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The Impact of Student Club Development on the Scientific Literacy of Vocational College Students

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Abstract: This paper explores the impact of student club development on the scientific literacy of vocational college students. As society increasingly values innovation and scientific literacy, vocational colleges bear a significant responsibility in cultivating students' overall quality. Taking the Modeling and Simulation student club as a case study, the research team conducted a 12-week study. The results indicate that various club activities aimed at enhancing scientific literacy have positively influenced the development of students' scientific competencies. Students' practical skills and innovative thinking have been effectively improved. Our research demonstrates the positive role of student clubs in enhancing the scientific literacy of vocational college students, providing valuable experience and references for the development of similar clubs in the future.

Keywords: Student club; Scientific literacy; Vocational college students; Vocational education

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1. Introduction

In today's rapidly advancing technological era, scientific literacy has become a crucial indicator of an individual's ability to adapt to future societies. As a key institution for nurturing applied talents, vocational colleges face the significant mission of cultivating students' scientific literacy [1,2]. This literacy not only relates to students' academic achievements but also directly impacts their career development and social adaptability. Particularly in vocational education, students' scientific literacy is closely linked to their innovative and practical skills, enhancing their capacity to solve real-world problems and laying a solid foundation for their future careers. Existing research indicates that the enhancement of scientific literacy contributes not only to personal development but also has a profound effect on the overall level of societal civilization and economic growth. Individuals with scientific literacy are better equipped to meet the demands of technological advancement, driving innovation and industrial upgrades. Moreover, scientific literacy plays a significant role in cultivating students' sense of social responsibility. Through systematic learning of scientific knowledge, students can gain a more comprehensive understanding of the relationship

between science and society, thereby strengthening their sense of responsibility and mission toward societal progress [3].

2. Development of student organizations and cultivation of scientific literacy

2.1. Importance of student organization development

Student organizations, as an essential part of campus culture, play a crucial role in promoting the holistic development of students [4]. Through participation in organizational activities, students can enhance their practical skills and teamwork abilities, while also cultivating innovative thinking and problem-solving capabilities. Activities within these organizations often encompass various forms of practice, such as research projects, technical competitions, and community service, allowing students to deepen their understanding and application of knowledge through hands-on experience, thereby enhancing their overall competencies. Student organizations enrich campus cultural life by providing diverse activity options. The variety of organizations not only sparks students' interests but also fosters the intersection and integration of knowledge across different disciplines. For instance, scientific clubs can collaborate with arts and literature organizations to host interdisciplinary events, broadening students' perspectives and enhancing their cultural literacy. This cultural exchange and interaction contribute to the development of open-minded thinking, increasing students' interest in scientific exploration. By organizing various innovation and entrepreneurship activities, organizations offer students practical opportunities, assisting them in transforming theoretical knowledge into real-world applications. This practice not only enhances students' scientific literacy but also improves their competitiveness in the future job market [5,6].

2.2. Importance of cultivating scientific literacy

Scientific literacy is one of the fundamental competencies required for individuals to thrive in modern society. It encompasses multiple dimensions, including scientific knowledge, scientific thinking, and scientific methods. With strong scientific literacy, students are better equipped to understand and apply scientific knowledge, enhancing their critical thinking skills and enabling them to make informed decisions [7]. Furthermore, scientific literacy enables students to analyze and solve complex problems using scientific methods, thereby improving their overall personal quality. The significance of scientific literacy extends beyond individual development; it also plays a key role in the sustainable development of society. As technology advances and society undergoes rapid changes, the public's demand for scientific knowledge is increasing. Citizens with scientific literacy can more effectively engage in social affairs and drive societal progress and development. The widespread promotion of scientific literacy helps enhance public understanding and attention to critical issues such as technology ethics and environmental protection, thereby facilitating a positive interaction between science and society [8].

3. Case study and results analysis

3.1. Introduction to the student club

This study undertakes an in-depth exploration of the Modeling and Simulation student club, with the primary objective of fostering students' scientific literacy and innovative prowess through the application and practice of modeling and simulation methodologies. The membership of this club predominantly comprises individuals from related disciplines, including new energy technology, automotive manufacturing, and in-

telligent building design. This interdisciplinary amalgamation provides students with a multifaceted array of perspectives and thought processes, thereby promoting robust knowledge exchange and sharing. Through engagement in club activities, students not only hone their practical competencies but also gain a deeper comprehension of scientific theories in practical contexts, ultimately leading to a significant enhancement in their scientific literacy.

3.2. Club activities

Over the course of the club's 12-week guidance period, the research team collaborated intimately with club members to devise a comprehensive suite of activity plans aimed at bolstering scientific literacy, as illustrated in **Table 1**. These activities encompass a wide range of domains, including academic writing, patent knowledge acquisition, and innovative skills competitions. By executing these diverse tasks, the club strives to elevate students' understanding and practical proficiency concerning scientific literacy, ultimately augmenting their competitiveness in future career endeavors.

Table 1. Implemented club activities (lectures)

No.	Themes	Time (minutes)
1	The Structure of Academic Papers	35
2	Methods for Writing Abstracts of Academic Papers	40
3	Methods for Writing Literature Reviews in Academic Papers	45
4	How to Write the Research Methods Section in Academic Papers?	45
5	Data Analysis in Academic Papers - A Case Study	45
6	Patents Are All Around Us	35
7	The Innovativeness of Patents - Case Study 1	45
8	The Innovativeness of Patents - Case Study 2	45
9	Key Points of Patent Drawing - A Case Study	45
10	The Importance of Innovative Skills Competitions	50
11	Steps and Precautions for Participating in Innovative Skills Competitions	60

3.3. Assessment methods

To gauge the influence of the student club's activities on the progression of scientific literacy, this study devised a meticulously crafted survey questionnaire, the specifics of which are outlined in **Table 2**. The questionnaire encompasses eight questions (labeled Q1 to Q8), spanning various areas such as comprehension of scientific literacy, reading and writing proficiency in academic papers, mastery of patent knowledge, and the ramifications of participation in innovative skills competitions. Each question is rated using a scoring system that ranges from 0 (representing the lowest score) to 1 (indicating the highest). Surveys were administered at the inception of the experiment (Week 1) and its conclusion (Week 12), allowing for a comparative analysis of the average scores obtained during the initial and final phases of the experiment. The objective of this comparison is to ascertain the impact of the club activities on the students' scientific literacy.

Table 2. Questionnaire survey questions

No.	Themes	Scoring range
Q1	Do you understand the meaning and content of scientific literacy?	0–1
Q2	Have you read any academic papers?	0–1
Q3	Do you understand the structure of academic papers?	0–1
Q4	Does learning about academic papers contribute to your scientific literacy?	0–1
Q5	Do you have a certain understanding of patents?	0–1
Q6	Does learning about patents contribute to your scientific literacy?	0–1
Q7	Can innovative skills competitions enhance your scientific literacy?	0–1
Q8	How helpful do you think participating in club activities is for improving scientific literacy?	0–1

3.4. Results

Regarding Q1, the initial survey recorded an average score of 0.21, which subsequently improved to 0.82 in the final survey. This significant increase suggests that club activities effectively enhanced students' understanding of scientific literacy. Through engaging discussions and informative lectures within the club, students were able to delve deeper into this concept, thereby strengthening their theoretical foundation. For Q2, the initial average score stood at a mere 0.15, whereas the final score soared to 0.76. This substantial rise demonstrates that club activities successfully stimulated students' interest in reading. By organizing academic papers sharing sessions and discussions, students not only augmented their comprehension of academic literature but also honed their critical thinking skills. In terms of Q3, the initial score of 0.14 escalated to 0.72 by the end of the assessment period. This reflection indicates that club activities provided students with a clearer understanding of the structure of academic writing. Through practical writing exercises and peer evaluations, students mastered the fundamental structure of academic papers, thereby enhancing their writing skills. For Q4, the initial average score was 0.26, which improved to 0.86 in the final survey. This significant improvement signifies that students generally recognized the positive impact of academic knowledge on their scientific literacy. The learning focused on academic papers within club activities facilitated students' integration of theory with practice, further reinforcing their scientific thinking. Regarding Q5, the initial survey revealed a low score of 0.06, which increased to 0.68 in the final assessment. This suggests that club activities effectively improved students' awareness of patent knowledge. Through organized lectures on patent knowledge and case analyses, students began to appreciate the importance of intellectual property and its application in scientific research. For Q6, the initial average score for this question was 0.19, which rose to 0.68 by the end of the study. This increase reflects that students' learning about patent knowledge contributed to their enhancement of scientific literacy. By linking the content to real-world cases, students started to recognize the intricate relationship between innovation and knowledge protection. In terms of Q7, the score increased from 0.23 to 0.80, demonstrating the substantial impact of participating in innovation skills competitions on students' scientific literacy. These competitions motivated students to apply theoretical knowledge to practical problems, thereby enhancing their practical skills and fostering innovative thinking. For Q8, the initial average score was 0.24, which increased to 0.85 by the end of the survey. This significant improvement indicates a notable enhancement in students' recognition of extracurricular activities. These activities provided an interactive learning platform, enabling students to deepen their understanding of scientific literacy through hands-on experience.

Over the 12-week period, club activities significantly enhanced students' scientific literacy, with average scores rising from initial lows to near-perfect final assessments. Students' understanding of academic papers, patents, and the structure of scholarly work notably improved, reflecting the effectiveness of the club's initiatives. Participation in innovative skills competitions and academic discussions fostered practical application and critical thinking, crucial for scientific literacy. Overall, students recognized the substantial contribution of these activities to their scientific competency and future career readiness.

4. Conclusion

The construction of student clubs plays a pivotal role in enhancing the scientific literacy of students in vocational colleges. The analysis reveals that participation in these clubs cultivates critical thinking, problem-solving skills, and a collaborative spirit, all of which are essential components of scientific literacy. Furthermore, the significance of nurturing scientific literacy extends beyond individual growth; it is crucial for societal progress and addressing contemporary challenges. Vocational colleges bear the responsibility of integrating scientific literacy into their curricula and extracurricular activities, thereby equipping students with the necessary competencies for the evolving job market.

In conclusion, the development of student associations in vocational institutions is not merely an academic exercise but a strategic imperative that shapes the future of students and society at large. As educational stakeholders, it is essential to recognize and harness the potential of these organizations to cultivate a scientifically literate populace capable of driving innovation and fostering sustainable development. Future research should explore longitudinal impacts and best practices for maximizing the benefits of student associations in vocational education.

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Disclosure statement

The authors declare no conflict of interest.

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