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# A Study on the Characteristics of Student Athletes at Universities in Guizhou Province

**Wang TianYuan**
Chinese Graduate School, Panyapiwat Institute of Management, Thailand
*Corresponding author, E-mail: tierneywangty@gmail.com, ORCID ID: https://orcid.org/0009-0005-1577-9840
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**Abstract**

**Background and Aim:** Developing China into a formidable sports nation necessitates the support of top-tier talents, while the advancement of sports higher education serves as a crucial underpinning for nurturing skilled sports professionals. The pedagogy within sports education is notably distinct, with sports students embodying a uniquely central role in the learning process. Consequently, enhancing the caliber of sports education demands an exploration of pedagogical strategies not solely from the educators' viewpoint but also through an investigation into the distinctive attributes of sports students as active participants in their learning journey.

**Materials and Methods:** The study commenced with interviews involving 13 sports educators from Chinese universities to identify elements pertinent to evaluating university sports students' learning characteristics from the educators' viewpoint. Grounded in the learner characteristics theory, the analysis framework's structure was established. After this, exploratory factor analysis was employed to affirm the validity of the proposed research framework. Leveraging this framework and incorporating established scales, the "Questionnaire on Characteristics of University Sports Students as Learners" was constructed. A cohort of 700 sports students, ranging from freshmen to juniors, participated in the survey. The gathered data underwent extensive analysis to investigate the prevailing learner characteristics among university sports students in Guizhou Province.

**Results:** The research identified three pivotal learner characteristics in university sports students: cognitive, emotional, and ability-related components. The cognitive facet involves learning attitudes and motivation; the emotional facet comprises self-efficacy and anxiety; and the ability facet includes learning strategies and training investment. Analysis of the data revealed no significant gender-based differences in these characteristics. However, it highlighted notable disparities across academic years: freshmen exhibited the highest scores in cognitive components, followed by sophomores, with juniors registering the lowest scores. In the assessment of emotional aspects, sophomores outperformed though the margin of difference was nominal between the freshmen and juniors. Conversely, in the evaluation of ability aspects, juniors achieved significantly greater scores compared to their freshmen and sophomore counterparts. Regarding college entrance examination performance, a discernible trend indicated that higher scores in the cultural section correlated positively with enhanced performance across all evaluated elements and their respective dimensions. However, this correlation was not observed in sports examination scores, which did not demonstrate significant differences in cognitive aspects but did reveal disparities in both ability and emotional aspects.

**Conclusion:** The performance of student-athletes across ability, emotional, and cognitive dimensions is affected by a multitude of factors, such as gender, academic year, cultural course grades, physical education assessments, and sports exam scores. To enhance the overall quality and performance of sports students, emphasis should be placed on fostering their learning competencies, emotional equilibrium, and cognitive capabilities, and developing tailored training initiatives that account for varying academic levels and individual differences. Additionally, we should strengthen the comprehensive evaluation and assessment of students' overall qualities to more effectively facilitate their all-encompassing growth.

**Keywords**: University athletic students; Learner characteristics; Sports higher education

## Introduction

Sports Majors in ordinary colleges and universities, as a significant part of China's higher education system, bear the responsibility of training sports professionals at all levels. The quality of talent cultivation in higher education, and its ability to serve national and regional economic and social development, is reflected in the structure and quality of disciplines and majors. Therefore, both at the policy and practical levels, higher standards are required for sports programs in universities. Additionally, there is an increasing demand for high-quality classroom teaching in sports majors.

The prerequisite for improving classroom teaching quality is understanding the students, as learner characteristics are very important for instructional designers. Only by understanding these characteristics can the direction and ideas for teaching reform be further clarified. Current research on teaching reform in



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sports majors often focuses on applying different learning theories to propose teaching strategies for physical practice or theory classes, rarely starting from the unique learning issues of the specific group of sports students. Therefore, to enhance the teaching quality of sports majors, it is especially important to focus on the characteristics of the students.

Sports students have their unique characteristics, and currently, the teaching of sports majors largely follows traditional educational logic without sufficient updates in teaching strategies or variation in teaching styles, let alone focusing on the characteristics of sports students, which often results in teachers proposing learning strategies based on existing stereotypes. Unique learner characteristics determine both the learning traits of the learners and the teaching methods of the educators. To improve the teaching quality in sports majors, it is essential to focus on learner characteristics as a key factor influencing teaching, implementing "teaching according to the student's ability."

A systematic and in-depth exploration of sports students' characteristics can establish a significant foundation for accurately understanding their needs, designing targeted course plans, and adopting effective teaching strategies, thereby significantly enhancing the educational level of sports majors. As a university sports instructor and manager, I closely monitor the learning issues of sports students. In actual classroom teaching, the differences between sports students and ordinary college students are noticeable; however, the method to explore sports students' learning characteristics remains unclear. Moreover, there are no specific sports teaching strategies available for reference, resulting in classroom teaching often relying on methods from my own educational experience. In classroom settings, teaching and learning processes are interdependent, with the teacher's actions prompting and facilitating effective student learning behaviors. Therefore, understanding student characteristics is essential to improve learning quality and, consequently, teaching quality.

**Research objectives**

1. Construct the analysis framework of university sports student learners' characteristics and develop the questionnaire
2. Secondly, investigate the characteristics of sports students in Guizhou Province.

**Literature review**

Learning is an important way for humans to understand the world and enhance their abilities. In educational activities, people usually consider "educated individuals" or "students" as concepts distinct from "educators" or "teachers." However, the term "learner" is more common than "educated individual" or "student." In many cases, people use "learner" instead of "educated individual" or "student" because of the following reasons: First, the concept of "educated individual" undoubtedly views the educational subject as a relatively passive person, someone who merely "receives education." That is to say, "education" refers to what educators impart to the physical and mental aspects of the educated individual. This perspective is logically untenable and practically harmful. Second, although "student" can also be used to denote "learner," it primarily refers to individuals who are psychologically and physiologically immature, due to the implication of "young" in the term "student." Over the past fifty years, with the advent of lifelong learning and the expansion of educational goals to include adults and even all citizens of society, the term "learner" better reflects the diverse educational goals. Therefore, learner characteristics can be understood literally as the characteristics of all individuals learning inside or outside school.

1. Western Learner Characteristics Study:

The theoretical roots of learner characteristics can be traced back to Witkin (1949; 1978), who viewed them as "a characteristic functional pattern that reveals our perceptual and cognitive activities in a highly consistent and universal manner" (Witkin & Goodenough, 1981). In other words, learner characteristics are seen as traits, such as being unaffected, rather than as states. Witkin's work laid the foundation for understanding individual differences in cognitive styles. As early as 1949, Witkin published research related to field dependence/independence, a cognitive style dimension that describes how individuals perceive and



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interact with their environment (Witkin et al., 1954). Field-dependent individuals have difficulty separating an item from its context, often relying on external cues for guidance, while field-independent individuals can easily break down an organized whole into its relevant parts, demonstrating a more analytical approach (Witkin et al., 1977). This distinction has been crucial in educational psychology, as it helps explain how students approach learning tasks and process information differently.

Subsequently, research on learner characteristics in the field of psychology gradually increased. Guilford (1967) referred to cognitive learner characteristics as intellectual abilities. He organized these intellectual abilities along three dimensions: operations (cognition, memory, divergent production, convergent production, and evaluation); content (visual, auditory, symbolic, semantic, and behavioral); and products (units, classes, relations, systems, transformations, and implications). Guilford believed these dimensions to be independent of each other, theoretically allowing for 150 different components of intelligence, leading to diversity among learners (Guilford, 1967; Guilford & Hoepfner, 1971). This model of intellect structure highlights the complexity and variability of cognitive learner characteristics, emphasizing the need to recognize and address this diversity in educational settings.

In the 1990s, a task force from the American Psychological Association (APA) conducted a comprehensive review of the extensive body of research literature in psychology, culminating in a detailed report by 1997 (APA, 1997; George, 2017). This review summarized and identified the main components related to learner characteristics and learning environments, leading to the development of a set of learner-centered psychological principles. These discussions resulted in 14 psychological characteristics and principles focusing on various aspects such as the nature of the learning process, goals of learning, knowledge construction, strategic thinking, the learning environment, motivational and emotional factors (impact of motivation and emotion on learning, intrinsic motivation, the influence of motivation on effort), developmental and social factors (impact of development on learning, social influences on learning), and individual differences (individual variability, learning diversification, standards, and assessment) (APA, 1997).

As the field continued to evolve, the elements of learner characteristics were further enriched. Gagné (2007) categorized the characteristics of learners into three types: The first category involves innate qualities determined by genetic factors, including sensory sensitivity during the information input stage, cognitive abilities like working memory during the internal processing stage, and the speed of concept extraction during the information retrieval stage (Gagné, 2007). The second type consists of qualities acquired through experience, including intellectual abilities, cognitive capacities, language skills, attitudinal skills, and motor skills. The third category pertains to qualities that modify learning, such as abilities and traits.

Gagné believed that abilities and traits are the primary features influencing human behavioral performances. Abilities include general intelligence (IQ) and specific skills like verbal comprehension, reasoning, numerical proficiency, spatial orientation, associative memory, and memory span (Gagné, 2007). Traits encompass achievement motivation, anxiety, locus of control, and self-efficacy. Although these traits are influenced by long-term learning, they are generally considered relatively stable and less impacted by educational interventions.

Building on Gagné's research, Smith and Ragan (2005) proposed a new, more comprehensive learner analysis framework that considers developmental psychology and differential psychology regarding learners' characteristics. They believe that instructional designers should study not only the differences among learners but also their similarities. Furthermore, they suggest that the description of learner characteristics can be divided into First, cognitive characteristics, which primarily include specific prior knowledge, general abilities, specific abilities, developmental level, language development level, reading level, cognitive processing styles, and cognitive and learning strategies. Second, biological mechanisms. Third, emotional traits, including interests, learning motivation, learning attitudes, perceptions, and experiences with specific media, academic self-concept, anxiety levels, beliefs, and attributions of achievement. Fourth, social characteristics, encompass peer relationships, attitudes towards authority,



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tendencies towards cooperation or competition, moral standards, socio-economic background, racial background, and role models (Smith & Ragan, 2005).

2. Eastern Learner Characteristics Study

Compared to educators, students have their distinct characteristics: First, each person has unique research objectives. Even if two individuals express the same goals, they may not share the same understanding or motivations. Second, each individual's learning environment or foundational knowledge differs, influencing their interests, abilities, and learning styles. Third, each person encounters different challenges and difficulties in their learning process. Therefore, efficient learning requires tailored assistance, making individualized teaching a crucial principle. Fourth, due to individual differences, people vary in their self-reflection and self-control during self-directed learning activities, which consequently leads to variations in learning outcomes. Thus, learning is a highly individualistic activity. To promote effective or efficient learning among students, teachers must recognize not only the common characteristics of their students but also understand their diverse needs. A teacher's understanding of a student's personality and individual differences directly affects the educational outcomes and the effectiveness of pedagogical strategies (Chinese universities. 2002)_

Some Chinese scholars have conducted a series of analyses on learner characteristics based on their national context. The learner analysis framework proposed by Wumeina (1994) serves as a primary model for Chinese scholars. She posited that studying students' learning behaviors is aimed at better understanding their learning states and methods. Learning readiness refers to the suitability of a learner's existing knowledge level or psychological development level for new learning activities. Research on students' learning readiness involves two main aspects: First, it analyzes basic characteristics that influence students' participation in learning, such as psychology, gender, cognitive maturity, learning motivation, personal expectations for learning, work experience, life experiences, and economic, cultural, and social backgrounds. Second, it examines the knowledge and skills students possess during the process of learning a specific subject, which reflects their understanding and perspective on the relevant learning content. This aspect determines the students' initial capabilities and the educational starting point (Wumeina, 1994).

Addressing the learning states of students involves understanding whether they are in a favorable state throughout their learning process: "Learning readiness" refers to the compatibility between a student's pre-existing knowledge and psychological development and the requirements of new learning tasks. "Basic abilities" denote the relevant knowledge and skills a learner possesses when studying a particular topic, including their understanding of and attitude toward the learned content. "Information literacy" represents the overt information capabilities and the implicit awareness, emotions, and attitudes towards information that learners possess.

In the field of psychology, He (2016) and others believe that a student's cognitive, affective, and social characteristics significantly influence their capacity for effective information processing. Although teachers cannot fully account for every psychological, physiological, and socio-economic factor influencing a student, they must recognize some critical psychological aspects that heavily impact teaching design, such as cognitive developmental features, baseline levels, cognitive structures, learning styles, and learning motivation (He, 2016).

Xie et al. (2016) argue that influenced by various physiological, psychological, and sociocultural factors, students exhibit both commonality and stability, as well as varying personality traits. General traits refer to factors such as age, gender, grade level, life experiences, and social background that affect learners. Personal traits include factors like starting abilities, learning styles, motivations, and self-efficacy, which are crucial in affecting students' academic performance (Xie et al., 2016). Although teachers can't address all psychological, physiological, and socio-economic factors for each student comprehensively, it is essential to recognize the main factors (such as personality traits) that significantly influence teaching design to enhance its applicability and specificity.



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## Conceptual Framework

The conceptual framework of this paper is illustrated in Figure 1.

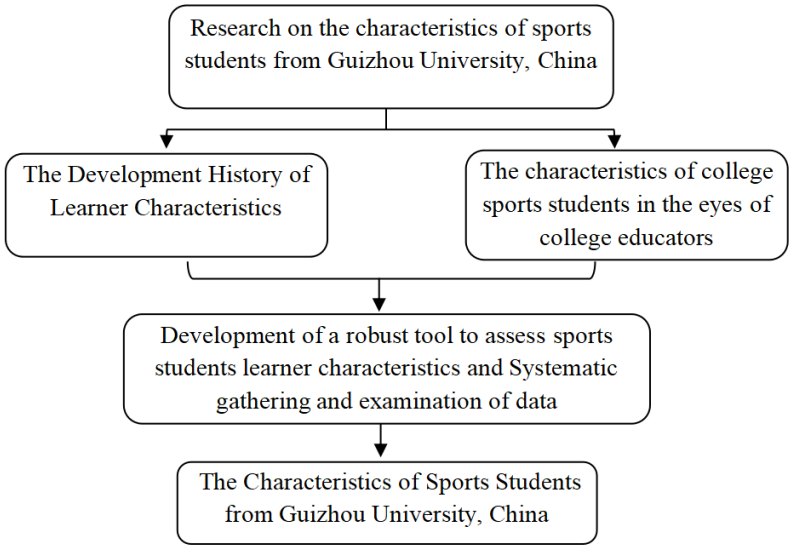


**Figure 1** Conceptual Framework
**Note:** Constructed by the researcher

## Methodology

1. Research Methodology

Teacher interviews were conducted, and the semi-structured interview text was used to analyze the characteristics of learners through coding, to form and improve the specific observation points and questioning points of the status measurement questionnaire.

Questionnaires were compiled based on literature review and expert interview, distributed and collected through the online questionnaire platform, and conducted data analysis after receiving the questionnaire.

2. Population and Sampling

The formal test involved 737 participants, who were full-time undergraduate sports students in 4 universities of Guizhou Province, including majors such as sports education, leisure sports, and social sports, all admitted through cultural and sports performance exams in the college entrance examination.

3. Analysis of Data

Analysis was conducted using SPSS statistical software, which showed descriptive statistics and ANOVA statistics. Descriptive statistics were used to present the data for sex, age, and grade. ANOVA was used to contrast the differences between the different descriptive statistics.

## Result

1. Semi-Structured Interviews and Selection of Interview Subjects

The study initially employed a semi-structured interview approach, using a self-developed interview guide tailored to university sports students' learning characteristics. This guide included instructions, research objectives, and significance, focusing on dimensions to assess university sports students' learning characteristics and further subdividing these dimensions (see Appendix 1). Apart from the pre-set questions, the study allowed for follow-up questions based on the interview's specifics, thoroughly exploring the nuances of university sports students' learning characteristics.

The selection process occurred in two stages. The first stage involved convenience sampling of familiar university teachers, chosen based on interview feasibility. In the second stage, purposive sampling



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was employed, selecting appropriate subjects based on the researcher's judgment of the study's objectives. Thus, seven physical education teachers were selected for face-to-face interviews. Table 1 provides details:

**Table 1** Basic Information of First Stage Interview Subjects

| No. | Highest Degree/Research Area | Years of Teaching | Title |
|---|---|---|---|
| 1 | Bachelor / Physical Education | 17 | Associate Prof. |
| 2 | Master / Physical Education | 15 | Associate Prof. |
| 3 | Doctor / Physical Health | 15 | Associate Prof. |
| 4 | Master / Physical Education | 12 | Associate Prof. |
| 5 | Bachelor / Physical Education | 10 | Lecturer |
| 6 | Master / Physical Education | 10 | Lecturer |
| 7 | Master / Physical Education | 9 | Lecturer |

Following the interview principle that "the number of interview subjects in typical research is often 15±10," and considering factors like the first stage subjects' quantity and teaching experience, the second stage selected more experienced and higher-ranked interview subjects. Eventually, six additional physical education teachers were interviewed, reaching theoretical saturation as no new insights emerged. Table 2 provides details:

**Table 2** Basic Information of Second Stage Interview Subjects

| No. | Highest Degree/Research Area | Years of Teaching | Title |
|---|---|---|---|
| 1 | Bachelor / Physical Education | 30 | Professor |
| 2 | Doctor / School Physical Education | 29 | Professor |
| 3 | Doctor / Sports Industry | 19 | Professor |
| 4 | Master / Physical Education | 15 | Associate Prof. |
| 5 | Master / Physical Education | 14 | Associate Prof. |
| 6 | Bachelor / Physical Education | 14 | Associate Prof. |

2. Interview Data Collection and Analysis

Data collection was divided into three stages. The first stage involved gathering basic participant information and establishing a rapport for effective communication. The second stage focused on participants' teaching experiences, specifically how they perceive students' learning characteristics across different teaching scenarios. Clarifying participants' responses was crucial, especially when they mentioned vague concepts like "learning ability." The third stage sought teachers' perspectives on students' learning processes, emphasizing both previously discussed and new learning characteristics.

After data collection, the material was systematically processed into analyzable text. The transcription converted spoken interviews into written form, ensuring accuracy through immediate post-interview transcription and participant confirmation when ambiguities arose. Using WPS audio-to-text functionality, initial transcriptions were verified and corrected word-by-word, resulting in 13 transcribed documents in Word format.

Data analysis entailed converting interview recordings into text for open and focused coding stages.

In the open coding phase, the researcher broke down, examined, compared, and conceptualized all interview transcripts. The initial coding phase used terms reflecting learner characteristics and adhered to principles like remaining open, precise, and close to the data. The concept formation followed initial coding, resulting in open coding outcomes as shown in Table 3:



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**Table 3** Open Coding Results

| Conceptualized Initial Coding | Initial Coding | Reference Points Example |
|---|---|---|
| Learning Recognition | Learning is just for graduation. | Many students believe that university learning is only for graduates and might not relate to their future jobs. |
| Learning Plan | No learning plan | Students feel that listening to lectures without further review suffices for exams. |
| Attention | Hard to concentrate | Theory classes differ from practical ones, leading to difficulty in maintaining attention. |
| Self-Control | Poor behavior control | Sports students are generally more active, showing weak self-restraint. |
| Learning Self-Efficacy | Lack of confidence in cultural subjects | Some students inherently feel weak in cultural studies, a common belief among sports students. |
| Training Self-Efficacy | Confidence in specialized training | Most sports students, except those training for entrance exams, feel capable in their training activities. |
| Learning Interest | Interested subjects drive better learning | Students show marked interest and engagement in specialized courses. |
| Learning Adaptation | Dislike for new knowledge | Students prefer familiar theoretical knowledge over new concepts. |
| Training Time Investment | Little after-class training | Students complete assigned training under supervision but rarely practice afterward. |
| Course Preference | Prefer specialized courses | High participation and enthusiasm are noted in specialized courses. |
| Learning Method | Rote memorization | Most students rely on rote memorization rather than understanding. |
| Resource Utilization | Rarely visit the library | Despite abundant learning resources, students seldom utilize the library. |
| Learning Time Investment | Minimal time spent on learning | Students admit to rarely reviewing or seeking additional information outside class. |
| Learning Habits | No preview or review for classes | Students often remain silent when asked about class preparation or review. |
| Learning Initiative | Unwilling to do extra exercises | Students resist additional training beyond required activities. |
| Internal Motivation | Motivated by self-interest | Students are proactive about activities beneficial to themselves. |
| External Motivation | Attend classes due to obligation | Students attend theory classes primarily due to attendance requirements. |

Post open coding, further conceptualization through focused coding involved analyzing frequent initial codes and comparing them to form-focused codes, as detailed in Table 4:

**Table 4** Focused Coding Results

| Focused Coding (Frequency) | Initial Coding (Conceptualized) |
|---|---|
| Learning Attitude (48) | Learning Habits<br>Learning Recognition<br>Learning Initiative |
| Learning Motivation (60) | Learning Interest |



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| Focused Coding (Frequency) | Initial Coding (Conceptualized) |
|---|---|
| | Course Preference |
| | Internal Motivation |
| | External Motivation |
| Learning Self-Efficacy (32) | Learning Self-Efficacy |
| | Training Self-Efficacy |
| Learning Anxiety (42) | Learning Adaptation |
| | Self-Control |
| | Attention |
| Learning Strategy (51) | Learning Plan |
| | Learning Method |
| | Resource Utilization |
| Training and Learning Investment (27) | Training Time Investment |
| | Learning Time Investment |

From interviews with physical education teachers, six main learner characteristic elements emerged: learning motivation, learning attitude, learning self-efficacy, learning anxiety, learning strategy, and training and learning investment. These elements can be further classified into cognitive (learning attitude, motivation), affective (learning self-efficacy, anxiety), and ability factors (learning strategy, training, and learning investment).

3. Development of the University Sports Students' Learner Characteristics Assessment Scale:

This section forms a research tool for measuring the learner characteristics of university sports students based on empirical data from interviews, laying a foundation for the validation of the analysis framework.

Based on interviews clarifying the characteristics of sports students as learners, the scale selects items from widely used domestic and international dimension scales, employing a 5-point Likert scale. All questions are single-choice, with the mean score of the items within each dimension representing the score for that dimension. The total mean score of the scale is calculated by summing the mean scores of each dimension and dividing by the number of dimensions, with higher scores indicating higher levels of the characteristic.

The formal test subjects are full-time undergraduate sports students in Guizhou Province, including majors such as sports education, leisure sports, and social sports, all admitted through cultural and sports performance exams in the college entrance examination. The formal test involved 800 participants.

Cronbach's Alpha reliability tests were conducted on the questionnaire, with the results presented in Table 5. The Cronbach's Alpha coefficients for each dimension are as follows: 0.943 for learning strategies, 0.945 for learning motivation, 0.944 for learning attitude, 0.943 for learning engagement, 0.938 for learning self-efficacy, and 0.940 for learning anxiety. All scales exceeded the 0.7 threshold, indicating the high reliability of the data, thus making it suitable for further analysis.

**Table 5** Reliability results

| Dimension division | Amount | Cronbach Alpha |
|---|---|---|
| Learning Strategy | 7 | 0.943 |
| Learning Motivation | 7 | 0.945 |
| Learning Attitude | 7 | 0.944 |
| Training and Learning Investment | 7 | 0.943 |
| Learning Self-Efficacy | 7 | 0.938 |
| Learning Anxiety | 7 | 0.940 |



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The validity analysis was conducted using the KMO and Bartlett's Test of Sphericity. The results presented in Table 6, indicate a KMO value of 0.989, which exceeds the acceptable threshold of 0.6. Additionally, Bartlett's Test yielded a p-value of less than 0.001, suggesting that there are significant correlations among the variables and that factor analysis is appropriate.

**Table 6** KMO and Bartlett's Test of Sphericity

| **KMO** | | **0.989** |
|---|---|---|
| Bartlett's Test of Sphericity | Approximate Chi-squared value | 29759.633 |
| | *df* | 861 |
| | *p* Value | 0 |

Table 7 demonstrates that the absolute values of the factor loading for all items exceed 0.4, indicating a correspondence between the items and their respective factors. Specifically, items Q7 to Q13 correspond to the learning strategies factor; items Q14 to Q20 correspond to the learning motivation factor; items Q21 to Q27 correspond to the learning attitude factor; items Q28 to Q34 correspond to the learning investment factor; items Q35 to Q41 correspond to the learning self-efficacy factor; and items Q42 to Q48 correspond to the learning anxiety factor.

**Table 7** Table of Factor loading (Rotated)

| | **Factor loading** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Title** | **Factor 1** | **Factor 2** | **Factor 3** | **Factor 4** | **Factor 5** | **Factor 6** | **Communality** |
| Q7 | 0.238 | **0.668** | 0.322 | 0.242 | 0.205 | 0.185 | 0.742 |
| Q8 | 0.232 | **0.661** | 0.318 | 0.241 | 0.24 | 0.222 | 0.756 |
| Q9 | 0.253 | **0.648** | 0.302 | 0.214 | 0.21 | 0.275 | 0.74 |
| Q10 | 0.237 | **0.671** | 0.242 | 0.266 | 0.237 | 0.219 | 0.741 |
| Q11 | 0.236 | **0.654** | 0.267 | 0.261 | 0.229 | 0.246 | 0.736 |
| Q12 | 0.262 | **0.679** | 0.259 | 0.245 | 0.253 | 0.177 | 0.751 |
| Q13 | 0.233 | **0.661** | 0.333 | 0.195 | 0.228 | 0.239 | 0.749 |
| Q14 | 0.355 | 0.233 | 0.244 | 0.296 | **0.62** | 0.216 | 0.758 |
| Q15 | 0.308 | 0.195 | 0.24 | 0.164 | **0.681** | 0.3 | 0.771 |
| Q16 | 0.31 | 0.236 | 0.282 | 0.19 | **0.653** | 0.237 | 0.75 |
| Q17 | 0.341 | 0.289 | 0.174 | 0.252 | **0.642** | 0.221 | 0.755 |
| Q18 | 0.31 | 0.315 | 0.231 | 0.291 | **0.572** | 0.25 | 0.723 |
| Q19 | 0.307 | 0.265 | 0.272 | 0.243 | **0.643** | 0.28 | 0.789 |
| Q20 | 0.332 | 0.289 | 0.202 | 0.255 | **0.618** | 0.256 | 0.747 |
| Q21 | **0.67** | 0.221 | 0.23 | 0.233 | 0.33 | 0.222 | 0.763 |
| Q22 | **0.642** | 0.22 | 0.179 | 0.234 | 0.329 | 0.27 | 0.729 |
| Q23 | **0.675** | 0.228 | 0.226 | 0.212 | 0.281 | 0.252 | 0.746 |
| Q24 | **0.697** | 0.214 | 0.246 | 0.216 | 0.234 | 0.235 | 0.749 |
| Q25 | **0.738** | 0.243 | 0.218 | 0.218 | 0.265 | 0.195 | 0.807 |
| Q26 | **0.649** | 0.274 | 0.224 | 0.233 | 0.28 | 0.244 | 0.738 |
| Q27 | **0.651** | 0.254 | 0.253 | 0.206 | 0.229 | 0.26 | 0.715 |
| Q28 | 0.236 | 0.273 | **0.706** | 0.301 | 0.145 | 0.182 | 0.775 |
| Q29 | 0.201 | 0.321 | **0.674** | 0.259 | 0.184 | 0.217 | 0.745 |
| Q30 | 0.237 | 0.321 | **0.612** | 0.274 | 0.269 | 0.244 | 0.74 |
| Q31 | 0.227 | 0.301 | **0.676** | 0.261 | 0.21 | 0.231 | 0.764 |



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| Title | Factor loading | | | | | | Communality |
|---|---|---|---|---|---|---|---|
| | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 | Factor 6 | |
| Q32 | 0.306 | 0.223 | **0.617** | 0.203 | 0.254 | 0.275 | 0.705 |
| Q33 | 0.195 | 0.353 | **0.666** | 0.278 | 0.241 | 0.173 | 0.772 |
| Q34 | 0.235 | 0.266 | **0.681** | 0.26 | 0.234 | 0.202 | 0.752 |
| Q35 | 0.244 | 0.235 | 0.196 | 0.296 | 0.299 | **0.662** | 0.768 |
| Q36 | 0.292 | 0.253 | 0.265 | 0.328 | 0.238 | **0.603** | 0.747 |
| Q37 | 0.284 | 0.264 | 0.238 | 0.239 | 0.316 | **0.612** | 0.738 |
| Q38 | 0.323 | 0.326 | 0.259 | 0.238 | 0.208 | **0.569** | 0.702 |
| Q39 | 0.257 | 0.284 | 0.309 | 0.302 | 0.209 | **0.594** | 0.729 |
| Q40 | 0.344 | 0.231 | 0.191 | 0.225 | 0.319 | **0.579** | 0.696 |
| Q41 | 0.29 | 0.216 | 0.273 | 0.286 | 0.264 | **0.634** | 0.758 |
| Q42 | 0.187 | 0.229 | 0.313 | **0.664** | 0.222 | 0.283 | 0.756 |
| Q43 | 0.252 | 0.218 | 0.334 | **0.63** | 0.253 | 0.245 | 0.744 |
| Q44 | 0.291 | 0.288 | 0.337 | **0.579** | 0.232 | 0.181 | 0.702 |
| Q45 | 0.3 | 0.322 | 0.27 | **0.585** | 0.246 | 0.181 | 0.702 |
| Q46 | 0.245 | 0.247 | 0.29 | **0.661** | 0.23 | 0.274 | 0.77 |
| Q47 | 0.269 | 0.282 | 0.229 | **0.641** | 0.232 | 0.287 | 0.751 |
| Q48 | 0.215 | 0.263 | 0.267 | **0.661** | 0.194 | 0.306 | 0.755 |

Analysis of the factor extraction results and the amount of information provided by the factors, as presented in Table 8, reveals that a total of six factors were extracted. The variance explained by these six factors after rotation is as follows: 13.749%, 13.203%, 13.028%, 11.871%, 11.799%, and 10.939%, respectively. The cumulative variance explained by these factors after rotation is 74.589%.

**Table 8** Total Variance Explained

| Factor | Eigen | | | % of Variance (Unrotated) | | | % of Variance (Rotated) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Eigenvalue | % of Variance | Cumulative % of Variance | Eigenvalue | % of Variance | Cumulative % of Variance | Eigenvalue | % of Variance | Cumulative % of Variance |
| 1 | 25.569 | 60.879 | 60.879 | 25.569 | 60.879 | 60.879 | 5.775 | 13.749 | 13.749 |
| 2 | 1.809 | 4.306 | 65.186 | 1.809 | 4.306 | 65.186 | 5.545 | 13.203 | 26.952 |
| 3 | 1.201 | 2.859 | 68.045 | 1.201 | 2.859 | 68.045 | 5.472 | 13.028 | 39.98 |
| 4 | 1.006 | 2.396 | 70.44 | 1.006 | 2.396 | 70.44 | 4.986 | 11.871 | 51.851 |
| 5 | 0.889 | 2.116 | 72.557 | 0.889 | 2.116 | 72.557 | 4.955 | 11.799 | 63.65 |
| 6 | 0.854 | 2.033 | 74.589 | 0.854 | 2.033 | 74.589 | 4.594 | 10.939 | 74.589 |
| 7 | 0.469 | 1.116 | 75.705 | - | - | - | - | - | - |
| 8 | 0.443 | 1.055 | 76.76 | - | - | - | - | - | - |
| 9 | 0.411 | 0.978 | 77.739 | - | - | - | - | - | - |
| 10 | 0.406 | 0.966 | 78.704 | - | - | - | - | - | - |
| 11 | 0.399 | 0.951 | 79.655 | - | - | - | - | - | - |



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| Factor | Eigen | | | % of Variance (Unrotated) | | | % of Variance (Rotated) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Eigenvalue | % of Variance | Cumulative % of Variance | Eigenvalue | % of Variance | Cumulative % of Variance | Eigenvalue | % of Variance | Cumulative % of Variance |
| 12 | 0.391 | 0.93 | 80.585 | - | - | - | - | - | - |
| 13 | 0.375 | 0.892 | 81.477 | - | - | - | - | - | - |
| 14 | 0.368 | 0.875 | 82.353 | - | - | - | - | - | - |
| 15 | 0.362 | 0.863 | 83.215 | - | - | - | - | - | - |
| 16 | 0.354 | 0.842 | 84.057 | - | - | - | - | - | - |
| 17 | 0.342 | 0.814 | 84.871 | - | - | - | - | - | - |
| 18 | 0.333 | 0.794 | 85.665 | - | - | - | - | - | - |
| 19 | 0.328 | 0.781 | 86.446 | - | - | - | - | - | - |
| 20 | 0.317 | 0.755 | 87.202 | - | - | - | - | - | - |
| 21 | 0.311 | 0.741 | 87.943 | - | - | - | - | - | - |
| 22 | 0.303 | 0.723 | 88.665 | - | - | - | - | - | - |
| 23 | 0.296 | 0.705 | 89.37 | - | - | - | - | - | - |
| 24 | 0.293 | 0.699 | 90.069 | - | - | - | - | - | - |
| 25 | 0.286 | 0.681 | 90.749 | - | - | - | - | - | - |
| 26 | 0.28 | 0.667 | 91.416 | - | - | - | - | - | - |
| 27 | 0.269 | 0.641 | 92.057 | - | - | - | - | - | - |
| 28 | 0.264 | 0.628 | 92.685 | - | - | - | - | - | - |
| 29 | 0.255 | 0.606 | 93.292 | - | - | - | - | - | - |
| 30 | 0.253 | 0.603 | 93.895 | - | - | - | - | - | - |
| 31 | 0.248 | 0.591 | 94.485 | - | - | - | - | - | - |
| 32 | 0.244 | 0.582 | 95.067 | - | - | - | - | - | - |
| 33 | 0.242 | 0.576 | 95.643 | - | - | - | - | - | - |
| 34 | 0.237 | 0.565 | 96.208 | - | - | - | - | - | - |
| 35 | 0.226 | 0.539 | 96.747 | - | - | - | - | - | - |
| 36 | 0.22 | 0.524 | 97.271 | - | - | - | - | - | - |
| 37 | 0.211 | 0.501 | 97.772 | - | - | - | - | - | - |
| 38 | 0.203 | 0.484 | 98.256 | - | - | - | - | - | - |
| 39 | 0.191 | 0.455 | 98.712 | - | - | - | - | - | - |
| 40 | 0.19 | 0.453 | 99.164 | - | - | - | - | - | - |
| 41 | 0.179 | 0.426 | 99.591 | - | - | - | - | - | - |
| 42 | 0.172 | 0.409 | 100 | - | - | - | - | - | - |

Based on Table 9, it is observed that males constitute approximately 69.06% of the sample, while females represent about 30.94%, indicating a male predominance in the sports major. In terms of age distribution, individuals aged 18 to 22 are relatively evenly distributed, with proportions ranging from 19.4% to 20.76%. Regarding grade levels, first-year, second-year, and third-year students account for approximately 33.38%, 30.39%, and 36.23%, respectively. Overall, the sample size selected for this survey is deemed adequate and representative.

**Table 9** Overview of the demographic characteristics of the sample

| Information | Title | Frequency | Percent (%) |
|---|---|---|---|
| Sex | Male | 509 | 69.06 |



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| Information | Title | Frequency | Percent (%) |
|---|---|---|---|
| Age | Female | 228 | 30.94 |
| | 18 | 149 | 20.22 |
| | 19 | 144 | 19.54 |
| | 20 | 148 | 20.08 |
| | 21 | 143 | 19.4 |
| | 22 | 153 | 20.76 |
| Grade | Freshman | 246 | 33.38 |
| | Sophomore | 224 | 30.39 |
| | Junior | 267 | 36.23 |

Table 10 presents the current scores for cognitive factors and their dimensions. For "cognitive factors," the sample size is 737, with a mean score of 3.443, which is greater than 3 but less than 4, indicating an overall moderate level of cognitive factors. The standard deviation is 1.104, and the median is 3.929, suggesting significant variability among respondents, with some scoring slightly above the moderate level. For "learning motivation," the sample size is 737, with a mean score of 3.468, which is the highest of the two dimensions but still below 4, indicating a moderate level of learning motivation. The standard deviation is 1.143, and the median is 4, indicating considerable variation among respondents, with some exhibiting a good level of motivation. For "learning attitude," the sample size is 737, with a mean score of 3.418, which is greater than 3 but not reaching 4, reflecting a moderate learning attitude. The standard deviation is 1.165, and the median is 3.857, suggesting substantial variability among respondents, with some having a learning attitude slightly above the moderate level.

**Table 10** Current status of cognitive elements and their dimensions

| Title | N | Min. | Max. | Mean | S.D. | Median |
|---|---|---|---|---|---|---|
| Cognitive elements | 737 | 1.143 | 4.857 | 3.443 | 1.104 | 3.929 |
| Learning Motivation | 737 | 1 | 5 | 3.468 | 1.143 | 4 |
| Learning Attitude | 737 | 1 | 5 | 3.418 | 1.165 | 3.857 |

Table 11 reveals that grade level has a significant effect on learning motivation at the 0.01 level ($F = 13.694$, $p = 0.000$). The mean scores indicate that first-year students score higher than both second-year and third-year students, while second-year students score higher than third-year students. Similarly, grade level significantly affects learning attitude at the 0.01 level ($F = 14.771$, $p = 0.000$), with first-year students scoring higher than second-year and third-year students, and second-year students scoring higher than third-year students. Furthermore, grade level also significantly impacts cognitive factors at the 0.01 level ($F = 15.450$, $p = 0.000$), with first-year students scoring higher than both second-year and third-year students, and second-year students scoring higher than third-year students. Overall, the levels of cognitive factors and their dimensions decrease progressively from the first year through to the third year.

**Table 11** Results of cognitive elements and their dimensional ANOVA for different grades

| Title | Grade | M±SD | F | P | Post-hoc multiple comparisons |
|---|---|---|---|---|---|
| Learning Motivation | Freshman | 3.72±1.17 | 13.694 | 0.000** | Freshman>Sophomore; Freshman>Junior; Sophomore>Junior |
| | Sophomore | 3.51±1.17 | | | |
| | Junior | 3.20±1.03 | | | |
| Learning Attitude | Freshman | 3.71±1.28 | 14.771 | 0.000** | Freshman>Sophomore; Freshman>Junior; Sophomore>Junior |
| | Sophomore | 3.40±1.13 | | | |
| | Junior | 3.16±1.02 | | | |
| | Freshman | 3.72±1.17 | 15.45 | 0.000** | |



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| Title | Grade | M±SD | F | P | Post-hoc multiple comparisons |
|---|---|---|---|---|---|
| Cognitive elements | Sophomore | 3.45±1.09 | | | Freshman>Sophomore; Freshman>Junior; Sophomore>Junior |
| | Junior | 3.18±0.99 | | | |

Table 12 indicates that for "emotional factors," the sample size is 737, with a mean score of 3.414, which is above 3 but below 4, reflecting an overall moderate level of emotional factors. The standard deviation is 1.089, and the median is 3.875, suggesting considerable variability among respondents, with some displaying slightly higher-than-average levels of emotional factors. For "self-efficacy in learning," the sample size is 737, with a mean score of 3.41, indicating moderate performance in this area. The standard deviation is 1.133, and the median is 3.833, showing substantial variability among respondents, with some exhibiting slightly higher-than-average levels of self-efficacy. For "learning anxiety," the sample size is 737, with a mean score of 3.418, indicating moderate levels of learning anxiety. The standard deviation is 1.132, and the median is 3.875, reflecting considerable variability, with some respondents having slightly higher-than-average levels of anxiety. Overall, the scores for emotional factors are somewhat lower than those for cognitive factors, positioning them at a moderate-to-high level.

**Table 12** Current status of emotional elements and their dimensions

| Title | N | Min. | Max. | Mean | S.D. | Median |
|---|---|---|---|---|---|---|
| Emotional elements | 737 | 1.146 | 4.854 | 3.414 | 1.089 | 3.875 |
| Learning Self-Efficacy | 737 | 1 | 5 | 3.41 | 1.133 | 3.833 |
| Learning Anxiety | 737 | 1 | 5 | 3.418 | 1.132 | 3.875 |

Table 13 reveals that grade level significantly affects self-efficacy in learning at the 0.01 level (F = 8.678, p = 0.000). The mean scores indicate that first-year students score higher than third-year students, and second-year students score higher than third-year students. For learning anxiety, grade level also shows significant effects at the 0.01 level (F = 11.568, p = 0.000), with second-year students exhibiting higher levels than both first-year and third-year students, and first-year students scoring lower than second-year students. Additionally, grade level significantly affects emotional factors at the 0.01 level (F = 8.788, p = 0.000), with second-year students scoring higher than both first-year and third-year students. Overall, students in their second year score the highest in emotional factors and their dimensions, followed by first-year students, whereas learning anxiety is higher among third-year students compared to first-year students.

**Table 13** Results of emotional elements and their dimensional ANOVA for different grades

| Title | Grade | M±SD | F | P | Post-hoc multiple comparisons |
|---|---|---|---|---|---|
| Learning Self-Efficacy | Freshman | 3.44±1.07 | 8.678 | 0.000** | Freshman>Junior; Sophomore>Junior |
| | Sophomore | 3.63±1.21 | | | |
| | Junior | 3.21±1.09 | | | |
| Learning Anxiety | Freshman | 3.22±0.97 | 11.568 | 0.000** | Sophomore>Freshman; Sophomore>Junior |
| | Sophomore | 3.70±1.24 | | | |
| | Junior | 3.36±1.14 | | | |
| Emotional elements | Freshman | 3.33±0.98 | 8.788 | 0.000** | Sophomore>Freshman; Sophomore>Junior |
| | Sophomore | 3.66±1.18 | | | |
| | Junior | 3.28±1.07 | | | |

Table 14 presents the current scores for ability factors and their dimensions. For "ability factors," the sample size is 737, with a mean score of 3.432, which is above 3 but below 4, indicating an overall moderate level of ability factors. The standard deviation is 1.105, and the median is 3.929, suggesting that some



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respondents exhibit slightly higher-than-average levels of ability factors, though there is considerable variability. For "learning strategies," the sample size is 737, with a mean score of 3.442, indicating a moderate level of learning strategies. The standard deviation is 1.157, and the median is 3.857, showing that some respondents demonstrate slightly higher-than-average levels of learning strategies, with significant variability. For "training investment," the sample size is 737, with a mean score of 3.421, reflecting a moderate level of training investment. The standard deviation is 1.165, and the median is 3.857, indicating that respondents show slightly higher-than-average levels of training investment, with considerable variability.

**Table 14** Current status of Ability elements and their dimensions

| Title | N | Min. | Max. | Mean | S.D. | Median |
|---|---|---|---|---|---|---|
| Ability elements | 737 | 1.071 | 4.786 | 3.432 | 1.105 | 3.929 |
| Learning Strategy | 737 | 1 | 5 | 3.442 | 1.157 | 3.857 |
| Training and Learning Investment | 737 | 1 | 5 | 3.421 | 1.165 | 3.857 |

Table 15 shows that grade level significantly affects learning strategies at the 0.05 level (F = 3.739, p = 0.024). The mean scores reveal that third-year students score higher than first-year students, and third-year students also score higher than second-year students. For training investment, grade level exhibits significant effects at the 0.01 level (F = 8.472, p = 0.000). The mean scores indicate that second-year students score higher than first-year students, third-year students score higher than first-year students, and third-year students also score higher than second-year students. Additionally, grade level significantly impacts ability factors at the 0.01 level (F = 6.068, p = 0.002), with third-year students scoring higher than both first-year and second-year students. Overall, the levels of ability factors and their dimensions increase progressively from the first year through the third year.

**Table 15** Results of ability elements and their dimensional ANOVA for different grades

| Title | Grade | M±SD | F | P | Post-hoc multiple comparisons |
|---|---|---|---|---|---|
| Learning Strategy | Freshman | 3.36±1.10 | 3.739 | 0.024* | Junior>Freshman; Junior>Sophomore |
| | Sophomore | 3.35±1.09 | | | |
| | Junior | 3.60±1.25 | | | |
| Training and Learning Investment | Freshman | 3.20±1.03 | 8.472 | 0.000** | Sophomore>Freshman; Junior>Freshman; Junior>Sophomore |
| | Sophomore | 3.42±1.10 | | | |
| | Junior | 3.62±1.30 | | | |
| Ability elements | Freshman | 3.28±1.00 | 6.068 | 0.002** | Junior>Freshman; Junior>Sophomore |
| | Sophomore | 3.39±1.04 | | | |
| | Junior | 3.61±1.22 | | | |

## Discussion

This study analyzes and discusses the framework and current status of learner characteristics among sports major students, further supplementing and enriching related research in the field of vocational education for sports majors. It emphasizes the key issue of improving the quality of classroom teaching in sports majors—how to conduct teaching in a manner that suits the students. To some extent, this is conducive to raising attention and emphasis on issues related to students' learning and learner characteristics within the field of sports major education and lays a certain foundation for subsequent research.

However, due to limitations in time, practical conditions, and capability, as well as the complexity of the learning process and the richness of learner characteristics among sports major students, this study still has many shortcomings that need to be addressed. Firstly, compared to other studies, this research, due



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to practical limitations, only considered the actual situation of three grade levels. However, the sample size of students from these three grade levels is still relatively small, which may lead to insufficient research on learner characteristics throughout the entire university learning development process (Creswell, 2014).

Additionally, this study did not conduct experimental or longitudinal research. Although interviews and questionnaires were employed to actively collect data, each research method has its limitations (Patton, 2002). To better grasp the learner characteristics and patterns of sports major students and propose more targeted optimization strategies, a combination of multiple research methods is needed (Denzin & Lincoln, 2011). Future research should consider expanding the sample size and including longitudinal studies to provide a more comprehensive understanding of learner characteristics across different stages of university education.

## Conclusion

This study, analyzing the abilities, emotional, and cognitive factors of sports students at universities in Guizhou Province, underscores the importance of understanding the diverse learning characteristics of these students. The findings reveal that although there are no statistically significant gender differences, there are notable variations across different academic years. Freshmen show the highest cognitive scores, possibly due to their enthusiasm and openness to new knowledge and skills. However, as they advance through their academic years, a decline in cognitive performance is observed, likely due to increased academic and training pressures. In terms of emotional stability, sophomores score higher than freshmen and juniors, which may be attributed to better adjustment to university life. In the area of abilities, juniors outperform their younger counterparts, likely benefiting from accumulated experience and skill development. These insights highlight the need for targeted training and development programs that address the unique needs of each academic year, emphasizing the development of learning abilities, emotional stability, and cognitive skills. The research calls for educational institutions to adopt a more nuanced approach to supporting sports students, ensuring that priority is given to their individual growth and development, thereby achieving better outcomes in both academic and athletic endeavors.

## Recommendation

Based on the current findings, this study offers several recommendations for improving the educational experience of sports students and proposes directions for future research. Educational institutions should develop and implement differentiated training programs tailored to the unique needs of sports students at different academic levels. Recognizing the distinct variations in cognitive, emotional, and ability elements across academic years, these programs should bolster the strengths and address the challenges specific to each group. Additionally, establishing robust evaluation and assessment systems is crucial for monitoring students' holistic development in these domains. Such systems will provide feedback that can inform personalized support strategies. Universities should also prioritize mental health support services, especially for freshmen and juniors who exhibit fluctuations in emotional stability. Enhanced classroom teaching that aligns with the learning characteristics of sports students is another key recommendation, requiring educators to be trained to address the specific needs of these students, creating a more engaging and supportive learning environment.

For future research, expanding the sample size and including students from all academic years and different universities would provide a more comprehensive understanding of learner characteristics and their evolution over time. Longitudinal studies tracking students' development throughout their academic careers could offer valuable insights into the long-term effects of various educational interventions. Incorporating experimental methodologies could also help test specific hypotheses about the impact of tailored educational interventions on sports students' cognitive, emotional, and physical development. Additionally, exploring other potential variables, such as socioeconomic background, previous training experience, and specific sports discipline, could lead to a more nuanced understanding of the factors contributing to students' academic and athletic success. By addressing these areas, educational institutions



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can better support the development of sports students, ensuring they achieve their full potential both academically and athletically.

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