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The Correlation Between Students' Comprehension of the Human Movement System and Their Attitudes Toward Maintaining Bone and Joint Health

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Abstract This study examines the correlation between students' comprehension of the human movement system and their attitudes toward maintaining bone and joint health among XI MIPA students at MA Wahid Hasyim Balung Jember. Using a quantitative correlational research design, data were collected through multiple-choice tests measuring students' comprehension and Likert-scale questionnaires assessing their attitudes. A total of 66 students participated in the study, with data analyzed using Spearman's rank correlation test. The findings indicated that students had a high level of comprehension, with 77% achieving a very high category and 11% classified as high. However, their attitudes toward bone and joint health were predominantly moderate, with 74% in the medium category and only 24% in the high category. Statistical analysis revealed no significant correlation between comprehension and attitude, as evidenced by a correlation coefficient of -0.056 and a p-value of 0.653 ($p > 0.05$). These results suggest that despite possessing strong cognitive understanding, students do not necessarily translate their knowledge into proactive health behaviors. The findings highlight the need for educational strategies that bridge the gap between theoretical knowledge and practical application, encouraging students to adopt healthier behaviors.

Keywords: Correlation, Students' comprehension, Human movement system, Attitudes, Maintaining bone and joint health

INTRODUCTION

Education is one of the fundamental means for supporting national development (Jahantab, 2021). National development is closely related to educational standards, which regulate and structure learning processes. According to Indonesian Government Regulation No. 57 (2021), Article 1, Paragraph 1, education is defined as a conscious and planned effort to create a learning environment and educational process that enables students to actively develop their potential, including spiritual strength, self-control, intelligence, noble character, and necessary skills. Furthermore, Government Regulation No. 4 (2022), which amends Regulation No. 57, emphasizes that national education must be based on Pancasila, the 1945 Constitution, the Unitary State of Indonesia, and Unity in Diversity. These legal foundations highlight the importance of education as a key aspect of national development, ensuring that students acquire not only academic knowledge but also values that shape their character and overall personal development.

Understanding is defined as the ability to construct meaning from information, encompassing the ability to grasp meaning, explain, infer, identify relationships, and apply learned knowledge to various situations. The level of understanding refers to how well an individual can process and apply information in different contexts (Yaniaja et al., 2020). Sudijono (2016) states that a student is considered to understand a subject if they can explain and elaborate on it using their own words. Similarly, Purwanto emphasizes that comprehension is not merely about memorization but involves grasping concepts and being able to apply them. These perspectives suggest that comprehension involves cognitive mastery and the ability to integrate information meaningfully.

Students' comprehension of the human movement system is crucial (Ferdiansyah et al., 2022), as understanding this topic can influence their mindset and behaviors. Attitudes and behaviors are often shaped by the knowledge individuals acquire (Triyono & Herdiyanto, 2017). When students develop a strong understanding of a subject, they are more likely to exhibit behaviors aligned with that knowledge. The curriculum in Indonesia, particularly the 2013 Curriculum, includes the human movement system as part of the biology syllabus for the first semester of the eleventh grade in high schools and madrasahs. This topic covers the structure of the skeletal system, types of bones and joints, and various disorders affecting the musculoskeletal system, along with their causes and preventive measures. Ideally, students who understand this material should develop a proactive attitude toward maintaining their bone and joint health, not only for themselves but also for those around them.

Attitudes are shaped through lifelong social processes (Zafi, 2018), where individuals gain information and experiences within family, school, and community settings. According to Azwar (2022), one of the key components of attitude formation is the cognitive component, which consists of beliefs and understanding gained through observation, hearing, and experience. The

knowledge individuals acquire provides the foundation for shaping their attitudes and perceptions toward a given subject.

The effort to enhance human resource quality through education is essential for national progress (Lestari & Nuryanti, 2022). This quality is influenced by various factors, including teacher competence, school facilities, teaching materials, instructional methods, and the availability of learning resources. Additionally, human resource development is closely linked to health and well-being. Maintaining a healthy lifestyle is vital in ensuring that individuals remain productive and capable of contributing effectively to society (Amanda et al., 2023).

School environments and daily student activities significantly impact their physical health. Studies by Saputri & Sutikno (2021) indicate that children aged 10 to 17 tend to remain sedentary for approximately 7 to 8 hours per day, either due to full-day schooling or a lack of productive activities at home. Unlike activities such as walking and running, prolonged sitting causes certain muscle groups to remain inactive, potentially leading to muscle weakening. Poor sitting posture can further contribute to physical discomfort and musculoskeletal issues.

A lack of understanding and awareness about musculoskeletal health can result in various disorders. The World Health Organization (WHO) reports that scoliosis prevalence in Indonesia ranges from 3% to 5% of the population, with cases primarily occurring in adolescents aged 10 to 17. Dr. Regina Varani from the Spine Clinic Family Holistic explains that scoliosis is a common spinal disorder in teenagers. Similarly, Dr. Faisal Mi'raj, a specialist in orthopedic surgery, classifies bone disorders in children into congenital abnormalities, which are present at birth, and acquired conditions, which result from various factors such as poor posture, nutritional deficiencies, hormonal imbalances, infections, injuries, and metabolic disorders (Amelia, 2023).

Many of these musculoskeletal disorders are linked to daily habits and lifestyle choices that individuals may not recognize as detrimental. Repetitive and excessive physical activities, combined with a lack of preventive measures, can contribute to these issues. Regular exercise is crucial in mitigating the negative effects of poor habits (Jasri et al., 2025), as it helps restore the balance and functionality of the musculoskeletal system.

An observational study conducted on August 3, 2023, with biology teacher at MA Wahid Hasyim Balung Jember, revealed that many students exhibit poor posture habits. Some students tend to push their heads forward, slouch while writing, and walk with improper posture due to habitual behaviors developed over time. During class, students often lean forward onto their desks, resulting in complaints of back and waist pain. Additionally, students rarely consume milk before starting their daily activities, drink insufficient water, and show little enthusiasm for engaging in physical exercise outside of mandatory physical education classes. At home, students tend to spend more time using electronic devices rather than participating in active pursuits. These behaviors indicate a lack of awareness and concern for bone and joint health.

The relationship between knowledge and attitudes involves both positive and negative aspects. The more positive aspects individuals recognize in an object or concept, the more likely they are to develop a favorable attitude toward it. According to behavioral theory, knowledge serves as a predisposing factor that influences behavior formation (Fadlilah & Rahil, 2019). Attitudes developed from knowledge are often reflected in specific behaviors.

Given the potential long-term consequences of poor bone and joint health, it is crucial to examine the extent to which students' understanding of the human movement system correlates with their attitudes toward maintaining musculoskeletal health. Understanding this relationship can provide valuable insights into whether education on this topic effectively influences students' behaviors.

METHOD

This study employed a quantitative approach to examine the relationship between students' comprehension of the human movement system and their attitudes toward maintaining bone and joint health. Quantitative research involves the systematic collection and statistical analysis of numerical data to investigate specific phenomena (Sugiyono, 2013). In this study, the data collected consisted of students' cognitive learning outcomes on the human movement system and their responses to a Likert-scale questionnaire assessing their attitudes toward bone and joint health. The research utilized a non-experimental correlational design. Correlational research involves collecting data to determine the relationship between two or more quantified variables (Nasution et al., 2023).

The population of this study comprised all XI MIPA students at MA Wahid Hasyim Balung Jember during the 2023/2024 academic year. The total population consisted of 91 students, distributed across three classes: XI MIPA 1, XI MIPA 2, and XI MIPA 3. The sample selection was conducted using purposive sampling, a technique in which the researcher selects participants based on specific criteria that ensure the sample is representative of the population. Two classes, XI MIPA 2 (31 students) and XI MIPA 3 (35 students), were selected as the research sample, while XI MIPA 1 served as a pilot study group. The decision to exclude XI MIPA 1 from the sample was based on recommendations from the biology teacher, as this class was designated as an advanced class.

Data collection employed three primary techniques: questionnaires, multiple-choice tests, and documentation. The attitude questionnaire assessed students' behaviors regarding bone and joint health and was designed in a closed-ended Likert-scale format to ensure consistency in responses adopting the work of Alatas (2005). The comprehension test consisted of multiple-choice questions evaluating students' understanding of the human movement system. Additionally, documentation data included students' average daily test scores and demographic information.

The research instruments underwent a rigorous validation process to ensure their reliability and accuracy. The attitude questionnaire and comprehension test were subjected to expert validation to assess content validity. Expert evaluations determined that all items in the questionnaire and comprehension test were highly valid. Construct validity was established using statistical methods to ensure that the test items accurately measured the intended variables.

Reliability testing was conducted using Cronbach's Alpha coefficient to determine the internal consistency of the instruments. The comprehension test achieved a reliability score of 0.946, and the attitude questionnaire achieved a score of 0.9, both of which indicate a very high level of reliability. This suggests that the instruments produced stable and consistent results across different administrations.

Item discrimination analysis was performed to assess the ability of each test question to differentiate between students with high and low comprehension levels. Items that failed to meet the minimum discrimination index were revised or excluded. Furthermore, item difficulty analysis classified test questions as easy, moderate, or difficult, ensuring an appropriate distribution of question complexity.

Data analysis involved both descriptive and inferential statistics. Descriptive analysis summarized the students' comprehension levels and attitudes using frequency distributions and percentage calculations. Five categories were used to interpret scores: very high, high, moderate, low, and very low. The comprehension test and attitude questionnaire scores were analyzed using these classification criteria.

Inferential statistics were employed to test the research hypothesis. Normality tests were conducted using the Kolmogorov-Smirnov method to determine whether the data were normally distributed. The results indicated that the data were not normally distributed ($p<0.05$), necessitating the use of non-parametric statistical methods. A linearity test was performed to assess whether a linear relationship existed between students' comprehension of the human movement system and their attitudes toward bone and joint health. The results demonstrated that the relationship was linear, justifying the use of correlation analysis.

To test the research hypothesis, the Spearman's rank correlation coefficient was used, as this method is appropriate for analyzing relationships between two non-normally distributed variables. The decision criteria for hypothesis testing were based on significance levels: if the p-value was greater than 0.05, the null hypothesis (H0) was accepted, indicating no significant correlation between the variables. Conversely, if the p-value was less than 0.05, the alternative hypothesis (Ha) was accepted, suggesting a significant correlation.

The correlation coefficient was interpreted using standard guidelines: values between 0.00 and 0.25 indicated a very weak relationship, 0.26 to 0.50 indicated a moderate relationship, 0.51 to 0.75 indicated a strong relationship, and 0.76 to 1.00 indicated a very strong relationship. Positive correlation values indicated that an increase in one variable corresponded with an increase in the other, whereas negative values suggested an inverse relationship.

FINDINGS AND DISCUSSION

This study aimed to investigate the correlation between students' comprehension of the human movement system and their attitudes toward maintaining bone and joint health among XI MIPA students at MA Wahid Hasyim Balung Jember. The findings were analyzed based on descriptive statistics and inferential tests, particularly Spearman's rank correlation analysis.

The results of the comprehension test on the human movement system showed that the majority of students demonstrated a high level of understanding. As shown in Tabel 1, of the 66 respondents, 77% scored in the very high category, 11% in the high category, and 12% in the moderate category, with no students falling into the low or very low categories. This indicates that the students generally possess strong cognitive abilities related to the human movement system. Such comprehension is essential in biology education as it allows students to grasp the structure and function of the skeletal and muscular systems, which are crucial for human movement.

Table 1. The results of students' comprehension of the human movement system.

No	Category	Frequncy	Percentage
1	Very High	51	77%
2	High	7	11%
3	Moderate	8	12%
4	Low	0	0%
5	Very Low	0	0%
	Total	**66**	**100%**

Regarding students' attitudes toward maintaining bone and joint health, the questionnaire results as shown in Tabel 2 revealed that 74% of the students exhibited a moderate level of concern, 24% displayed a high level, and 2% demonstrated a low level. This suggests that although most students were aware of the importance of bone and joint health, their attitudes did not consistently reflect a high commitment to maintaining these aspects of health. Factors such as lifestyle, external influences, and the effectiveness of health education might contribute to this discrepancy.

Table 2. The results of students' attitudes toward maintaining bone and joint health.

No	Category	Frequncy	Percentage
1	Very High	0	0%
2	High	16	24%
3	Moderate	49	74%
4	Low	1	2%
5	Very Low	0	0%
	Total	**66**	**100%**

The inferential analysis using Spearman's correlation test showed that there was no significant relationship between students' comprehension of the human movement system and their attitudes toward maintaining bone and joint health, with a correlation coefficient of -0.056 and a p-value of 0.653 ($p > 0.05$). This finding indicates that a high understanding of the human movement system does

not necessarily translate into proactive behaviors in maintaining bone and joint health. Several explanations may account for this result.

First, understanding theoretical knowledge does not always result in behavioral changes (Icek, 2021). Knowledge alone is insufficient to drive consistent health-related actions. According to the Health Belief Model, behavior change is influenced not only by knowledge but also by perceived susceptibility, perceived severity, perceived benefits, and self-efficacy (Green et al., 2020). Although students understand the human movement system, they may not perceive themselves at risk of developing musculoskeletal disorders, which could reduce their motivation to adopt preventive behaviors.

Second, environmental and social factors play a crucial role in shaping health attitudes (Al-Jayyousi et al., 2021; Levin-Zamir & Bertschi, 2018). Many students may not prioritize bone and joint health due to the absence of immediate consequences. Adolescents typically focus on short-term health benefits rather than long-term preventive measures. Additionally, the school environment and home settings may not strongly emphasize the importance of maintaining bone and joint health, leading to inconsistent attitudes despite adequate knowledge.

Another factor that could explain the lack of correlation is the nature of the assessment tools used. The multiple-choice test assessed students' cognitive understanding of the human movement system, while the questionnaire evaluated self-reported attitudes. Self-reported data are often subject to social desirability bias, where students may respond in ways they believe are expected rather than reflecting their true attitudes and behaviors. This discrepancy might contribute to the weak relationship observed in the study.

The study also highlights the importance of instructional strategies in bridging the gap between knowledge and behavior. While students exhibited high comprehension levels, their attitudes toward maintaining bone and joint health remained moderate. This suggests a need for more engaging and practical learning approaches that emphasize the real-world application of biological concepts. Interactive activities such as case studies, role-playing, and hands-on experiments could enhance students' awareness of the importance of bone and joint health (Ullah & Anwar, 2020; Villardón-Gallego et al., 2018).

Furthermore, school-based health programs could be instrumental in reinforcing positive attitudes. Schools could integrate movement and posture assessments, encourage regular physical activities, and provide workshops on ergonomic habits. Involvement from healthcare professionals, such as physiotherapists or sports medicine experts, could enhance students' understanding of the long-term implications of poor musculoskeletal health. Parental influence also plays a vital role in shaping students' health behaviors. Parents who prioritize bone and joint health through exercise and balanced nutrition can model healthy habits for their children. Collaborative efforts between schools and families could create a more supportive environment for students to develop positive health behaviors.

This study found no significant correlation between students' comprehension of the human movement system and their attitudes toward maintaining bone and

joint health. This finding underscores the complexity of health-related behavior formation, suggesting that knowledge alone is insufficient to drive action. Future research could explore interventions that enhance the practical application of biological knowledge to health behaviors.

CONCLUSION

This study aimed to determine the correlation between students' comprehension of the human movement system and their attitudes toward maintaining bone and joint health. The findings revealed that while students demonstrated a high level of comprehension, their attitudes toward bone and joint health remained moderate. Statistical analysis showed no significant relationship between these two variables, indicating that knowledge alone does not necessarily lead to behavioral change. This suggests that additional factors, such as environmental influences, lifestyle habits, and the effectiveness of educational interventions, may play a more significant role in shaping students' health behaviors. To enhance students' commitment to bone and joint health, biology education should incorporate more interactive and experiential learning strategies. Schools can also implement targeted health programs that emphasize the real-world implications of maintaining musculoskeletal health. Future studies should investigate longitudinal effects and intervention-based approaches to better understand how education can effectively influence health behaviors.

REFERENCES

Al-Jayyousi, G. F., Sherbash, M. A. M., Ali, L. A. M., El-Heneidy, A., Alhussaini, N. W. Z., Elhassan, M. E. A., & Nazzal, M. A. (2021). Factors influencing public attitudes towards COVID-19 vaccination: a scoping review informed by the socio-ecological model. *Vaccines*, *9*(6), 548. https://doi.org/10.3390/vaccines9060548

Alatas, A. (2005). *Hubungan antara pemahaman siswa tentang materi pelajaran indera penglihatan terhadap perilaku menjaga kesehatan* (Undergraduate thesis). UIN Jakarta. https://repository.uinjkt.ac.id/dspace/handle/123456789/26624

Amanda, N. D., Nurhidayah, T. M., & Ramadhani, T. Y. (2023). Menjaga Kesehatan Tubuh dalam Perspektif Islam. *Religion: Jurnal Agama, Sosial, Dan Budaya*, *2*(5), 373-380. https://doi.org/10.55606/religion.v1i5.372

Azwar, S. (2022). *Sikap Manusia Teori dan Pengukurannya*. Yogyakarta: Pustaka Pelajar.

Amelia, P. (2023, July 23). Penyebab kelainan tulang pada anak. *Orami Magazine*. Retrieved from https://www.orami.co.id/magazine/kelainan-tulang-pada-anak

Fadlilah, S., & Rahil, N. H. (2019). Faktor-Faktor Yang Berhubungan Dengan Perilaku Pencegahan Cidera Muskuloskeletal Pada Pemain Futsal. *Jurnal keperawatan BSI*, *7*(1). https://doi.org/10.31311/jk.v7i1.5271

Ferdiansyah, Z. D., Kuswandi, D., & Soepriyanto, Y. (2022). Pengembangan objek 3D memanfaatkan piramida hologram berbasis smartphone materi sistem gerak manusia. *Jurnal Kajian Teknologi Pendidikan*, *5*(1), 72-80. http://dx.doi.org/10.17977/um038v5i12022p072

Green, E. C., Murphy, E. M., & Gryboski, K. (2020). The health belief model. *The Wiley encyclopedia of health psychology*, 211-214. https://doi.org/10.1002/9781119057840.ch68

Icek, M. F. (2021). Belief, attitude, intention, and behavior: an introduction to theory and research.

Jahantab, Z. (2021). Role of education in national development. *Pakistan Journal of Applied Social Sciences*, *12*(1), 87-108. https://doi.org/10.46568/pjass.v12i1.543

Jasri, J., Biahimo, M. R., Haryani, M., Irawan, S., Alamri, S., Firmansyah, M., ... & Deluma, D. (2025). Edukasi Perilaku Hidup Sehat Untuk Mencegah Penyalahgunaan Narkoba Di SMAN 1 Kabila. *Jurnal Riset dan Pengabdian Interdisipliner*, *2*(1), 39-43. https://doi.org/10.37905/jrpi.v2i1.29337

Lestari, E. A., & Nuryanti, N. (2022). Pentingnya Kualitas Sumber Daya Manusia Dalam Meningkatkan Mutu Pendidikan Anak. *Jurnal Pendidikan Dan Konseling (JPDK)*, *4*(5), 3689-3694. https://doi.org/10.31004/jpdk.v4i5.7204

Levin-Zamir, D., & Bertschi, I. (2018). Media health literacy, eHealth literacy, and the role of the social environment in context. *International journal of environmental research and public health*, *15*(8), 1643. https://doi.org/10.3390/ijerph15081643

Nasution, N.E.A., Al Muhdhar, M.H.I., Sari, M.S., & Balqis. (2023). Relationship between Critical and Creative Thinking Skills and Learning Achievement in Biology with Reference to Educational Level and Gender. *Journal of Turkish Science Education*, *20*(1), 66-83. https://doi.org/10.36681/tused.2023.005

Saputri, J., & Sutikno, S. (2021). Penyuluhan Posisi Duduk Yang Benar Untuk Kesehatan Punggung Pada Siswa/I Smpn 15 Banjarmasin. *Jurnal Suaka Insan Mengabdi (Jsim)*, *3*(2), 142-146.

Peraturan Pemerintah No. 4 Tahun 2022, Pasal 1A.

Peraturan Pemerintah No. 57 Tahun 2021, Pasal 1.

Sudijono, A. (2016). Pengantar Statistik Pendidikan. Jakarta: PT. Raja Grafindo Persada Ruseffendi.

Sugiyono, D. (2013). Metode penelitian pendidikan pendekatan kuantitatif, kualitatif dan R&D.

Triyono, S. D. K., & Herdiyanto, Y. K. (2017). Konsep sehat dan sakit pada individu dengan Urolithiasis (Kencing Batu) di Kabupaten Klungkung, Bali. *Jurnal Psikologi Udayana*, *4*(2), 263-276. http://dx.doi.org/10.24843/JPU.2017.v04.i02.p04

Ullah, A., & Anwar, S. (2020). The effective use of information technology and interactive activities to improve learner engagement. *Education Sciences*, *10*(12), 349. https://doi.org/10.3390/educsci10120349

Villardón-Gallego, L., García-Carrión, R., Yáñez-Marquina, L., & Estévez, A. (2018). Impact of the interactive learning environments in children's prosocial behavior. *Sustainability*, *10*(7), 2138. https://doi.org/10.3390/su10072138

Yaniaja, A. K., Wahyudrajat, H., & Devana, V. T. (2020). Pengenalan model gamifikasi ke dalam e-learning pada perguruan tinggi. *ADI Pengabdian kepada Masyarakat Jurnal*, *1*(1), 22-30. https://doi.org/10.34306/adimas.v1i1.235

Zafi, A. A. (2018). Transformasi budaya melalui lembaga pendidikan (pembudayaan dalam pembentukan karakter). Al Ghazali, 1(1), 1-16. http://dx.doi.org/10.30738/sosio.v3i2.937