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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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IMPACT OF LEARNING ATTITUDES ON LEARNING ENGAGEMENT AMONG MEDICAL STUDENTS AT A VOCATIONAL COLLEGE: A CASE STUDY OF MEDICAL STATISTICS

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Abstract.

Objective: This study aimed to identify factors influencing learning attitudes and study engagement among vocational medical students and to further analyze the impact of learning attitude on study engagement.

Methods: A total of 243 first-year students enrolled in the Medical Statistics course at our institution participated in the study. They were assessed using the Chinese versions of the Statistical Attitudes Towards Teaching Survey (SATS-36) and the Utrecht Work Engagement Scale for Students (UWES-S). Linear regression analysis was employed to examine the effect of learning attitude on study engagement.

Results: Significant differences were observed in both the total learning attitude scores and overall study engagement scores based on students' perceptions of course interest, practicality, and teaching quality (all $P < 0.05$). A significant difference was also found in the vigor dimension of study engagement between only children and non-only children ($P = 0.036$). Multivariate linear regression analysis indicated that mean scores for the cognitive component, interest, and effort in learning attitude had a significant positive effect on total study engagement scores, whereas the mean score for perceived difficulty had a significant negative effect.

Conclusion: The overall levels of learning attitude and study engagement among the vocational students were moderate. Cultivating positive learning attitudes may help enhance students' study engagement.

Key words. Learning attitude, study engagement, medical statistics, influencing factors.

Introduction.

Medical Statistics, as an interdisciplinary field, skillfully applies the principles and methods of mathematical statistics to the medical domain, playing a vital role in various disciplines such as basic medicine, clinical medicine, preventive medicine, and public health [1]. This subject not only provides scientific tools for data analysis and interpretation in medical research but also facilitates the accumulation of medical knowledge and the optimization of clinical practice. In recent years, with the rapid advancement of medical science and the widespread integration of big data technologies, the collection, organization, and analysis of medical data have become increasingly complex and diverse. Against this backdrop, the importance of statistics courses has become ever more prominent in pharmaceutical undergraduate institutions. It is not only a key course for medical students to master scientific research methods and enhance their research capabilities but also crucial support for making scientific decisions and optimizing treatment plans in their future clinical practice. Similarly, to meet the demands of the times and new requirements for talent cultivation, pharmaceutical junior colleges are increasingly emphasizing the teaching of statistics. These institutions are committed to cultivating versatile talents who possess solid medical knowledge and skills, and can flexibly apply statistical methods for data analysis and problem-solving.

However, the concepts, formulas, and theories of statistics are often abstract and complex, posing a significant challenge for medical students who may lack a strong mathematical foundation or are accustomed to intuitive learning. When confronted with numerous mathematical symbols, intricate calculation processes, and abstract theoretical derivations, many students are prone to develop apprehension and even lose confidence and motivation to learn. Once this psychological state takes hold, it can negatively impact their learning outcomes, thereby affecting their future professional development. Furthermore, traditional teaching methods often focus on theoretical explanations and formula derivations, lacking integration with real-world medical cases, which makes it difficult to stimulate students' interest and motivation to learn. Consequently, amidst the heavy workload of medical courses and the inherent abstractness and challenge of statistics, students' interest and engagement in this subject are often less than satisfactory [2,3].

Existing research indicates that students' learning motivation and effectiveness are closely related to their learning attitudes. A positive learning attitude can stimulate students' intrinsic motivation, encouraging them to engage more actively in learning, thereby optimizing learning behaviors and improving learning efficiency [2]. Such an attitude is particularly important in learning statistics. It not only helps students overcome difficulties and challenges during the learning process and enhances their self-efficacy in learning but also promotes a deeper understanding and flexible application of statistical knowledge [4]. Students with a strong sense of professional identity often exhibit greater enthusiasm and loyalty to their field of study. They are more willing to invest time and effort in learning and exploration, and can maintain a positive mindset and persistent effort even when facing difficulties and challenges [5].

This study selects junior college students enrolled in the Medical Statistics course as participants, aiming to explore how their attitudes toward statistics influence their learning engagement, with the goal of providing useful references for enhancing the quality of course education.

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Materials and Methods.

Study Population:

This study recruited first-year students from the Preventive Medicine and Medical Laboratory Technology programs enrolled in the "Medical Statistics" course during the spring semester of 2023–2024 at our institution. The textbook used was Medical Statistics, published by the People's Medical Publishing House and edited by Wang Tong and Yao Yingshui. Data collection was conducted through an online questionnaire distributed via the Questionnaire Star platform.

Research Methods:

Based on a review of the relevant literature, a general information questionnaire was developed. The survey collected basic demographic characteristics, including gender, student ID number, place of origin, and singleton status. Course-related information was also gathered, covering aspects such as perceived course interest, practicality, and evaluation of the teaching.

Statistical Attitude Scale:

This study employed the adapted Chinese version of the Statistical Attitudes Toward Statistics (SATS-36) scale. The instrument comprises 36 items rated on a 7-point Likert scale (1 = "strongly disagree" to 7 = "strongly agree"). It assesses six dimensions: Affect (6 items: (3, 4*, 15*, 18*, 19, 28*) Cognitive Competence (6 items:5*, 11*, 26*, 31, 32, 35*), Value (9 items: 7*, 9, 10, 13*, 16*, 17, 21*, 25*, 33*), Difficulty (7 items: 6, 8*, 22, 24*, 30*, 34*, 36*), Interest (4 items: 12, 20, 23, 29), and Effort (4 items: 1, 2, 14, 27). Items marked with an asterisk * are negatively worded and were reverse-scored before calculating total and dimension scores. Higher total scores indicate more positive attitudes toward statistics. The scale demonstrated good internal consistency, with a Cronbach's α of 0.860 for the overall scale and α coefficients of 0.618, 0.632, 0.819, 0.604, 0.917, and 0.802 for the six dimensions, respectively.

Learning Engagement Scale:

The Learning Engagement Scale is designed to assess the level of students' involvement in the learning process. This study employed the Chinese version of the Utrecht Work Engagement Scale for Students (UWES-S), revised by Li Xiying et al., which is tailored for the Chinese university student population. The scale consists of 17 items across three dimensions: vigor, dedication, and absorption. Responses were captured using a 7-point Likert scale, ranging from 0 ("never") to 6 ("always/daily") [6]. The scale demonstrated excellent internal consistency, with a Cronbach's α coefficient of 0.973 in this study.

Statistical Methods:

Data analysis was performed using SPSS Statistics version 26.0. Continuous variables are described as mean ± standard deviation, while categorical variables are presented as frequencies and percentages. A linear regression analysis was employed to examine the impact of learning attitude on learning engagement. Collinearity was diagnosed using the variance inflation factor (VIF) and tolerance. The assessment criteria were as follows: a VIF < 10 indicated no multicollinearity, 10 ≤ VIF < 100 indicated strong multicollinearity, and a VIF ≥ 100 indicated severe multicollinearity. A tolerance value of < 0.1 was also considered indicative of severe multicollinearity. The significance level was set at $\alpha = 0.05$.

Results.

General Information:

A total of 261 questionnaires were distributed, and 243 valid responses were collected, yielding an effective response rate of 93.1%. The sample consisted of 86.4% female and 13.6% male students. Regarding family background, 21.8% were only children, while 78.2% were non-only children. In terms of course perceptions, 40.7% of the students reported interest in the Medical Statistics course, and a high proportion (82.3%) acknowledged its practicality. Furthermore, 77.8% of the students rated the course teaching as "good". Details are presented in Table 1.

Table 1. *Demographic and Course-Related Characteristics of the Participants (n=243).*

Variable	Category	n (%)
Gender	Male	33 (13.6)
	Female	210 (86.4)
Place of Origin	Urban	90 (37.0)
	Rural	153 (63.0)
Only Child	Yes	53 (21.8)
	No	190 (78.2)
Interest in the Course	Interested	99 (40.7)
	Neutral	135 (55.6)
	Not Interested	9 (3.7)
Perceived Usefulness of the Course	Useful	200 (82.3)
	Neutral	39 (16.1)
	Not Useful	4 (1.6)
Evaluation of Teaching	Good	189 (77.8)
	Fair	52 (21.4)
□	Poor	2 (0.8)

Learning Attitude and Engagement Scores:

The mean score per item for the overall SATS-36 learning attitude scale was 4.32 ± 0.53. Among its dimensions, 'Difficulty' received the lowest score (3.15 ± 0.66). For learning engagement, the overall mean score per item was 4.03 ± 0.92, with the 'Dedication' dimension scoring the lowest (3.93 ± 0.95). Detailed scores are presented in Table 2.

Analysis of Influencing Factors Across Dimensions of Learning attitude and Learning engagement:

The total scores of the SATS-36 learning attitude scale and learning engagement significantly differed based on students' level of interest in the course, perceived practicality of the course, and evaluation of the teaching (all $P < 0.05$). However, no statistically significant difference was found in the 'Difficulty' dimension of the SATS-36 across different levels of course interest. Furthermore, gender and place of origin showed no significant effects on either learning attitude or learning engagement. A significant difference was observed in the 'Vigor'

Table 2. *Learning attitude and Learning engagement Scores (□χ±s□score).*

Scale / Dimension	Number of Items	Total Score (Mean ± SD)	Mean Score per Item (Mean ± SD)	Cronbach's α
SATS-36 Total Score	36	155.63±19.15	4.32±0.53	0.860
Affect	6	25.19±4.87	4.20±0.81	0.618
Cognitive Competence	6	25.21±4.60	4.20±0.77	0.632
Value	9	42.81±7.64	4.76±0.85	0.819
Difficulty	7	22.04±4.59	3.15±0.66	0.604
Interest	4	18.47±4.41	4.62±1.10	0.917
Effort	4	21.91±3.99	5.48±1.00	0.802
UWES-S Total Score	17	68.51±15.62	4.03±0.92	0.973
Vigor	6	23.82±5.75	3.97±0.96	0.929
Dedication	5	19.63±4.74	3.93±0.95	0.907
Absorption	6	25.06±5.67	4.18±0.94	0.943

Table 3. *Comparison of Learning Attitudes and Learning Engagement Scores across Demographic and Course-Related Variables (Mean ± SD).*

Variable	Group	Affect	Cognitive Competence	Value	Difficulty	Interest	Effort	SATS-36 Total	Vigor	Dedication	Absorption	UWES-S Total
Gender	Male	4.19±0.93	4.21±0.82	4.67±0.89	3.3±0.73	4.68±1.31	5.28±1.19	4.32±0.52	3.80±1.28	3.83±1.22	3.95±1.32	3.86±1.26
	Female	4.2±0.79	4.2±0.76	4.77±0.84	3.12±0.64	4.61±1.07	5.51±0.96	4.32±0.53	4.00±0.90	3.94±0.9	4.21±0.87	4.06±0.85
	t	-0.048	0.038	-0.627	1.458	0.355	-1.222	-0.077	-0.864	-0.623	-1.077	-0.853
	P	0.962	0.97	0.531	0.146	0.723	0.223	0.939	0.393	0.534	0.289	0.399
Place of Origin	Urban	4.16±0.89	4.17±0.81	4.69±0.88	3.10±0.67	4.57±1.09	5.36±0.97	4.27±0.54	4.10±0.96	4.00±0.93	4.27±0.94	4.13±0.92
	Rural	4.22±0.76	4.22±0.74	4.79±0.83	3.18±0.65	4.65±1.11	5.55±1.01	4.36±0.53	3.90±0.95	3.88±0.96	4.12±0.94	3.97±0.92
	t	-0.546	-0.44	-0.897	-0.947	-0.559	-1.43	-1.257	1.597	0.991	1.169	1.313
	P	0.585	0.66	0.371	0.345	0.577	0.154	0.21	0.112	0.323	0.244	0.191
Only child	Yes	4.27±0.91	4.36±0.85	4.94±0.96	3.12±0.72	4.86±1.19	5.38±1.07	4.42±0.52	4.21±1	4.12±0.99	4.3±1.04	4.22±0.99
	No	4.18±0.78	4.16±0.74	4.71±0.81	3.16±0.64	4.55±1.07	5.50±0.98	4.30±0.53	3.9±0.94	3.87±0.93	4.14±0.92	3.98±0.89
	t	0.733	1.649	1.614	-0.412	1.836	-0.786	1.451	2.105	1.699	1.095	1.687
	P	0.465	0.1	0.111	0.681	0.068	0.433	0.148	0.036	0.091	0.274	0.093
Interest in Course	Interested	4.55±0.86[a]	4.48±0.81	5.06±0.88	3.16±0.66	5.13±1.07	5.78±1.01	4.59±0.54	4.24±0.93	4.18±0.88	4.43±0.89	4.29±0.86
	Neutral	4.01±0.63[b]	4.07±0.63	4.58±0.75	3.14±0.63	4.34±0.88	5.30±0.86	4.17±0.41	3.8±0.85	3.78±0.88	4.02±0.87	3.87±0.84
	Not interested	3.19±0.92[c]	3.24±0.94	4.11±0.97	3.11±1.04	3.22±1.77	4.75±1.70	3.59±0.44	3.44±1.84	3.27±1.77	3.81±1.81	3.52±1.79
	F	23.32	17.71	12.93	0.03	26.68	9.79	34.11	7.821	7.85	6.293	7.741
	P	□0.001	□0.001	□0.001	0.97	□0.001	□0.001	□0.001	0.001	□0.001	0.002	0.001
Perceived Usefulness	Useful	4.28±0.83	4.25±0.78	4.88±0.84	3.08±0.623	4.75±1.05	5.62±0.91	4.39±0.52	4.07±0.89	4.01±0.89	4.27±0.88	4.12±0.85
	Neutral	3.82±0.58	3.97±0.67	4.22±0.58	3.44±0.65	4.01±0.98	4.83±1.04	4.00±0.48	3.53±0.96	3.55±0.9	3.76±0.89	3.62±0.88
	Not Useful	3.67±0.53	3.92±0.83	3.61±0.45	3.89±1.07	4.00±2.45	4.69±1.95	3.89±0.12	3.29±2.52	3.35±2.55	3.33±2.54	3.32±2.53
	F	6.577	2.626	15.443	8.188	8.547	12.474	11.04	6.482	4.779	6.747	6.47
	P	0.002	0.074	□0.001	□0.001	□0.001	□0.001	□0.001	0.002	0.009	0.001	0.002
Teaching Evaluation	Good	4.31±0.84	4.29±0.78	4.92±0.85	3.09±0.64	4.78±1.062	5.65±0.93	4.42±0.53	4.07±0.9	4.03±0.89	4.27±0.87	4.13±0.85
	Fair	3.81±0.54	3.88±0.60	4.23±0.57	3.32±0.62	4.04±0.90	4.89±0.90	3.98±0.35	3.65±0.93	3.6±0.91	3.87±0.94	3.71±0.89
	Poor	3.58±0.82	4.00±1.41	3.44±0.63	4.00±1.82	4.00±4.24	4.63±3.36	3.86±0.04	3.00±4.24	3.00±4.24	3.00±4.24	3.00±4.24
	F	8.743	6.327	18.089	4.308	10.376	13.634	17.128	5.08	5.25	5.424	5.619
	P	□0.001	0.002	□0.001	0.015	□0.001	□0.001	□0.001	0.007	0.006	0.005	0.004

Table 4. *Correlation matrix between learning attitude dimensions and learning engagement (r).*

Dimension	UWES-S Total	Vigor	Dedication	Absorption
Total SATS-36 Score	0.441**	0.431**	0.425**	0.422**
Affect	0.254**	0.262**	0.248**	0.228**
Cognitive Competence	0.273**	0.290**	0.259**	0.242**
Value	0.277**	0.240**	0.250**	0.311**
Difficulty	-0.314**	-0.255**	-0.260**	-0.389**
Interest	0.673**	0.649**	0.661**	0.643**
Effort	0.578**	0.531**	0.530**	0.610**
Note: **P□0.01				

Table 5. *Multiple Linear Regression Analysis of Factors Associated with Learning Engagement in Medical Statistics.*

Variable	*B*	*S.E.*	*Beta*	*t*	*P*	*95%CI*	*VIF*	Tolerance value
Affect	-0.123	0.089	-0.109	-1.394	0.165	-0.298~0.051	2.887	0.346
Cognitive Competence	0.219	0.094	0.183	2.335	0.020	0.034~0.404	2.901	0.345
Value	-0.089	0.078	-0.082	-1.14	0.255	-0.243~0.065	2.455	0.407
Difficulty	-0.186	0.082	-0.133	-2.281	0.023	-0.347~-0.025	1.602	0.624
Interest	0.429	0.057	0.516	7.479	□0.001	0.316~0.542	2.248	0.445
Effort	0.189	0.062	0.206	3.068	0.002	0.068~0.311	2.123	0.471

***Note:** B = unstandardized coefficient; SE = standard error; Beta = standardized coefficient; CI = confidence interval. The dependent variable is the total score of learning engagement.*

dimension of learning engagement between only children and non-only children (P = 0.036), as presented in Table 3.

Learning attitude and Learning Engagement: A Correlation Analysis:

Total scores and all dimensional scores of the Learning Attitude (SATS-36) and Learning Engagement (UWES-S) scales demonstrated significant correlations (all $P < 0.01$). A significant positive correlation was observed between the total SATS-36 score and the total UWES-S score ($r = 0.441$). Furthermore, most learning attitude dimensions showed positive correlations with engagement, whereas the 'Difficulty' dimension was negatively correlated with learning engagement.

Regression Analysis of Learning Engagement:

A multiple linear regression model was fitted with the total learning engagement score as the dependent variable and the mean scores of the learning attitude dimensions (Affect, Cognitive Competence, Value, Difficulty, Interest, and Effort) as independent variables, along with perceived course interest, practicality, and teaching evaluation as covariates. The collinearity diagnostics showed that the tolerance values ranged from 0.345 to 0.624 and the VIF values ranged from 1.602 to 2.901, indicating the absence of multicollinearity in the model. The results indicated that the mean scores for Cognitive Competence ($\beta = 0.219$, $p = 0.020$), Interest ($\beta = 0.492$, $p < 0.001$), and Effort ($\beta = 0.189$, $p = 0.002$) had significant positive effects on the total learning engagement score. In contrast, the mean score for Difficulty ($\beta = -0.186$, $p = 0.023$) exhibited a significant negative impact.

Discussion.

Learning Attitudes of Junior College Students are at a Moderate Level:

The SATS-36 is a scale with good reliability and validity used to measure students' attitudes towards learning Medical Statistics and is widely applied in medical education research [7,8]. This study involved 243 students taking the Medical Statistics course at a medical junior college. Their attitudes were assessed across six dimensions and were found to be at a moderate level (4.32 ± 0.53), which is lower than that reported for undergraduate nursing students (4.40 ± 0.64) [9] and postgraduate students at a medical university in Inner Mongolia (4.58 ± 0.42) [10]. The slightly less positive attitudes among junior college students compared to their undergraduate counterparts may be associated with factors such as insufficient learning initiative, relatively low interest in the subject, and weaker self-management skills. It is recommended to strengthen the stimulation of learning motivation and provide guidance on learning strategies during the teaching process. Furthermore, the dimension scores were similar to those found in domestic studies, with the 'Difficulty' dimension receiving the lowest score, indicating that students perceive the course as challenging [2,11]. This is likely attributable to the highly integrated and logical nature of Medical Statistics content, coupled with the fact that most students lack a foundational background in probability theory and advanced mathematics [12]. Studies involving both undergraduate and postgraduate students have similarly found that students generally perceive the course as difficult and highly practical [13,14]. This suggests that instructors need to consider how to balance the course difficulty with students' comprehension capacity during curriculum design.

Learning Engagement of Junior College Students is at a Moderate to High Level:

Learning engagement is a crucial indicator measuring students' active learning state, encompassing cognitive dimensions such as vigor, dedication, and absorption [15]. This study found that the overall learning engagement of junior college students was at a moderate to high level, with good performance in the vigor and absorption dimensions, but a relatively lower score in the dedication dimension. This phenomenon is closely related to the nature of junior college education, which emphasizes professional skills and practicality. Students tend to focus more on behavioral and cognitive engagement, demonstrating high initiative and agency [16]. However, the relatively lower academic qualification level of junior college students might, to some extent, limit their career development prospects and expectations, potentially leading to a lack of long-term planning and clear goals for some students, thereby affecting their dedication during the learning process. Additionally, while junior college students enter with a relatively weaker academic foundation, they are required to complete a heavy load of basic medical knowledge and professional skill training within two years. This intensive workload may create significant pressure for some students, reducing their learning efficacy and sense of dedication. When facing complex content, some students might feel overwhelmed, further impacting their learning efficacy and dedication. Given the professional and practical orientation of junior college education, it is recommended to adopt more flexible, practice-oriented teaching methods to enhance course appeal. Simultaneously, efforts should be strengthened to stimulate learning motivation, provide guidance

on learning strategies, clarify career goals, and boost learning proactivity. Schools should offer more practical opportunities and career guidance to enhance students' learning confidence and career expectations, foster a positive learning atmosphere, encourage peer learning and collaboration, and establish robust support systems to help students cope with academic pressure and challenges, thereby ultimately improving their learning engagement.

Factors Influencing Learning Attitudes and Engagement:

Students who reported higher interest in the course, perceived it as highly practical, and evaluated the teaching positively demonstrated more positive learning attitudes and higher levels of learning engagement. Firstly, the level of student interest in the course is a key factor. Research indicates a significant positive correlation between student interest and their achievement in statistics [17], meaning students with higher interest often exhibit more positive attitudes and greater engagement. Secondly, the perceived practicality of the course significantly influences student attitudes and engagement. Courses perceived as highly practical, directly applicable to real-world work, can enhance work efficiency and quality. Therefore, if students recognize the high practicality of Medical Statistics for their future careers, they are likely to engage more actively [18,19]. Thirdly, teaching evaluation also plays an important role. Teaching evaluation is a vital component of classroom instruction, impacting both teaching effectiveness and student participation. The use of encouraging evaluations can enhance student interest and involvement [20], potentially improving learning attitudes and engagement. Research on teaching evaluation in postgraduate Medical Statistics courses also suggests that positive evaluations can increase student satisfaction and confidence, thereby boosting engagement [21]. Furthermore, family background, specifically "only child" status, was also identified as a factor influencing learning engagement. Our data showed that only children scored significantly higher on the Vigor dimension. This may be explained by the specific family structure in China, where only children often receive more concentrated family resources and expectations. This environment of high investment and expectation can enhance their self-efficacy and learning motivation [22], thereby enabling them to demonstrate greater energy and resilience in their academic work.

Learning Attitudes Influence Learning Engagement:

Learning attitude is a significant factor influencing student learning engagement, encompassing dimensions such as cognitive competence, interest, effort, and perceived difficulty regarding the learning content. Delving into these dimensions is crucial for understanding and optimizing student learning behaviors in Medical Statistics. Firstly, cognitive competence refers to students' ability to understand and master statistical knowledge, forming the foundation for learning. Studies suggest that students' cognitive attitude towards Medical Statistics is a key factor affecting their learning outcomes [23]. Modular teaching methods, which break down complex concepts into stages, have been shown to significantly enhance positive cognition among postgraduate students in Medical Statistics courses [24], indicating that improving cognitive competence can effectively promote engagement. Secondly, interest, as an intrinsic motivator, profoundly influences learning enthusiasm and is a core indicator of student interest in the content. Research found high scores on the interest dimension among students learning Health Statistics, suggesting that interest is a powerful driver for active learning [25]. This might be because Health Statistics is closely linked to medical practice, allowing direct application to solve real-world problems, thus sparking curiosity and the desire to explore. Therefore, educators should continue exploring ways to stimulate and maintain student interest in statistics, such as through case studies and practical operations, making learning more engaging. Furthermore, effort reflects the investment students make in the learning process. Evidence shows that the effort dimension received the highest score in studies on learning Medical Statistics [11], and a positive correlation exists between learning attitude and research capability [8]. This indicates that greater student effort in learning Medical Statistics correlates with higher learning engagement. Finally, perceived difficulty is students' subjective assessment of how challenging the learning content is. Multiple studies note that students generally perceive Medical Statistics as difficult, and this perception directly affects their engagement. For instance, over 75% of students considered learning statistics relatively difficult [26], a perception that might lead to frustration and reduced engagement. The various dimensions of learning attitude collectively influence student learning engagement. To enhance engagement, educators should focus on improving students' cognitive competence, stimulating and maintaining their interest, encouraging greater effort, and implementing measures to reduce perceived difficulty. The integrated use of methods such as introducing IT-assisted learning, providing diverse learning resources, and organizing group collaborative learning can effectively improve students' attitudes towards Medical Statistics, thereby increasing their learning engagement and ultimately enhancing teaching outcomes.

Research Limitations.

This study has several limitations. First, its cross-sectional design prevents the establishment of causal relationships between learning attitudes and engagement. Second, the high proportion of female participants (86.4%) limits the generalizability of gender-based findings. Third, the sample was drawn solely from Chinese medical institutions, which may restrict the applicability of the results to other cultural or educational settings. Finally, the internal consistency of three SATS-36 subscales (Affect, Cognitive Competence, and Difficulty) was moderate (Cronbach's α between 0.604 and 0.632), potentially affecting the measurement precision of these constructs. Future research should employ longitudinal designs, more balanced samples, and scales with robust psychometric properties across all dimensions.

Conclusion.

This study establishes that specific learning attitudes directly predict engagement in medical statistics. Cognitive competence, interest, and effort were independent positive drivers, while perceived difficulty was a significant negative predictor. These findings advocate for educational strategies that simultaneously foster self-efficacy and interest while systematically reducing

perceived difficulty. Future longitudinal studies are needed to validate these causal relationships and translate them into effective interventions.

Author contributions.

Mengyun Huang designed the study. Wanjun Zhang and Jing Wang contributed to literature searching, data collection and analysis. Tianzhu Wu assessed study quality. Wang Yang and Mengyun Huang wrote and revised the manuscript. All authors read and approved the final manuscript.

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