Analysis of the Task-Driven Instruction Method of the Course "Statistics" Based on SPSS

Peiru Dai(✉), Wei Zhang, and Qingmei Chen

Guangdong University of Science and Technology, Dongguan, Guangdong, China
frequal@163.com, zw1010551@whu.edu.cn

Abstract. Based on the concept of competency-based teaching, a task-driven teaching approach is adopted in the realistic teaching of the Statistics course to improve students' competence. This paper collects data on the evaluation of students' influence factors on teaching methods and teaching effects, and uses SPSS to analyze the data through research, and finds that in task-driven teaching, the teaching design of tasks is the main effect and the mediating effect of students' factors, based on the data results for the later task-driven Based on the data results, we found that in task-driven teaching, the instructional design of the task is the main effect and the mediating effect of student factors.

Keywords: Task-driven instruction method · SPSS · Instructional Design · Teaching Effectiveness

1 Introduction

China's 13th Five-Year Plan for National Education Development in 2017 proposes that eligible general undergraduate universities transform into application-oriented. The talent cultivation of applied undergraduate colleges and universities is different from both research universities, which mainly cultivate academic talents, and vocational colleges and universities, which mainly cultivate skilled talents, and it is based on the realistic demand of strengthening the structural balance of talent supply. Applied talents are mainly engaged in non-academic research work under the guidance of certain theoretical norms, and their task is to convert abstract theoretical symbols into concrete operational ideas or product configurations and apply the knowledge to practice (Pan Mao-yuan, 2010) [1]. Unlike the traditional knowledge-based education model, competency-based education aims to cultivate students with professional knowledge and skills, adapt to the competitive needs of society, and be able to use various resources to solve practical problems. Based on this, more and more universities have started to apply the "competency-based" education theory in their teaching. Yao Xingliang [2] (2020) has made useful thoughts and researches on the teaching of marketing planning based on the competence orientation, with the work task as the main line, optimizing the teaching content, realizing the zero distance between the teaching content and the work content, aiming at cultivating the ability of higher vocational students to apply what they have learned and creating useful talents for economic construction. Chen Yitian [3] (2021)

I. A. Khan et al. (Eds.): HWESM 2023, ASSEHR 760, pp. 84–93, 2023.
https://doi.org/10.2991/978-2-38476-068-8_13

explored the talent cultivation strategies of applied undergraduate colleges and universities under the perspective of competency-based education in order to improve the quality of talent cultivation in applied undergraduate colleges and universities.

At present, the teaching of "Statistics" course is mainly based on theoretical teaching, and the students' logical thinking as well as the ability of comprehensive analysis of problems is not sufficient to improve. Therefore, based on the theory of "competence-based" education for applied talents, in order to cultivate students' data analysis ability, we need to strengthen students' practice and participation in teaching, and adopt the task-driven teaching method: in the teaching of "Statistics", we introduce case scenarios and prepare task sheets for different types of data analysis, so as to guide students with task-driven learning. The task-driven approach is used: the teaching of Statistics is introduced by case scenarios, task sheets for different types of data analysis are prepared, and students are guided by task-driven active learning to achieve better teaching effects. In this paper, we investigate the influence of student factors and teachers' task-driven teaching design on the teaching effectiveness of the task-driven teaching approach by using the SPSS method, and then improve the teaching mode of the course based on the analysis results.

2 Factors and Hypotheses

2.1 Task-Driven Instruction

Task-driven teaching is based on the teaching objectives, implying knowledge in one or several teaching tasks, and constructing new knowledge by completing the tasks. In "Statistics" course using task-driven teaching, the teaching design of the task sheet mainly considers the following factors: the comprehensiveness of knowledge, whether the scenario or case in the task is attractive to students, the specific and clear requirements of task operation, the appropriate level of difficulty of the task, the task can meet the goal of students' ability development and the task gives students sufficient opportunities to practice. The task-driven teaching method can reflect the main position of students, stimulate students' desire to know and develop their thinking ability. Using task-driven teaching method, students' active learning is driven by tasks, and students' ability is effectively cultivated [4] (Tian Chengliang,2020). Teachers design tasks and instruction to enhance students' participation in learning by integrating knowledge into the tasks, thus enhancing teaching effectiveness. Huang, Bin [5] (2021) under the premise of consolidating the theoretical foundation, strengthening statistical applications, focusing on practical aspects, and using case teaching to stimulate students' learning interest. This can also enhance the postgraduate students' practical awareness, application awareness, statistical application ability and data analysis ability, so as to meet the scientific research requirements of statistical application in various majors. The most important aspect of teaching reform is to build a statistical analysis talent training mode of theory-in-class experiment-outside practice, and task-driven teaching is a more effective teaching method.

Based on this, hypothesis 1 is proposed: Task-based instructional design has a positive influence on the teaching effect through students.

2.2 Student Factors

Ideally, an effective task-driven teaching approach can lead to active student participation in practice to achieve proficiency. However, for different students, showing different learning attitudes, different interest in the course, and even different peer support atmosphere will affect the teaching and learning effects that students show after receiving the tasks. Students' learning attitudeschanged positively, and their statistical analysis ability increased significantly and formed a virtuous cycle (Zong, Zhanhong, 2019) [6]. Peer-assisted learning is an effective teaching and learning strategy that helps students improve their academic performance, optimize learning strategies, enhance motivation and self-efficacy, and improve teamwork and communication skills (Zhang, R., 2022) [7]. Students' interest in the course will enhance students' learning status (Wang, L., 2022) [8], thus enhancing the effectiveness of learning the course content. The students' understanding of the course knowledge is also a student factor that affects the learning effect (Gao, Juan, 2022) [9]. Regardless of how well the instructional task is designed, differences in student factors can affect the effectiveness of teaching and learning. Based on this, hypothesis 2 is proposed: student factors play a mediating role in the effect of task instructional design on teaching effectiveness.

2.3 Teaching Effectiveness

The main purpose of this study is to enhance students' knowledge mastery through task-driven realization. By driving students to practice, knowledge is transformed into competency and enhanced. This is the main goal of task-driven teaching. Besides, the study shows that task-driven teaching method can enhance students' learning initiative and enthusiasm, improve interaction among students, and improve teachers' teaching level at the same time, which has reference significance for cultivating applied talents training in applied colleges and universities (Liu, Lifang, 2020) [10]. Thus, in evaluating the teaching effectiveness, students were evaluated in terms of mutual assistance in learning, the initiative of student participation, and the improvement of course knowledge and ability, respectively.

3 Methods and Materials

3.1 Influencing Factor Model

Based on the above hypotheses, this paper constructs a conceptual model of the influencing factors of teaching with task-driven instruction in the Statistics course (Fig. 1).

3.2 Questionnaire Design and Data Collection

This study used a five-point Likert scale to design a "questionnaire on factors affecting teaching effectiveness in task-driven teaching". The questionnaire measured students' perceptions of each variable on a five-point scale: strongly agree (5 points), moderately agree (4 points), generally agree (3 points), disagree (2 points), and strongly disagree (1

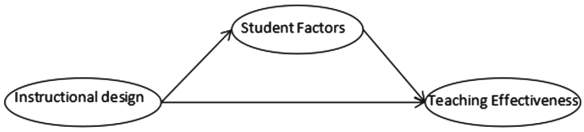

Fig. 1. The model of factors influencing the teaching effectiveness of task-driven teaching approach

point). The survey was conducted among the students in the classes taught by the task-driven teaching method in the Statistics course in this academic year. Questionnaires were distributed among 193 students who participated in the task-driven teaching method, and a total of 170 valid questionnaires were collected, and the rate of valid questionnaires collected was 88.1%.

The scale is summarized after appropriate adjustments based on the actual situation of actual task-driven teaching implementation by referring to the relevant scales of other scholars (Table 1).

Task-driven instructional design: this scale is adjusted based on the scale used by Gao Juan [10] in her study of the learning effects of blended instruction according to the actual design characteristics of task-driven instruction and the achievement of the cultivation purpose. The task design scale of this study includes 6 dimensions. The reliability of this study was tested using SPSS. The reliability of the scale is 0.908, which is greater than 0.8, indicating that the scale has good reliability. See Table 2 for details.

The CITC score is the Corrected Item-Total Correlation, which is the correlation coefficient between each item and the total score. The current CITC coefficient for each item is moderate and above (0.4), indicating that the item is at least moderately correlated with most of the other items, indicating that the existing items are good combination components.

Student factors: this scale is also adapted from Gau juan's student factors scale, using the 4-item scale used. In this study, the reliability of the scale is 0.767, which is between 0.7 and 0.8, indicating that the scale has good reliability. CITC $>$ 0.4 indicates that the existing items are good combination components. See Table 3 for details.

Instructional effectiveness: the variable is set based on the main purpose of task-driven instruction, the scale used a five-item scale The reliability of this scale is 0.901, which indicates that the scale has good reliability. CITC $>$ 0.4 indicates that the existing items are good combination components. See Table 4 for details.

Control variables: In order to conduct an accurate analysis of the research questions and to exclude the interference of irrelevant variables to the relevant questions, the control variables in this study included statistical variables such as gender and class of the subjects.

4 Data Analysis

4.1 Common Method Variation Test

In this study, the Harman's One-factor Test (HST) was used to test the data for common method variance in the sample. The KMO value of 0.906 was obtained after an exploratory factor analysis of all question items, and the scale explained 68.186% of

Table 1. Table of teaching effects, influencing factors variables and their meanings

Factors	Variables	Measurement question items
Instructional design	Difficulty level	The level of difficulty of the task content in the task
	Knowledge comprehensiveness	The knowledge points in the task integrate multiple knowledge chapters, reflecting comprehensiveness
	Request Specificity	Specific and clear requirements in the mission
	Case Appeal	The scenario or case in the task is attractive to students
	Clarity of training objectives	Clear objectives in the task for student competency development
	Opportunities for student participation	Sufficient opportunities for students to engage in statistical analysis exercises
Student Factors	Interest in learning	Students' interest in learning the course
	Initiative	Students' initiative in learning is good
	Mutual support among students	Good learning atmosphere of mutual help among students
	Degree of understanding of knowledge	Students have a good understanding of knowledge
Teaching Effectiveness	Motivation to participate	Active participation in the various tasks in the course
	Knowledge acquisition	Degree of knowledge of statistical analysis
	Comprehensive ability	Students' ability to synthesize and analyze data
	Active learning	Improvement of learning initiative
	Enhanced interactivity	Students' motivation to communicate with others in order to complete tasks

the total variance, of which the maximum variance explained by the factor was 47.99%, indicating that no single factor could explain the vast majority of the variance, and the common method bias was well controlled in this study. The specific values are shown in Table 5.

Table 2. Cronbach's Reliability Analysis of the Task Instructional Design Scale

Title	CITC	The α coefficient of the deleted item	Cronbach α
Difficulty level	0.640	0.907	0.908
Knowledge comprehensiveness	0.768	0.890	
Request Specificity	0.777	0.888	
Case Appeal	0.730	0.897	
Clarity of training objectives	0.804	0.884	
Opportunities for student participation	0.780	0.887	
Standardized Cronbach α coefficient: 0.910			

Table 3. Cronbach reliability analysis of student factor scales

Title	CITC	The α coefficient of the deleted item	Cronbach α
Interest in learning	0.601	0.695	0.767
Initiative	0.606	0.690	
Mutual support among students	0.578	0.708	
Degree of understanding of knowledge	0.491	0.749	
Standardized Cronbach α coefficient: 0.768			

Table 4. Cronbach's reliability analysis of the Teaching Effectiveness Scale

Title	CITC	The α coefficient of the deleted item	Cronbach α
Motivation to participate	0.605	0.909	0.901
Knowledge acquisition	0.769	0.876	
Comprehensive ability	0.836	0.861	
Active learning	0.824	0.863	
Enhanced interactivity	0.740	0.883	
Standardized Cronbach α coefficient: 0.900			

4.2 Descriptive Statistics

As shown in Table 6, the instructional design of the tasks was significantly and positively correlated with the student factor ($r = 0.452$, $p < 0.01$) and with the instructional

Table 5. Common method variance test

Total number of stated variants						
Components	Starting Eigenvalues			Fetch square and load		
	Total	Mutated %	Cumulative %	Total	Mutated %	Cumulative %
1	7.678	47.99	47.99	7.678	47.99	47.99
2	1.882	11.762	59.753	1.882	11.762	59.753
3	1.349	8.434	68.186	1.349	8.434	68.186
4	0.828	5.174	73.36			
5	0.618	3.865	77.225			

Table 6. Means, standard deviations and correlation coefficients of the study variables

	Instructional design	Student Factors	Teaching Effectiveness
Instructional design	1		
Student Factors	.452**	1	
Teaching Effectiveness	.617**	.623**	1

Comment: N = 170; ***p < 0.001; **p < 0.01; *p < 0.05.

effectiveness ($r = 0.617$, $p < 0.01$). The student factor was significantly and positively correlated with instructional effectiveness ($r = 0.623$, $p < 0.01$).

4.3 Hypothesis Testing

The Main Effect of Instructional Design

Hypothesis 1 proposes that instructional design is positively related to instructional effectiveness. This main effect was tested in SPSS 26.0 using multiple linear regression. The instructional design of the task is set as the independent variable and the instructional effectiveness is set as the dependent variable, and the control variables is first placed into the regression equation and then the independent variable (instructional design) was added. The results of the regression shows that the instructional design of the task had a significant effect on instructional effectiveness ($r = 0.617$, $p < 0.01$), indicating that instructional design was significantly and positively related to instructional effectiveness. Thus, hypothesis 1 is tested.

Mediating Effects of Student Factors

Hierarchical regression is used to verify the mediating role of student factors between instructional design and instructional effectiveness according to the analysis steps suggested by Baron and Kenny. Task instructional design is significantly and positively related to student factors ($r = 0.426$, $p < 0.01$). Student factors are significantly and positively correlated with instructional design ($r = 0.751$, $p < 0.01$). The effect of instructional design on instructional effectiveness ($r = 0.421$, $p < 0.01$) remained significant

Table 7. Results of main effects and mediating effects tests

Variables	Teaching Effectiveness	
	M1	M2
Instructional design	0.617**	0.421**
Student Factors		0.433**
△R2	0.377	0.524
F	103.237	93.941

after the student factor entered the equation, but became less significant. Therefore, the student factor play a partially mediating role in the implementation of the task-driven instructional approach for enhancing teaching effectiveness, which supports hypothesis 2.

The results of the relevant main and mediating effects tests are shown in Table 7.

5 Conclusion

The above data analysis shows that task-driven instructional design has a positive impact on teaching effectiveness enhancement. Thus, it is important to strengthen the task instructional design before task implementation. At the same time, the student factor plays a mediating role in the process. We need to focus not only on the task instructional design aspect, but also on how to facilitate student factors in the instructional implementation process.

5.1 Task-Driven Instructional Design

Enhance the attractiveness of the task and increase students' interest in learning. Based on the results of the previous analysis, we interviewed the students again. The interviews revealed that the students were satisfied with the design of the task teaching. However, the scenarios or cases in the tasks were not attractive enough for the students. Thus, before implementing the task-driven teaching approach, we should strengthen the case attraction. Combined with the case introduction of a real-life workplace scenario, allows students to better substitute for their roles.

Refine the operational requirements of the task to promote students' understanding of the task. The data shows that students' inadequate understanding of the task affects instructional effectiveness. The model of task sheets is different from traditional assignments. The existing task sheets often do not have completely standard answers, and each student will make different analysis results depending on their data analysis skills, such as the depth of analysis and the form of the graphs. Thus, to not change the difficulty of the existing tasks, but to ensure that they are at the training requirements, it is necessary to strengthen the teacher's introduction of the task sheet content.

Optimize task teaching design to strengthen students' comprehensive ability. The pedagogical design of the task also needs to be enhanced with regard to the content of

the integrated data analysis skills development. Although some students found the task difficult due to the lack of basic knowledge. However, some students find the tasks more challenging because of the difficulty, and they are more interested in practicing. Good and comprehensive instructional design enhances student interest.

5.2 Pay Attention to Student Factors

In task-driven instruction, attention needs to be paid to the student factor as a mediating influence. First, students' level of understanding of knowledge is related to their current level of knowledge. To better implement task-driven, we need to provide some basic knowledge content for students of different levels. This can enhance students' understanding of the knowledge. Second, teachers try to enhance students' learning initiative through instructional implementation in their teaching. If students lack initiative, they will still not practice even though reference knowledge as well as clear guidelines are provided in the task book. Third, the learning atmosphere in the class is also important. The teaching promotes mutual assistance in learning among students, thus influencing the learning initiative of their classmates. Fourth, teachers should do a good job in guiding the task through teaching methods and teaching techniques in order to enhance students' interest in the course.

The current study did not analyze the extent to which teacher factors influenced the implementation of task-driven instruction. Thus, in the subsequent implementation, the role of teacher factors in task-driven instruction will be further considered, such as the teacher's design of task-driven instruction, the teacher's teaching attitude, the teacher's guidance to students, and so on. Teacher factors will be analyzed comprehensively in order to improve the effectiveness of the implementation of task-driven teaching approach in a comprehensive manner.

References

1. Pan Maoyuan. (2010). What is an applied bachelor's degree? Explorations in Higher Education (01), 10-11
2. Yao Xingliang. (2020). Research on teaching marketing planning based on competence-based. Wealth Today (02), 110-111.
3. Chen, Yi-Tian. (2021). Research on talent cultivation of applied undergraduate universities under the perspective of competency-based education. Heilongjiang Science (05), 80-81.
4. Tian, Cheng-Liang. (2020). Using task-driven to improve the quality of teachers' online training: An example of new physics teachers' training in Haidian District. Beijing Education (General Education Edition) (11), 35-36.
5. Huang, B. (2021). Exploring the teaching reform of applied mathematical statistics course based on the cultivation of postgraduate data analysis ability. Journal of Jilin Institute of Chemical Technology (06), 1-4. https://doi.org/10.16039/j.cnki.cn22-1249.2021.06.001. doi:https://doi.org/10.16039/j.cnki.cn22-1249.2021.06.001.
6. Zong Zhanhong. (2019). Practice and exploration of statistical analysis capability training for undergraduate students. Statistics and Management (06), 18-21. https://doi.org/10.16722/j.issn.1674-537x.2019.06.005.doi:10.16722/j.issn.1674-537x.2019.06.005.

7. Zhang, R.. (2022). Peer-to-peer learning for college students: A comparison of typical experiences in American and Australian colleges and universities. Journal of Chengdu Normal College (02), 80-89.
8. Wang Ling. (2022). The effect of public teacher training students' motivation to enter school on learning status: the mediating effect of learning interest. Contemporary Teacher Education (02), 55-61. https://doi.org/10.16222/j.cnki.cte.2022.02.002.doi:10.16222/j.cnki.cte.2022.02.002.
9. Gao Juan., Zhou X. T., Chen S. & Sui J.. (2022). A study on course reengineering based on blended teaching learning effect evaluation - A case study of Chinese business environment. Modern Business Industry (22), 211-213. https://doi.org/10.19311/j.cnki.1672-3198.2022.22.087.doi:10.19311/j.cnki.1672-3198.2022.22.087.
10. Liu, Li-Fang. (2020). Practical research on task-driven teaching method in applied colleges and universities - taking cross-border e-commerce course as an example. Foreign Trade and Economics (08),146-149.