improve their teaching decisions. How to implement summative assessment for differentiated instruction, on the other hand, is a matter of ambiguity. Some advocate that different students should be treated with different standards of assessment to reflect the purpose of differentiated instruction to respect individual differences. However, some argue that there is inequity in this approach and that the same criteria should be used for assessment. The approach should still be based on evidence and designed in terms of the goals of training and the future development needs of students.

4 PRACTICE OF EVIDENCE-BASED DIFFERENTIATED INSTRUCTION FOR NCOS

In order to conduct research on differentiated instruction for non-commissioned officers, the course Principles and Application of ASON was selected for practice. For ease of presentation, the course will be referred to as ASON below.

4.1 Judgment of whether differentiated instruction can be used for NCOs

Prior to implementing differentiated instruction, teachers collect student enrollment data, previous student learning data, pre-class questionnaires, and communicate with student representatives.

Firstly, background of students is analyzed based on the above evidence. In terms of students' knowledge reserve, the degree of NCOs students before admission includes undergraduate, college, junior college, high school and junior high school. In terms of students' work experience, the survey found that some students' jobs are not related to their majors, which makes them feel confused about their future and lack motivation to study.

Secondly, other factors are analyzed that affect with teaching effectiveness. It is found that poor teaching effect is a common problem, including courses taught by experienced teachers. Therefore, teachers' ability is not a factor affecting the quality of teaching.

From the above analysis, it can be seen that the NCO students show typical diversified characteristics, and the poor teaching effectiveness has nothing to do with ability of teachers. The main reason for it is that the mismatch between uniform teaching methods and diverse student needs, so the NCO students are very suitable for differentiated teaching.

4.2 Differentiation of instructional objectives and content

In order to have reasonable teaching objectives, the evidence collected by teachers includes: training objectives, teaching syllabus, military training syllabus, employer research, previous student learning data, student enrollment data, pre-class questionnaire, and communication between teachers and student representatives.

Based on the above evidence, it is found that students come from different types of jobs that have different requirements. In addition, great changes are taking place in the equipment of the army with the development of technology. Therefore, the NCOs teaching should not only meet the current job needs of students, but also help them build a theoretical foundation and master higher-level practical skills prepared for the future.

Therefore, it is necessary to formulate goals from the three dimensions of job factors, career development needs and army development needs. we formulate differentiated teaching objectives, which are divided into bottom protection requirements and career development requirements. On this basis, the reorganization of teaching content is targeted, and it is divided into three categories, namely, basic content, challenging content and excellent content. The first two correspond to the bottom-preserving export requirements in teaching objectives, and the excellent content corresponds to the requirements of students' future career development.

4.3 Differentiation of teaching implementation

Through the pre-course questionnaire and communication with student representatives, it was found that the NCO students are more mature than normal student and will not have inferiority complex due to differentiated treatment. Therefore, coarse- and fine-granularity differentiation are adopted.

4.3.1 Coarse-granularity differentiation

The purpose of coarse-granularity differentiation is to provide appropriate content and methods for different levels of learners. There are two main forms: class division teaching and remedial teaching. Each of these two approaches has its own characteristics and is applicable to different situations.

In class division teaching, Students are divided into A and B classes based on the results of placement assessment; B classes are taught with basic and challenging content, while A classes are taught with additional excellent content. A and B classes use different teaching methods and teaching rhythms. It is the advantage that the teaching method and teaching pace are more targeted; the disadvantages of it are that at least two teachers are needed, the students are stratified and cured. class division teaching is applicable to the situation where students are seriously stratified and the number of students at different levels is close to each other.

In remedial teaching, there is a unified teaching method and rhythm, but also a fixed school hours are set for special training. During the special training time, the lead instructor will teach excellent content for most of students and the tutor will make up the difference based on the results of the diagnostic assessment. The advantage of remedial teaching is more flexible. however, this approach is not suitable for students with serious stratification due to the uniform teaching method and pace. Therefore, it is suitable for the situation where the number of students at one level is much larger than that at another.

4.3.2 Fine-granularity differentiation

Fine-granularity differentiated teaching enables timely feedback and interaction between teachers and students at the same level, thus providing learners with personalized learning support.

The key to fine-granularity differentiated teaching is to achieve timely feedback and interaction between teaching and learning, which can be achieved by the most traditional methods or by means of information technology. For example, to help theory learning, the ASON course publishes Daily Learning on Rain Classroom, which draws on the concept of microlearning to increase the effective time for students. Daily Learning is a diagnostic assessment, so teachers are able to keep track of their students and address their problems by the help of the powerful statistics and analysis of the technology platform. In addition, for practical skills learning, the ASON course achieves adaptive learning based on the simulation training platform, which can realize three training modes of wizard, self-assessment and assessment. Using the platform, the teacher's function converts from knowledge teaching to answering questions and solving problems, and enables students to personalize their learning at their own pace.

4.4 Differentiation of summative assessment

How to do final assessment is a difficult issue in differentiated teaching. For example, in the class division teaching, if the same test questions are used, it is unfair to the students in Class B because of the different contents learned by the students; if different test questions are used, it is unfair to the students in Class A. Therefore, it was decided to use the gradient test for the final assessment. In the theoretical examination, the gradient test is realized by using the difficulty rationing method: 80 points for basic content, 10 points for challenging content, and 10 points for excellent content. In the practical test, the questions are divided into three levels according to the difficulty coefficient: easy, medium and hard, corresponding to the basic content, challenging content and excellent content, with full scores of 80, 90 and 100 respectively. The students can determine the level of the test according to their own situation.

A randomized controlled trial is conducted in two classes. The results show that evidence-based differentiated instruction can significantly improve students' performance compared with general instruction, including theory score and total score, as shown in Figure 4 and Figure 5.

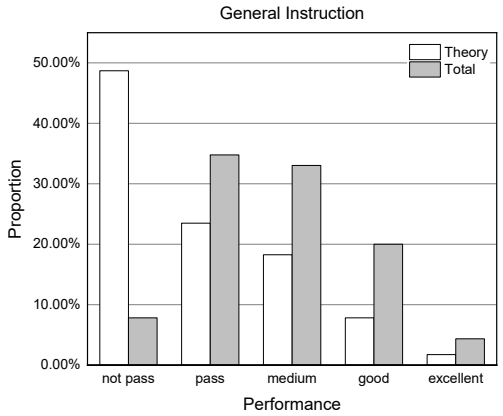

Figure 4: Performance of students in general instruction.

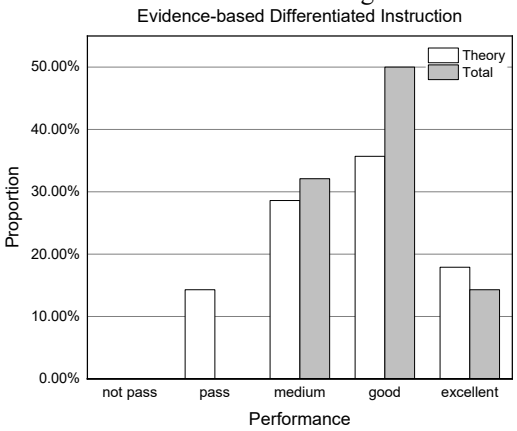

Figure 5: Performance of student in evidence-based differentiated instruction.

5 CONCLUSIONS

In the instruction of NCOs, we try to solve the difficulties of diversified students' background and poor teaching effect through differentiated training objectives, differentiated teaching contents and differentiated teaching implementation. The key to the success of differential teaching is to make scientific and reasonable teaching decisions based on authentic evidence. In the information technology era, there will be more and more sources of educational evidence. It is foreseeable that the application of big data and other technologies will bring new vitality to differentiated instruction.

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