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To Improve The Quality of Sports Statistics Teaching Through The Use of Case-Based Teaching for Undergraduates Majoring in Physical Education at Nanning Normal University

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Abstract

This study used an experimental design to compare the knowledge acquisition, course satisfaction, and learning interest of case-based and traditional sports statistics students. The study included 90 juniors from Nanning Normal University's College of Physical Education and Health in Guangxi, China. The experimental group was taught case-based teaching and the control group traditional teaching, but the teaching method, content, materials, and assessment criteria were the same, and the instructors followed the syllabus and instructional design. Testing and data collecting followed each action research cycle in the 16-week project. In the first cycle of action research data, self-assessment of knowledge mastery and interest in learning were significantly higher than baseline data for both groups; in the course test, the experimental group performed significantly better than the control group, but there was no difference. In the second cycle of action research data, self-assessment of knowledge mastery, course quiz performance, and course satisfaction were significantly higher in the experimental group than in the control group. Learning interest was not different. Conclusion: Case-based teaching in sports statistics increased physical education students' knowledge mastery and provides practical pedagogical guidance for sports statistics education and strong support for future research and practice. To fully comprehend the case-based teaching method's potential for sport statistics, more study is needed on its long-term effects, applicability, and implementation techniques.

Keywords: Sports Statistics Case-Based Teaching Physical Education Students

Introduction

As an important branch in the field of sports science, sports statistics provides a scientific basis for decision-making and practice in the field of sports by collecting, organizing, analysing and interpreting data. At the same time it not only focuses on the performance of athletes and teams, but also involves data analysis and the application of statistical methods. In higher education, it becomes especially crucial to cultivate students' ability to analyse data and apply statistical knowledge practically. As a teacher of sports statistics for many years, I have found that the theses of sports college students basically use only simple statistical methods, such as averages and percentages, and very few students use basic statistical methods, such as T-

test, F-analysis of variance, or correlation analysis. The reasons behind this problem are multifaceted. First, the knowledge covered in a sports statistics course is abstract, whereas students majoring in physical education tend to learn visual thinking rather than abstract thinking. Second, the content of sports statistics courses is abstract and profound, emphasizing theoretical teaching and formula derivation. In addition, students often lack motivation for theoretical learning, have a weak theoretical foundation, and have difficulty thinking independently, leading to challenges in this course. The current lack of sports statistics knowledge and insufficient application skills among sports college students is a real problem. Traditional theoretical teaching methods fail to lead them to think deeply about how to apply statistical knowledge to real sports scenarios.

Against this back cycle, the case method has become a highly sought-after teaching tool that guides students through real-life examples and provides them with a learning experience that is more relevant to their real-world needs. The teaching of sports statistics requires a more specific and practical approach to meet the urgent need of students to analysed and apply their statistical knowledge. The case method is a powerful teaching tool that can motivate students to gain a deeper understanding of theoretical knowledge, develop realworld problem-solving skills, and increase their confidence in the practical application of sports statistics. Under the current back cycle of rapid development of information technology, the large amount of sports data generated provides more possibilities for the case teaching method. A large amount of competition data, athletes' performance data and other related information provide rich materials for case design and experimental research, enabling students to understand more intuitively the practical application of data analysis in the field of sports. How to better introduce the case teaching method in this context of intertwined challenges and opportunities has become an urgent issue.

Therefore, the purpose of this study is to achieve the expected teaching effect by adopting the case teaching method in this course, in view of the fact that the classroom teaching effect of sports statistics has been low for a long time, the students have a rejection of the course, and the students cannot well grasp and apply the statistical knowledge they have learned, and thus the students can grasp the relevant knowledge of sports statistics and can apply it to practical problems.

Reforms in The Teaching of Sports Statistics

Sports statistics, although not listed as one of the seven major foundational courses in the “National Standards for Undergraduate Professional Courses," plays a significant role in the field of sports. For example, in the field of sports training, coaches and athletes can use key data such as ball possession rate and serve percentage to develop strategies (Wang, 2022). In the domain of sports psychology, statistical indicators like winning percentage and confidence level can be used to observe changes in athletes' psychological states after interventions, thus assessing the effectiveness of psychological training and its impact on athletes' performance. Sports statistics is also applied in areas such as youth physical development evaluation and scientific athlete selection (Liu, 2019). Sports statistics applies principles and methods of mathematical statistics (Yin & Liu, 2021; Zhou, 2020). The course content is abstract and profound Du (2012); Zhou (2020), requiring logical thinking and comprehension skills (Zhou, 2020). Additionally, sports majors tend to have better visual thinking than abstract thinking, and their theoretical foundation is often weak Dong (2019), leading to the perception that this course is challenging (You, 2019; Yin & Liu, 2021). Based on this, improving the teaching quality of sports statistics has been a concern among scholars. Various teaching methods have been

attempted, including PBL and TBL teaching models Dong (2019); Zhou (2020); Yin & Liu (2021), active learning-based approaches Wang & Li (2021); Chen & Zhang (2018); Zhang& Wang (2018), flipped classrooms Deng & Xu (2017); Wei & Li (2021), project-based teaching methods Wang & Gao (2015), and case-based teaching Zhou & Wang (2016), all of which have shown positive teaching effects. However, there is no one-size-fits-all teaching method, as it depends on factors such as students' aptitude, teaching methods, and course content (Du et al., 2013). Therefore, the selection of teaching methods should be based on the teacher's abilities, student characteristics at the institution, and the teaching environment. 2.2 Theoretical Foundations of the Case-based Approach.

Constructivist learning theory holds that learning is a process in which learners actively construct knowledge rather than passively accept it. In this process, learners form their own cognitive structure through active exploration, discovery, and reflection. The case teaching method is in line with the basic ideas of constructivist learning theory by providing cases of real situations and guiding students to independent inquiry and cooperative learning.

In the case teaching method, teachers design inspiring and guiding cases according to the constructivist learning theory. These cases usually contain real situations and problems, aiming to stimulate students' desire for inquiry and thinking ability. Students take the initiative to explore the problem and form their own cognitive structure by analysing the case, proposing hypotheses, conducting experiments, and verifying the steps. In this process, students not only acquire new knowledge, but also improve their ability to analyse and solve problems. Social interaction theory holds that learning takes place in social interaction, and learners can better promote their own learning through communication and cooperation with others. Group discussion and teamwork in the case teaching method provide students with opportunities to communicate and cooperate with each other, which helps to cultivate students' teamwork and communication skills.

In the case teaching method, teachers divide students into groups or teams according to the theory of social interaction and encourage them to engage in cooperative learning and discussion. Through group discussion and communication, students can share each other's viewpoints and experiences, inspire and supplement each other, and promote the sharing and construction of knowledge. In addition, teamwork can cultivate students' communications kills and collaborative spirit, helping them better adapt to the future work and social environment.

Methodology

This study uses a combination of quantitative and qualitative methods in order to comprehensively assess students' self-assessment of knowledge mastery, self-assessment of learning interest, course test scores, course satisfaction, and learning summaries. Quantitative data will be collected through self-assessment of knowledge mastery, self-assessment of interest in learning, course satisfaction, and standardized course tests. Qualitative data will be obtained through the writing of learning summaries by students in each class to gain insight into the students' experience in case-based instruction.

Timeline for data collection: baseline tests for self-assessment of knowledge mastery and self-assessment of learning interest will be administered before the study begins. Each cycle of action research was conducted at the end of each cycle to collect data: self-assessment of knowledge mastery, self-assessment of learning interest, course quiz scores, course satisfaction, and learning summaries. In order to analyse the changes of the data between the two cycles.

The data were cleaned before statistical analysis and the quantitative data collected at all time points were valid. After data cleaning, SPSS22.0 was used to carry out statistical analysis of quantitative data, including descriptive statistics, T-test, etc., in order to compare the differences between the experimental group and the control group before and after the different action stages. Qualitative data will be summarized and generalized to extract important ideas and themes from students' texts to support the interpretation of quantitative data.

Results

From the data in Table 1, it can be concluded that at the beginning of the experiment, there was no significant difference between the experimental group and the control group in either knowledge mastery self-assessment or learning interest self-assessment (T=1.318, P>0.05; T=0.252, P>0.05). This indicates that at the beginning of the study, the two groups of students had similar baseline levels of self-assessment of knowledge mastery and self-assessment of interest in learning, which could be continued in the follow-up study. The mean of the knowledge mastery self-assessment shows that the students' knowledge of sports statistics was very low and almost non-existent.

From the analysis of the data in Tables 2, 3, and 4, it can be concluded that at the end of the first cycle of action research, whether in the experimental group or the control group, only the self-assessment of knowledge mastery differed significantly from the baseline data: the experimental group (T=-14.539, P<0.05), the control group (T=-16.348, P<0.05)), and there was no significant difference between the self-assessment of learning interest and the baseline data of the two groups. The only significant difference between the experimental group's course quiz scores and the control groups in the first cycle of the action research (T=7.828, P<0.05)) was that there was no difference in the other dimensions of knowledge mastery self-assessment, learning interest self-assessment, and course satisfaction (T=-0.491, P>0.05; T=-0.805, P>0.05; T=0.013, P>0.05).. From the mean value, after 8 weeks of teaching, no matter after using the case teaching method or traditional teaching method, the students can obtain a certain knowledge mastery, and the course quiz scores of the students in the experimental group are higher than those of the control group. However, according to the logic, there should be a significant difference in the self-assessment of knowledge mastery, which is higher than the baseline score, but the result is just the opposite. It is possible that although the course test scores were higher than those of the control group, the self-assessment of knowledge mastery was subjective, and therefore there were times of conflict.

At the end of the first cycle of action research, the collected learning summaries of the students in the experimental and control groups were summarized and analysed. Overall, the positive learning experience of the students in the class using the case teaching method was only slightly higher than that of the control group, but the students in both classes wrote in their summaries that as physical education majors, their mathematical and logical abilities were more checked, and that they felt that physical education statistics were more difficult to understand. In particular, students using traditional teaching methods reacted slightly more strongly to more theoretical lectures and public derivations, which could not be remembered at all.

From the teacher's daily lectures, students participate in the classroom enthusiasm is not high, set up group work is only the group leader and individual students to discuss, not all students are involved.

From the analysis of the data in Tables 5, 6, and 7, it is concluded that after the second

cycle of action research, the self-assessment of knowledge mastery, course test scores, and course satisfaction of both the experimental group and the control group in the second cycle were significantly different from those of the first cycle, and there was no significant difference between the self-assessment of learning interest in the second cycle and that of the first cycle.

The experimental group's self-assessment of knowledge mastery, course quiz scores, and course satisfaction were each significantly different from the control group's ($T=4.567$, $p<0.05$; $T=8.861$, $p<0.05$; $T=8.387$, $p<0.05$). There was no significant difference in self-evaluation of learning interest ($T=0.516$, $P>0.05$). From the mean value of each dimension, after the last 8 weeks of teaching, no matter after using the case teaching method or the traditional teaching method, the students can obtain a certain degree of knowledge mastery, at the same time, the experimental group of students' knowledge mastery is much higher than that of the control group.

Through the implementation of the revised program in the second stage, it seems that overall,students' course satisfaction and grades in the experimental group were higher than those in the control group. If there is a case teaching class students named their own learning is summarized as: from resistance to acceptance, the transformation of sports statistics: the student mentioned that at the beginning of the teacher to see a large number of data given, the head is big, do not know where to start, but after 16 weeks of teaching, the teacher continues to use the case for teaching and explaining, the idea is more and more clear, and is no longer like before when faced with a set of data in a daze.

Discussion

The four hypotheses in the study have been mostly verified, no matter whether the case study or traditional teaching method is taught, the self-assessment of knowledge mastery and course quiz scores have been improving, while the self-assessment of knowledge mastery and course quiz scores of the final test of the experimental group are significantly higher than those of the control group. However, the self-assessment of learning interest did not increase significantly regardless of the stage. It has been an indisputable fact that college students majoring in physical education are not interested in learning. However the hypotheses that have been tested have provided us with strong evidence about the effectiveness of the case-based teaching method in sports statistics education.

Discussion of the Results of the First Cycle of Action Research

In the first cycle of the action research, both the experimental and control groups were significantly higher in their self-ratings of knowledge acquisition than their respective baseline data. This suggests that both case-based and traditional teaching methods have positively influenced students' knowledge acquisition in the short term, and after 8 weeks of study, the students' status has been changed from a non-existent state to an established one. And the experimental group's self-assessment of knowledge mastery and course quiz scores were higher than those of the control group. This can be attributed to the novel teaching methods and positive learning atmosphere, which stimulated students' interest in the knowledge of sports statistics and motivation for active learning. The course satisfaction of the experimental group was not significantly different from that of the control group, which may be due to the influence of the time factor; in the first cycle of action research, there may not have been enough time for the students to fully adapt to the new instructional design, and thus the change in course satisfaction has not yet been apparent.

Discussion of the Results of the Second Cycle of Action Research

In the second cycle of the action research, both the experimental and control groups showed significantly higher self-assessment of knowledge acquisition, course quiz scores, and course satisfaction than their respective first cycle data. This further reinforces the positive impact of the case-based approach on students' academic performance when applied over time. Possible explanations include students' gradual adaptation to the case-based approach to learning, instructors' proficiency in the use of the case-based approach during teaching and learning, and students' positive acceptance of and feedback on this pedagogy. Self-assessment of knowledge acquisition and course quiz scores in the second cycle of action research in the experimental group were all significantly different from those of the control group, and the characteristics of the case-based pedagogy, which emphasizes real-world problem solving, student participation, and interaction, thus facilitating deeper learning. The experimental group course satisfaction are significantly different from the control group, which just verified the previous analysis, due to the short period of time, students are still adapting to the new instructional design, to be 16 weeks of teaching all the way to the end of the course satisfaction in the experimental group and the control group before the emergence of significant changes.

Practical significance and educational implications of the experimental results

The experimental results of this study emphasize the practical effectiveness of the case-based approach to teaching statistics in physical education, which not only improves students' knowledge, but also enhances their satisfaction with the teaching and learning process. This provides educators with an effective teaching strategy, especially in the pursuit of depth of knowledge and active student participation. Educators may consider adopting a case-based approach in subjects such as sports statistics to optimize students' learning experience and knowledge acquisition.

Limitations of the Study and Future Research Directions

Despite the positive results of this study, there are some limitations. For example, the sample of the study was only from a specific college of a university, which may limit the generalizability of the findings. Future research could expand the sample to cover different types and levels of student populations. In addition, the study did not explore in depth the effects of individual student differences and subject characteristics on teaching effectiveness, which is a direction that future research could explore in depth.

Conclusion

The introduction of case-based instruction in sport statistics resulted in a significant increase in the level of knowledge of sport students, and these findings provide practical pedagogical guidance for sport statistics education and provide strong support for future research and practice. However, further research still needs to delve deeper into the long-term effects, applicability, and specific implementation strategies of the case-based teaching methodology in order to more fully understand its potential for application in sport statistics.

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