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Participation of College Students Majoring in Public Health in Scientific Research

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Abstract: Background/Objectives: This study explores the participation of college students in school scientific research and its influencing factors, aiming to provide a basis for promoting the cultivation of innovative medical talents in the field of public health. Methods: A questionnaire survey was conducted among 626 students from the School of Public Health at Guilin Medical University to understand their participation in scientific research and its influencing factors. Results: A total of 618 valid questionnaires were collected. The results showed that the proportion of respondents participating in scientific research was 49.68%, with significant differences in Age, Grade, Understanding of scientific research content, and personal willingness, P<0.05. Factors such as students Age (OR=0.579, 95% CI: 0.421~0.796), Grades (OR=0.362, 95% CI: 0.259~0.507), Understanding of Teacher Research Projects (OR=1.759, 95% CI: 1.274~2.429), Understanding of the Innovation and Entrepreneurship Training Program for College Students (OR=1.884, 95%CI: 1.333~2.662) and Familiarity with the "Challenge Cup" Extracurricular Science and Technology Works Competition (OR =1.421, 95% CI: 1.019~1.982), significantly affect students' participation in scientific research. Conclusions: College students' participation in scientific research has diverse characteristics and is influenced by multiple factors. Efforts to guide students' participation in research should take into account their grade level, age, and willingness to engage.

Keywords: collaboration education; scientific research; participation; questionnaire

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1. Introduction

In the context of public health education reform, actively exploring and constructing new talent training models, comprehensively improving the quality of talent training, has become an inevitable requirement for promoting educational modernization [1]. The quality of medical higher education, including public health majors, has a significant impact on population health. At present, the traditional simple classroom knowledge imparting model is no longer suitable for the training needs of applied and innovative professionals, and the reform of medical higher education teaching is constantly being promoted [2]. Interdisciplinary integration has reached a new stage and holds great potential for promoting sustainable development in the healthcare industry [3,4].

The combination of teaching and scientific research is the process in which higher education institutions introduce scientific research results into the teaching, organize students to participate in scientific research practice, and achieve the integration of science and education [5]. This principle was first systematically proposed by Wilhelm von Humboldt, the founder of Humboldt University in Berlin, in teaching reform, emphasizing the promotion of knowledge innovation through joint exploration between teachers and stu-

dents, and making scientific research the fundamental carrier of teaching. Its core objectives include promoting the synchronous updating of teaching content with the forefront of technology, promoting the systematic cultivation of students' scientific research abilities, and enhancing the academic level of the teaching staff [6]. The proposal of the concept of "combining scientific research with theoretical teaching" has injected new vitality into the development of higher education, emerging as a new hotspot in education reform exploration.

Studies have shown that universities can transform high-quality scientific research resources into teaching resources by opening key laboratories, organizing scientific research tutor teams, and encouraging participation in professional scientific research activities [7]. This can guide college students to deepen their understanding through practice, keep abreast of the latest technologies and developments in cutting-edge scientific research, and help cultivate their innovative awareness and capabilities [8,9]. Therefore, cultivating the scientific research quality of medical students and encouraging them to participate early and frequently in scientific research-related activities during their studies is of great significance, which is expected to support the education reform of universities and the cultivation of innovative and applied professional talents [10]. Science-education integration is the approach, and collaborative education is the goal. If the educational and teaching practices of universities lack a foundation in scientific research, they may become a form of rote learning that lacks depth and innovation. The implementation of the concept of "integration of science and education for collaborative education" is conducive to integrating educational resources, and plays a vital role in promoting the cultivation of innovative and applied talents and improving the knowledge innovation system [11].

In educational and teaching practice, the characteristics of students' participation in scientific research vary and may be influenced by multiple factors. This study intends to investigate the current status of students' scientific research participation, identify relevant factors, and provide effective countermeasures. This can offer a basis for the implementation of "integration of science and education for collaborative education" in medical colleges.

2. Materials and Methods

2.1. Survey Subjects

Full-time undergraduates majoring in Preventive Medicine, Health Inspection and Quarantine, Food Hygiene and Nutrition at the School of Public Health, Guilin Medical University, from January 1, 2024 to December 31, 2024, were selected as the survey subjects. Stratified random sampling was adopted: first, stratification was conducted by major, and then samples were drawn within each stratum using systematic sampling. Since each major has only one class per academic year, the survey proportion of each class was ensured to be consistent with the actual student composition of the school.

2.2. Sample Size Determination

The sample size was calculated using the formula $N = (Z^2 \times P \times (1-P))/E^2$. That is, N denotes the sample size; Z is the statistic (1.96 for a 95% confidence level); P is the expected recovery rate of valid questionnaires (assumed to be 60%); E is the margin of error (5%). The calculation showed that the minimum sample size required is 385. Considering a 20% invalid questionnaire rate, at least 462 questionnaires needed to be distributed.

2.3. Survey Methods

2.3.1. Questionnaire Design

The questionnaire was designed based on the theory of collaborative education integrating teaching and scientific research and existing studies, focusing on the following aspects: Participation of full-time students from the School of Public Health in teachers' scientific research projects, including experiments, data collation/analysis, and academic

paper writing; Hosting or substantive involvement in the College Students' Innovation and Entrepreneurship Training Program, various national and regional entrepreneurship competitions, and the "Challenge Cup" National College Students' Extracurricular Academic Science and Technology Works Competition; Excluding content related to graduation theses of graduating classes.

The questionnaire covered: General characteristics of college students (age, gender, grade, major, academic system, etc.); Understanding of scientific research content; Recognition and Willingness of students in scientific research.

2.3.2. Quality Control

The questionnaire content was meticulously reviewed and revised to ensure clear question phrasing and rigorous logic. Investigators underwent unified training, and a pre-survey was conducted to identify and improve issues in content design, survey methods, and questionnaire collection. After the formal survey, questionnaires were strictly inspected one by one. Incomplete, obviously erroneous, or non-compliant questionnaires were excluded. Data from valid questionnaires were double-entered into Epidata 3.1 by two independent personnel to ensure accuracy and reliability.

2.4. Data Processing

Data analysis was performed using IBM SPSS 28.0 software. Reliability and validity tests were conducted on the questionnaire data. Enumeration data were expressed as frequency (n) and percentage (%)， and the chi-square ($\chi 2$) test was used for intergroup comparison. Binary logistic regression analysis was adopted to screen relevant influencing factors, with odds ratio (OR) and its 95% confidence interval (CI). A two-sided test with $P<0.05$ was considered statistically significant.

3. Results

3.1. Characteristics of Questionnaire Survey

A total of 626 questionnaires were distributed, and 618 valid questionnaires were recovered, with an effective recovery rate of 98.72%. The reliability and validity analysis of the pre-survey questionnaire data showed that the Cronbach's alpha coefficient was 0.88 and the Kaiser-Meyer-Olkin (KMO) value was 0.79, indicating that the survey data had high reliability and validity.

Among the respondents, males accounted for 45.1% and females for 54.9%. In terms of age, 35.28% were under 21 years old, 32.36% were aged 21-22, and 32.36% were over 22 years old. For grade distribution, lower grades (freshmen: 17.48%, sophomores: 16.18%) and higher grades (juniors: 28.16%, seniors: 22.82%, fifth-year students: 15.37%) were recorded. By major (academic system), Preventive Medicine accounted for 54.85%, Health Inspection and Quarantine for 20.39%, and Food Hygiene and Nutrition for 24.76%. See Table 1.

Table 1. General characteristics of respondents.

Characteristics	Category	Constituent, n (%)
Gender	Male	314 (50.81)
	Female	304 (49.19)
Age	<21 years old	118 (19.09)
	21-22 years old	202 (32.69)
	>22 years old	298 (48.22)
Grade	Freshman	108 (17.48)
	Sophomore	130 (21.04)
	Junior	144 (23.30)
	Senior	141 (22.82)

Major (Academic System)	Fifth-year student	95 (15.37)
	Preventive Medicine (5-year)	339 (54.85)
	Health Inspection & Quarantine (4-year)	126 (20.39)
	Food Hygiene and Nutrition (4-year)	153 (24.76)

3.2. Analysis of Students' Scientific Research Participation

According to a survey of various majors in the School of Public Health, the proportion of students engaged in scientific research was 49.68%. The results indicate that there were differences in student research participation rates in terms of age (χ^2=23.28, P<0.001), grade (χ^2=35.88, P<0.001), awareness of teachers' scientific research projects (χ^2=11.86, P=0.001), knowledge of the College Students' Innovation and Entrepreneurship Training Program (χ^2=13.05, P<0.001), familiarity with the "Challenge Cup" Extracurricular Science and Technology Works Competition (χ^2=4.31, P=0.038), interest in participation (χ^2=3.94, P=0.047), willingness to commit time to scientific research (χ^2=13.14, P<0.001), and participation in experiments or data analysis (χ^2=18.86, P<0.001). See Table 2.

Table 2. Analysis of scientific research participation among college students.

Variables	**Status**	**Scientific Research Participation, n (%)**		χ2	P
Characteristics		**Yes**	No		
Age	≤22 years old	138(44.95%)	182(58.52%)	23.28	<0.001
	>22 years old	169(55.05%)	129(41.48%)		
Gender	Male	151(49.19%)	163(52.41%)	0.64	0.423
	Female	156(50.81%)	148(47.59%)		
Grade	Lower (Freshman & Sophomore)	82(26.71%)	156(50.16%)	35.88	<0.001
	Higher (Junior–Fifth)	225(73.29%)	155(22.19%)		
Academic System	5-year program	172(56.03%)	167(53.70%)	0.34	0.561
	4-year program	135(43.97%)	144(46.30%)		
Understanding of Research Content					
Teachers' Research Projects	Aware	198(64.50%)	158(50.80%)	11.86	0.001
	Unaware	109(35.50%)	153(49.20%)		
Students' Innovation & Entrepreneurship Training Program	Aware	231(75.24%)	192(61.74%)	13.05	<0.001
	Unaware	76(24.76%)	119(38.26%)		
"Challenge Cup" Extracurricular Competition	Aware	212(69.06%)	190(61.09%)	4.31	0.038
	Unaware	95(30.94%)	121(38.91%)		
Recognition of Participation					
School encourages participation	Agree	248(80.78%)	244(78.46%)	0.52	0.473
	Disagree	59(19.22%)	67(21.54%)		
Contributes to theoretical & practical learning	Agree	256(83.39%)	254(81.67%)	0.32	0.574
	Disagree	51(16.61%)	57(18.33%)		
Enhances Professional	Agree	271(88.27%)	262(84.24%)	2.11	0.146

Competence	Disagree	36(11.73%)	49(15.76%)		
Willingness to Participate					
Interested in participation	Yes	224(48.70%)	204(65.59%)	3.94	0.047
	No	83(51.4%)	107(34.41%)		
Devote Time (hours/week)	≤4	185(60.26%)	230(73.95%)	13.1	<0.00
	>4	122(39.72%)	81(26.05%)	4	1
Participate in Experiments or Data Analysis	Yes	171(55.70%)	119(38.26%)	18.8	<0.00
	No	136(44.30%)	192(61.74%)	6	1
Participate in paper writing	Yes	83(27.04%)	68(21.86%)	2.24	0.135
	No	224(79.96%)	243(78.14%)		
Personal willingness in paper publication	Yes	182(59.28%)	192(61.74%)	0.39	0.533
	No	125(40.72%)	119(38.26%)		

3.3. Factors Influencing Student Participation in Scientific Research

Binary logistic regression analysis indicated that factors such as Age (OR=0.58, 95%CI: 0.42~0.80), Grades (OR=0.36, 95%CI: 0.26~0.51), Awareness of teachers' scientific research projects (OR=1.76, 95%CI:1.27~2.43), Knowledge of College Students' Innovation and Entrepreneurship Training Program (OR=1.884, 95%CI: 1.33~2.66), and Familiarity with the "Challenge Cup" Science and Technology Works Competition (OR=1.42, 95%CI:1.02~1.98) significantly influenced students' participation in scientific research (P<0.05). See Table 3.

Table 3. Factors influencing students' scientific research participation.

Factors (Reference)	B	S.E.	Wals	OR	95% CI	P
Age (≤22 years old)	-0.55	0.16	11.32	0.58	0.42~0.80	0.001
Grade (lower grades)	-1.02	0.17	34.98	0.36	0.26~0.51	<0.001
Teachers' Research Projects (Aware)	0.57	0.17	11.77	1.76	1.27~2.43	0.001
College Students' Innovation & Entrepreneurship Program (Aware)	0.63	0.18	12.90	1.88	1.33~2.66	<0.001
"Challenge Cup" Competition (Aware)	0.35	0.17	4.29	1.42	1.02~1.98	0.038
Interest in Participation (Yes)	0.35	0.18	3.93	1.42	1.00~2.00	0.048
Devote Research Time (≤4 hours/week)	-0.63	0.17	12.99	0.53	0.38~0.75	<0.001
Participate Experiments or Data Analysis (Yes)	0.71	0.16	18.66	2.029	1.47~2.80	<0.001

4. Discussion

Scientific research education serves as a crucial approach to enhancing the quality of professional talent training. Early participation in scientific research by under- graduates brings multiple benefits [12]. For students, it strengthens basic professional knowledge, improves problem-solving abilities, stimulates the willingness to communicate, and enhances teamwork skills, innovative practical capabilities, and research literacy [13]. For universities, engaging in research promotes the organic integration of teaching and research, supporting the cultivation of comprehensive innovative talents and the improvement of both teaching quality and overall research capabilities. For society, it helps better meet market demands for medical innovation and high-level healthcare services [14].

The insufficient integration of teaching and research remains a major challenge for universities today [15]. In practice, it not only leads to low efficiency in the utilization of educational resources and scientific support, but also potentially affects the cultivation of students' professional practical abilities and innovative capabilities. The greatest advantage of the "science-education collaborative" model lies in its ability to effectively enhance students' disciplinary knowledge and skills, cultivate their innovative thinking and

practical abilities, integrate disciplinary knowledge with professional issues, and achieve the goal of "applying what is learned" [16]. Moreover, it plays a positive role in continuously promoting the optimization of professional structures, development of applied courses, and the cultivation of educators who effectively integrate scientific research and teaching.

In professional practice, extracurricular programs such as the College Students' Innovation and Entrepreneurship Training Program, various innovation and entrepreneurship competitions, and the "Challenge Cup" National College Students' Extracurricular Academic Science and Technology Works Competition attract active participation from students due to their unique application value and appeal. However, college students' engagement in scientific research is influenced by multiple factors, such as personal level: personal interests and motivation, professional knowledge accumulation, research skills (e.g., literature retrieval, data analysis), and current academic performance; institutional: whether curriculum design includes research methodology training, whether teacher-student collaboration and interdisciplinary research are encouraged, as well as practical platforms and resources (e.g., laboratory accessibility, research equipment sharing mechanisms, academic lectures, and the organization of research competitions like the "Challenge Cup" Works competition). These factors interact to potentially affect college students' participation in scientific research.

This survey shows that approximately 50% of students participate in research activities, indicating a relatively low overall participation rate. Additionally, factors such as age and grade were identified as independent predictors of students' engagement in extracurricular research. This finding is consistent with the analysis by Jiao Yicheng et al. based on the "National College Student Survey Research Database (NCSS)" [17], which revealed significant differences in research participation rates across grades—gradually increasing from freshman to senior year. Age and grade emerged as significant factors influencing students' participation in science-education collaborative activities, primarily because older students and upperclassmen typically accumulate more disciplinary knowledge and practical experience. This equips them with better competencies required for such activities, making them more inclined to seize and engage in research opportunities.

A deeper understanding of the university's research environment, resources, and academic atmosphere may also influence students' likelihood of participating in science-education collaborative activities. This study found that awareness of science-education collaboration and research competitions also affects participation rates. Students with better knowledge of science-education collaborative programs and research events are more likely to engage, as they have a clearer understanding of the connotations and values of these programs, as well as their own roles and responsibilities within them. Additionally, participation in research paper writing and publication influences engagement. Early exposure to research allows students to understand the basic research process comprehensively, potentially stimulating their research interest and creativity.

The increasing demand for healthcare, disease prevention, and health education services in society has led to a gradual improvement in the quality requirements for medical research and education. Educational institutions should comprehensively consider these realities, establish open research platforms and resources, address students' individual needs, and encourage them to actively participate in research activities. This can promote the transformation of students' theoretical knowledge into practical abilities, enhance their professional confidence, sense of achievement, and innovation ability.

The integration of teaching and research in medical colleges is not only an urgent requirement for current higher medical education but also the key to adapting to the future development of the medical field. Although cultivating medical students' research capabilities still faces various challenges, universities can inject more vitality into establishing a high-quality "science-education collaborative education" training system by add-

ing interdisciplinary research foundation courses, opening research platforms such as primary laboratories [18], optimizing research practice conditions, and strengthening publicity and incentive measures for the benefits of research participation.

5. Conclusions

The participation of college students in scientific research exhibits diverse characteristics and is influenced by a variety of factors, including demographic variables such as grade level and age, as well as cognitive factors like understanding of institutional and teacher-led research projects. Moreover, personal motivation and individual interests play critical roles in determining engagement levels. Given these multifaceted influences, educational institutions should adopt a comprehensive and targeted approach to encourage scientific research participation. This includes designing tailored mentorship programs, providing accessible research resources, and fostering an inclusive academic environment that nurtures curiosity and innovation. Furthermore, integrating research opportunities early in the curriculum and promoting interdisciplinary collaboration can enhance students' practical skills and critical thinking abilities. By strategically aligning educational policies with students' developmental stages and interests, universities can effectively cultivate a new generation of innovative and research-oriented professionals in the field of public health.

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References

1. G. E. Thibault, "Public health education reform in the context of health professions education reform," *Am. J. Public Health*, vol. 105, no. S1, pp. S8-S10, 2015, doi: 10.2105/AJPH.2014.302407.
2. P. P. Chan, et al., "Flipped classroom case learning vs traditional lecture-based learning in medical school ophthalmology education: a randomized trial," *Acad. Med.*, vol. 98, no. 9, pp. 1053-1061, 2023, doi: 10.1097/ACM.0000000000005238.
3. H. C. Lucas, J. S. Upperman, and J. R. Robinson, "A systematic review of large language models and their implications in medical education," *Med. Educ.*, vol. 58, no. 11, pp. 1276-1285, 2024, doi: 10.1111/medu.15402.
4. B. Chen, X. Yang, and H. Wang, "The role of interdisciplinary integration in medical education," *Med. Teach.*, 2025, pp. 1-1, doi: 10.1080/0142159X.2025.2497896.
5. J. F. S. A. Ghezzi, et al., "Strategies of active learning methodologies in nursing education: an integrative literature review," *Rev. Bras. Enferm.*, vol. 74, no. 1, p. e20200130, 2021, doi: 10.1590/0034-7167-2020-0130.
6. J. Thompson Burdine, S. Thorne, and G. Sandhu, "Interpretive description: A flexible qualitative methodology for medical education research," *Med. Educ.*, vol. 55, no. 3, pp. 336-343, 2021, doi: 10.1111/medu.14380.
7. P. V. O'Neal, L. C. McClellan, and J. M. Jarosinski, "A new model in teaching undergraduate research: A collaborative approach and learning cooperatives," *Nurse Educ. Pract.*, vol. 18, pp. 80-84, 2016, doi: 10.1016/j.nepr.2016.03.008.
8. J. Beca, "The need for improvement in innovativeness development and entrepreneurship training in high school and university science education," 2007.
9. Y. Jia, et al., "Research on practice teaching mode for undergraduate in the age of emerging engineering education," *Int. J. Electr. Eng. Educ.*, vol. 61, no. 1, pp. 4-16, 2024, doi: 10.1177/0020720919867412.

10. Z. Lu and S. Qiu, "Collaborative education mechanism of in-depth integration between schools and enterprises under the background of the construction of EEE--Taking the major of data science and big data technology of Nanning University as an example," in *Int. Conf. Comput. Sci., Eng. Educ. Appl.*, Cham: Springer Nature Switzerland, 2023, doi: 10.1007/978-3-031-36118-0_91.
11. D. H. Sonnenwald and B. Li, "Scientific collaboratories in higher education: exploring learning style preferences and perceptions of technology," *Br. J. Educ. Technol.*, vol. 34, no. 4, pp. 419-431, 2003, doi: 10.1111/1467-8535.00339.
12. S. Yigletu, et al., "“Collaboration toward one collective goal”: a mixed-methods study of short-term learning outcomes and long-term impacts among students participating in an undergraduate community-based participatory research (CBPR) course," *Front. Public Health*, vol. 9, p. 694840, 2021, doi: 10.3389/fpubh.2021.694840.
13. G. Wang, et al., "The effects of long-term extracurricular scientific research on the medical students: Insight from Jinan University Medical School," *Biochem. Mol. Biol. Educ.*, vol. 49, no. 4, pp. 535-545, 2021, doi: 10.1002/bmb.21499.
14. R. H. Adler and C. Sickora, "Research, practice and teaching united: implementing AACN academic guidelines in a community based behavioral health setting," *J. Prof. Nurs.*, vol. 49, pp. 21-25, 2023, doi: 10.1016/j.profnurs.2023.08.001.
15. D. van der Hoeven, et al., "Integration of basic and clinical sciences: student perceptions," *Med. Sci. Educ.*, vol. 30, no. 1, pp. 243-252, 2020, doi: 10.1007/s40670-019-00884-1.
16. J. Kopel, G. Brower, and J. W. Culberson, "Teaching methods fostering enjoyment and creativity in medical education," *J. Community Hosp. Intern. Med. Perspect.*, vol. 11, no. 6, pp. 821-824, 2021, doi: 10.1080/20009666.2021.1979739.
17. X. Xiao, F. Zhang, and J. Li, "Library and information science research in China—A survey based analysis of 10 lis educational institutes," *J. Acad. Librariansh.*, vol. 41, no. 3, pp. 330-340, 2015, doi: 10.1016/j.acalib.2015.02.012.
18. J. Zhang, Q.-Y. Yan, and S. Yue, "Nursing research capacity and its management in China: A systematic review," *J. Nurs. Manag.*, vol. 28, no. 2, pp. 199-208, 2020, doi: 10.1111/jonm.12924.