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Assessing Student Reflections on the Biophysics Curriculum: Insights into Perceptions and Future Expectations

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Abstract: Biophysics is essential for medical students as it provides a critical understanding of the physical principles underlying biological systems. Also, it enhances clinical practices and comprehension of medical technologies in medical education. Despite the significance of biophysics in the medical field, students' reflection on this subject remains a concern. This study assessed medical student' reflections on the biophysics curriculum regarding their perception and future expectations. To achieve research objectives, the reflection survey questionnaire was developed based on the Gibbs reflection model that consisted of (20) questions in the form of a 5-point Likert scale (1= strongly agree to 5= strongly disagree) and administered to 153 medical students (71 male and 82 female students) who enrolled in the first grade of faculty of medicine in Duhok university in the Iraqi-Kurdistan region. An ANOVA test was used to evaluate students' perception towards the biophysics curriculum, an ANOVA test was used, and the data indicated that 68 students (44.44%) had high perception, and 60 students (39.22%) showed medium perception. In comparison, only 25 students (16.34%) had a negative perception. To identify students' insight toward biophysics, a t-test was used, and the data showed that 65 (42.48%) reported poor education insight; conversely, 88 students (57.52%) indicated a good education. These findings highlight that many students

perceive the biophysics curriculum positively, although a significant proportion views it less favourably. The analysis of the correlation between student perception levels of the biophysics curriculum and their education insight categories reveals a significant correlation with a p-value of <0.0001. This correlation highlights that students who perceive the curriculum more favourably are likelier to report better educational insights. These results indicate that enhancing elements of the curriculum that students view negatively can improve their understanding and perception of the subject.

Keywords: Medical education, Biophysics curriculum, Teaching methods, students' reflection.

Introduction

Biophysics, a discipline that merges the principles, laws, and physics techniques to explore biological systems, is becoming increasingly vital in medical education. Biophysics is an initial element for understanding biological processes, linking theoretical physics with practical medical applications. This equips future healthcare professionals with a distinct perspective integrating scientific knowledge with clinical importance (Rubin & Riznichenko, 2014). Acknowledging its significant contribution, medical faculties have started to emphasise organised and structured biophysics curriculums to enhance students' understanding of intricate biological phenomena and develop skills pertinent to diagnostic and therapeutic advancements (Bialek, 2012; Meredith & Bolker, 2012; Parthasarathy, 2015).

Research problem

For medical students, acquiring a firm grasp of biophysics is essential for both academic achievement and professional effectiveness in a field that increasingly depends on technology and scientific accuracy. Integrating theoretical knowledge with clinical practice is especially vital in biophysics, as it directly impacts proficiency in areas such as imaging technologies, radiation therapy, and diagnostics (Khafizova et al., 2023). Therefore, a well-designed biophysics curriculum should encompass fundamental principles while motivating students to apply these concepts in practical, career-relevant ways (Hanson et al., 2020; Van Ness & Widenhorn, 2012).

Nevertheless, current research indicates that medical students frequently encounter difficulties integrating foundational sciences like biophysics into their overall medical learning, resulting in disengagement, decreased motivation, and diminished academic performance (Jalili et al., 2008). This situation highlights a broader challenge within medical education: students struggle to connect essential scientific knowledge with practical clinical skills. When there is no clear linkage between biophysics and its significance in clinical practice, students may not recognise its importance, which could adversely affect their educational outcomes and their future capabilities in an ever-evolving medical field (Awidi & Klutsey, 2024; Yang et al., 2013).

Research suggests that promoting students' reflective practices can effectively tackle this issue by improving their engagement and comprehension of the subject. For example, studies show that when students positively reflect on the significance of biophysics in their medical education, they achieve academic success and cultivate a deeper appreciation for its links to clinical practice (De Bie, 2016). Engaging in positive reflection can enhance students' motivation to learn, foster critical thinking skills, and encourage advancements in biophysics-related fields like medical imaging and treatment technologies (Nitz et al., 2014). Thus, encouraging reflection within the curriculum represents a promising strategy to connect

theoretical knowledge with practical application, ultimately resulting in a more holistic educational experience.

Research gaps

Although the significance of biophysics in medical education is well acknowledged, there is a lack of research investigating how students' reflections on the biophysics curriculum impact their motivation, engagement, and perception of its relevance. Most existing studies concentrate on curriculum design and content delivery, with few examining how reflective practices influence students' perceptions and learning outcomes in biophysics. Furthermore, there is a lack of understanding regarding the specific educational principles, such as effective teaching strategies and resource utilisation, that enhance student engagement and satisfaction in biophysics courses. Filling these gaps is essential for creating a flexible curriculum that aligns with the changing needs of medical students.

This study aims to address these gaps by evaluating medical students' reflections on the biophysics curriculum at Duhok University, focusing on their confidence levels, engagement, and perceptions of the subject's significance. Additionally, it seeks to identify essential educational insights that could boost student involvement and explore possible correlations between students' views on the curriculum and their academic experiences, which may influence their future aspirations in biophysics. The study intends to contribute to the existing literature by addressing these research questions while providing practical insights for curriculum developers and educators aiming to design more engaging, relevant, and effective biophysics courses. Thus, investigating student reflections on biophysics is vital for enhancing engagement and improving educational outcomes in medical education. Through this exploration, the study seeks to identify insights that can guide curriculum modifications to support students' academic and professional development. These findings will be significant not only for curriculum developers but also for educators. Still, they will also benefit the broader scientific community by highlighting effective teaching strategies that promote student engagement and improve learning outcomes in biophysics.

Research Aims and Research Questions

The primary goal of this study was to evaluate medical students' reflections on the biophysics curriculum at Duhok University in Iraq. To fulfil this objective, three research questions were established:

1. How do medical students view the biophysics curriculum?
2. What important educational insights can be gained from students' reflections on the biophysics curriculum?
3. What is the relationship between students' perceptions of the biophysics curriculum and their key educational insights that may shape their future aspirations in biophysics?

Literature Review

A well-structured biophysics curriculum is essential for enhancing students' understanding of medical technologies and diagnostic techniques, which is critical in a healthcare environment rapidly adopting advanced technological solutions (Meredith & Bolker, 2012). The role of biophysics in medical education is crucial, as it combines principles of physics with the study of biological systems, enabling future healthcare professionals to understand complex processes that underpin clinical applications (Rubin & Riznichenko, 2014). Despite its significance, medical students often perceive biophysics as challenging, which

underscores the need for educational strategies that make its principles accessible and relevant (Parthasarathy, 2015).

The Importance of Biophysics in Medical Education

Research indicated that a curriculum that integrates biophysics with practical applications helps students bridge theoretical knowledge with clinical practices, reinforcing biophysics' relevance to their future careers (Khafizova et al., 2023; Van Ness & Widenhorn, 2012). Studies on Biophysics advocated that a well-structured curriculum fosters critical skills in areas such as imaging technology, radiation therapy, and biomechanics and enhances problem-solving abilities that are important for medical diagnosis and treatment (Hanson et al., 2020). A study of a comprehensive review of the literature conducted by Mamatqulova (2024) emphasised that integrating biophysics into medical education fosters a culture of innovation and drives advancements in medical technology. Students proficient in biophysical principles are better equipped to engage with cutting-edge technologies such as microfluidics, biosensors, and computational modelling. These tools have transformative potential in improving diagnostics, drug delivery systems, and personalised medicine approaches, ultimately enhancing patient care and treatment outcomes (Mamatqulova, 2024). Moreover, research indicated that if the curricula focus on integrating these scientific principles with hands-on, patient-centred approaches, it will foster students' engagement and motivation toward the subject (Geschwind et al., 2024). Similarly, studies showed that reflective learning is increasingly recognised as a practical pedagogical approach to enhance students' engagement and comprehension in complex subjects like biophysics. Reflective practice models, such as Gibbs' Reflective Cycle, guide students through a structured process of examining their learning experiences, allowing them to connect theoretical knowledge with personal insights and future professional applications (Farrell, 2022). Gibbs' Reflective Cycle is one of the most famous cyclical models of reflection, leading students through six stages of exploring an experience: description, feelings, evaluation, analysis, conclusion and action plan (Mello & Wattret, 2021). By looking at the successful and unsuccessful aspects of an experience, reflection will help students learn from their past experiences and turn surface learning into deep learning (Mussarat et al., 2022). Apart from assisting the students to develop greater self-awareness, reflective learning helps students identify gaps in their learning and areas for improvement. Boud et al. (2013) suggest that structured reflection is the key to learning from experience and that reflection, as such, can be a very challenging part of the learning process. De Bie (2016) demonstrates that students who engage in reflective practices experience a deeper understanding of their subject matter, improved academic performance, and greater appreciation for the curriculum's relevance. In the context of biophysics, reflective practices encourage students to critically evaluate their perceptions of the subject and recognise its implications for their professional development, which can foster a positive learning environment and mitigate disengagement.

However, for biophysics to be highly effective within a medical curriculum, it requires an active teaching approach that communicates complex concepts and demonstrates their application in healthcare. Research indicates that using practical teaching methods enhances students' engagement. For example, research by Hegaze et al. (2014) emphasised that using the pragmatic approach in teaching biophysics, such as problem-based learning, enhances their perceptions about the subject. Besides, a study was done by Gafarovich (2024) to identify the integrative methodological approach to improve the teaching of biophysics by incorporating interdisciplinary projects, hands-on experiments, computational modelling, and case studies into the curriculum; educators can create a more engaging and enriching learning experience for students. Ultimately, by preparing the next generation of scientists with a strong foundation in integrative biophysics, we can accelerate progress in understanding the fundamental principles of life and solving

complex biological problems. A study by Lam et al. (2020) emphasised that active learning strategies enhance students' perception of the subject and increase critical thinking in practice. Research also specified that a curriculum that supports reflective and active learning strategies improves students' cognitive understanding and helps them form practical connections between biophysics and their future roles as healthcare providers (Moloney et al., 2023).

Gaps in Current Research

While previous studies have examined curriculum design and active learning methods in biophysics education, limited research explores the role of student reflections on curriculum perception and engagement. There is no empirical data on how reflective practices impact students' long-term perceptions of biophysics and career-related expectations in medical fields. Additionally, few studies have assessed how different teaching strategies specifically modified to biophysics can address engagement issues by making the curriculum more accessible and relevant. This gap highlights the need for research that assesses how reflective learning and contextualised curriculum design can enhance student engagement, motivation, and academic performance in biophysics.

Educators can foster a more engaging and impactful curriculum by exploring students' reflections on biophysics and identifying effective teaching strategies. This study aims to fill these gaps by investigating medical students' reflections on the biophysics curriculum at Duhok University, focusing on understanding their engagement levels, educational insights, and perceptions of relevance. The findings from this study will provide valuable insights for curriculum developers and educators seeking to optimise biophysics education for future healthcare professionals.

Materials and Methods

Research Design

This study employed a cross-sectional study design to assess medical students' reflections about the biophysics curriculum and determine whether there is any correlation between students' perceptions of the biophysics curriculum and the key educational insights at Duhok University in Iraq. The researcher used a reflection survey to collect data from first-year medical students.

Sample

The study's data were collected using a survey. The study was conducted among first-year medical students at Duhok University. The survey was administered to 153 students who study medicine at the University of Duhok in the Iraqi-Kurdistan region.

Instruments

To identify the student's reflections on the biophysics curriculum, a survey reflection was developed, which compromises 23 questions divided into two parts: the first section served to elicit demographic information about students about information about their gender, Student Enrollment (Paid/Unpaid) and area of residency. At the same time, the second part served to assess student's reflections on the biophysics curriculum. This part consisted of (20) questions on a 5-point Likert scale (1= strongly agree to 5= strongly disagree) and was formulated based on the Gibbs reflection model. The Gibbs model, a well-known framework in reflective practice, was selected for its systematic method of examining experiences (Farrell, 2022). This model helps people reflect by prompting them to think about various elements of their

experiences, such as events, emotions, assessment, examination, conclusion, and plan of action (Chai, 2024; Markkanen et al., 2020). This particular model is beneficial in educational environments because it prompts students to think critically about their learning experiences, resulting in improved comprehension and individual development (Fook, 2019; Moloney et al., 2023). In this study, the Gibbs model was used to create survey reflection items that covered different aspects of students' reflections, including their confidence, interest, and the importance of biophysics in their medical education. To answer the first research question about assessing students' perceptions, encompassing their confidence, interest, and perceived relevance of biophysics within the broader context of medical and biological sciences, 11 survey questions were asked. At the same time, 9 survey questions were used to answer the second research question that aimed to identify key educational insights, particularly the effectiveness of teaching methods and materials used in the biophysics curriculum. The reflection survey consisted of 20 items validated and reviewed by 6 experts in biophysics education, measurement and evaluation. Based on the experts' feedback, minor modifications were made to the questionnaire items. The survey was further administered to a sample of 20 students who were excluded from the fundamental research to identify the reliability of the study, and the reliability coefficient was 0.91, which indicates high and strong reliability (Mohamad et al., 2015; Widhiarso & Ravand, 2014).

Data Collection

The final version of the reflection survey questionnaire was self-administered for data collection. The survey was given to 153 medical students pursuing their bachelor's degree in medicine. Once the participants gave verbal consent, they were asked if they were willing to take part in the study and provided with the necessary instructions and information on how to complete the questionnaire.

Data Analysis

The data obtained for this study were analysed using descriptive and inferential statistics, such as t-tests and one-way ANOVA, to assess the students' perceptions and educational insights about the biophysics curriculum using the JMP Statistical Package. However, it examines the correlation between students' perceptions of the biophysics curriculum and the key educational insights that influence their future expectations in biophysics.

Results

The questionnaire was delivered to 153 first-grade students in the medicine faculty at Duhok University. The survey received a high response rate of 88%. The participants' demographic characteristics are presented in Table 1. The sample finally consisted of 71 males and 82 females. Of those participants, 47 were paid to enrol in the faculty, while 106 were unpaid students. Although most of the students were from Duhok city (131), 22 were from other cities belonging to the Iraqi Kurdistan Region.

Table 1

Socio-Demographics Characteristics (N = 153)

Variables & Categories	Frequency Distributions n (%)
Gender	

Variables & Categories	Frequency Distributions n (%)
Male	71 (0.46)
Females	82 (0.53)
Student Enrollment (Paid/Unpaid)	
Parallel (Paid)	47 (0.30)
Zankoline (Unpaid)	106 (0.69)
Area of residency	
Duhok City	131 (0.85)
Erbil City	7 (0.04)
Sulaymaniyah City	15 (0.09)
Total	153 (%)

Students' responses to the survey are shown in Table 2. The highest-rated reflection was students' confidence in the future of biophysics, with 86.27% of students either agreeing or strongly agreeing that biophysics will play a significant role in future advancements (Q20). Similarly, 80.39% of students expressed high confidence in their ability to learn biophysics (Q1), and 79.74% recognised the importance of biophysics in their education and future careers (Q2). On the other hand, the lowest-rated aspect was student engagement in biophysics, with only 30.53% agreeing or strongly agreeing that they felt fully engaged in the subject (Q14). Additionally, only 35.95% of students were satisfied with the teaching methods employed in biophysics (Q10), indicating this area needs improvement.

Table 2

Assessing Student Reflections on the Biophysics Curriculum: Insights into Perceptions and Future Prospects (N = 153)

Items	Frequency Distributions n(%)				
	SA.	**A.**	**N.**	**D.**	**SD.**
1) Confidence in learning biophysics	(35.29) 54	(45.10) 69	(15.03) 23	(3.27) 5	(1.31) 2
2) Importance of biophysics	(44.44) 68	(36.60) 56	(16.34) 25	(0.65) 1	(1.96) 3
3) Learning support	(20.26) 31	(43.79) 67	(28.76) 44	(4.58) 7	(2.61) 4
4) Enjoyment of learning biophysics	(28.76) 44	(27.45) 42	(28.76) 44	(11.76) 18	(3.27) 5
5) Performance expectation	(26.14) 40	(35.95) 55	(22.88) 35	(12.42) 19	(2.61) 4
6) Biophysics contributions	(26.80) 41	(44.44) 68	(23.53) 36	(4.58) 7	(0.65) 1
7) Advancement of biophysics in healthcare	(39.87) 61	(36.60) 56	(18.95) 29	(2.61) 4	(1.96) 3
8) Biophysics applications	(29.41) 45	(44.44) 68	(18.30) 28	(7.19) 11	(0.65) 1
9) Implication of biophysics	(33.33) 51	(43.14) 66	(19.61) 30	(3.92) 6	(0.00) 0
10) Teaching methods	(20.26)	(34.64)	(27.45)	(7.84)	(9.80)

Items	Frequency Distributions n(%)				
	SA.	A.	N.	D.	SD.
11) Teaching materials	31 (32.03)	53 (38.56)	42 (21.57)	12 (6.54)	15 (1.31)
12) Real-word relevance	49 (28.76)	59 (39.22)	33 (26.14)	10 (5.88)	2 (0.00)
13) Career optimism	44 (30.72)	60 (39.22)	40 (26.80)	9 (2.61)	0 (0.65)
14) Engagement of biophysics	47 (5.69)	60 (24.84)	41 (39.87)	4 (17.65)	1 (1.96)
15) Communication skills	24 (15.69)	38 (47.06)	61 (26.80)	27 (7.84)	3 (2.61)
16) Personal interest	24 (26.14)	72 (31.37)	41 (25.49)	12 (11.76)	4 (5.23)
17) Future contribution of biophysics	40 (33.33)	48 (35.29)	39 (26.80)	18 (4.58)	8 (0.00)
18) Treatment improvement	51 (45.10)	54 (35.29)	41 (18.95)	7 (0.65)	0 (0.00)
19) Medical Innovation	69 (33.99)	54 (41.83)	29 (22.22)	1 (1.96)	0 (0.00)
20) Future of biophysics	52 (52.94)	64 (33.33)	34 (13.07)	3 (0.65)	0 (0.00)
	81	51	20	1	0

To evaluate students' perception towards biophysics curriculum one way ANOVA test was used as in Table 3. The assessment of students' attitudes towards the biophysics curriculum showed notable variations among three levels of perception: high, medium, and low. The assessment revealed different perceptions, emphasizing different degrees of satisfaction and involvement with the curriculum. Of the 153 surveyed students, 25 (16.34%) had a negative perception, averaging a 15.84 (±1.31) score with a 95% confidence interval of 14.54 to 17.14. 60 students (39.22%) showed medium perception, scoring an average of 17.27 (±0.43) with a confidence interval of 16.43 to 18.11. while 68 students (44.44%) had a high perception, scoring an average of 21.65 (±1.13), and a 95% confidence interval of 20.86 to 22.44 was reported.

The findings indicate that most students favour the biophysics curriculum, with almost half giving it a high rating, but a smaller fraction showed less satisfaction. This distribution underscores student engagement and satisfaction variation, with clear distinctions between those who perceive the curriculum favourably, moderately, or poorly. The significant differences in mean scores across these groups, as indicated by the ANOVA test, suggest that the curriculum's effectiveness may not be consistent for all students, pointing to potential areas for improvement to enhance overall student perception and engagement.

Table 3

Evaluate Perception Towards Biophysics Curriculum

Variable	Mean ± Std. Dev.** n (%) *		Confidence Interval 95% Lower	Upper
Low Perception	25	15.8400	14.536	17.144

Medium Perception	60	17.2667	0.42591	16.425
High Perception	68	21.6471	20.857	22.438
Total	153	%		

Note. N = 153; n (%) * = Frequency and percentage; Std. Dev.** = Standard Deviation.

A t-test was used to identify students' insight toward biophysics, and the data in Table 4 presents the distribution of student education insights towards the biophysics curriculum. The data shows a significant disparity between students with poor and good education insights. Among the 153 students surveyed, 65 (42.48%) reported a poor education insight, with a mean score of 19.80 (±0.62) and a 95% confidence interval ranging from 18.86 to 20.74. On the other hand, 88 students (57.52%) indicated a good education insight, with a mean score of 25.39 (±0.60) and a confidence interval of 24.19 to 26.58. These findings highlight that most students perceive the biophysics curriculum positively, even though a significant percentage of students see it less favourably. The substantial difference in mean scores between the two groups suggests a clear divide in educational experiences and insights, emphasising the need for targeted interventions to address the concerns of those with poorer insights while enhancing the aspects valued by those with better perceptions. It is closely linked to a deeper understanding and more favourable educational outcomes.

Table 4

Student Education Insight Towards Biophysics Curriculum

Variable	Mean ± Std. Dev.** n (%)*		Confidence Interval 95% Lower	Upper
Poor Education Insight	65	19.8	18.856249	20.743751
Good Education Insight	88	25.386364	24.189759	26.582968
Total	153	%		

Note. N = 153; n (%) * = Frequency and percentage; Std. Dev.** = Standard Deviation.

The chi-square test is used to answer the third question about the correlation between student perception levels and education insight categories. This statistical test determines if there is a notable correlation between categorical variables, specifically student views on the biophysics curriculum and their levels of educational understanding. A p-value less than 0.0001 denotes a strong and significant relationship between these variables. Table (5) explores the correlation between student perception levels of the biophysics curriculum and their education insight categories. The analysis reveals a significant correlation between perception levels and education insight, with a p-value of <0.0001. Out of students with sound educational understanding, 57 individuals (37.25%) are classified as having high perception, while 23 (15.03%) are in the medium category, and 8 (5.23%) fall into the low category. Conversely, students lacking educational awareness are primarily found in lower perception levels, with 17 (11.11%) in the low perception category, 37 (24.18%) in the middle, and only 11 (7.19%) in the high perception category. This correlation underscores that students who perceive the curriculum more favourably are likelier to report better educational insights. Conversely, those with poorer educational insights tend to rate their perception of the curriculum lower. These results indicate that revising the curriculum element that students report negatively can improve overall educational consideration and attitudes.

Table 5

Correlation Between Student Perceptions and Education Insight Levels

Variables	Student Perception Levels n (%) *			P-value	Total n (%) *
	Low 11-16	Middle 17-23	High 24-36		
Good Education Insight	8 (5.23)	23 (15.03)	57 (37.25)	<0.0001*	88 (57.52)
Poor Education Insight	17 (11.11)	37 (24.18)	11 (7.19)		65 (42.48)
Total	25 (16.34)	60 (39.22)	68 (44.44)		153

Note. N = 153; n (%) * = Frequency and percentage; Bivariate (Pearson correlation coefficient) – chi-square test; p-value = <0.0001*

Discussion

The findings from this research offer essential information about how students view and learn from the biophysics program at the Faculty of Medicine at Duhok University. The results of students' reflections on the biophysics curriculum indicate diverse views, particularly in their perception of the subject's future significance. As shown in Table 2, most students expressed confidence in the future of biophysics, with similarly high percentages affirming its importance to their education, future careers, and ability to learn biophysics. These results suggest that students generally acknowledge the value of biophysics and its relevance to their future professional paths, which agreed with the National Research Council (2003) and Geschwind et al. (2024). However, engagement with the subject remains a critical issue, as only 30.53% of students felt fully engaged with the biophysics curriculum, which was consistent with Parthasarathy (2015), who also identifies that biophysics was an interesting subject among non-physics students as in the case of medical students. Additionally, 35.95% were dissatisfied with the teaching methods, highlighting specific areas where improvements are needed; this finding is further supported by Abdulhakim (2024), who emphasises that by administrating teaching methods that promote critical thinking into instructional strategies, educators can empower students to analyse, evaluate, and apply biophysical concepts effectively.

Analysis of student perceptions towards the biophysics curriculum indicated notable variations among three categories - low, medium, and high perception levels. Of all students, 44.44% expressed intense satisfaction regarding the curriculum, whereas 16.34% showed lower satisfaction. The differences in perception levels show that students have varying experiences with the curriculum, with around half of the respondents having a positive experience. At the same time, a significant minority are less engaged or satisfied, as shown in the research by Hegaze et al. (2014), who identified that 70% of the students were engaged in using active teaching methods such as PBL in teaching biophysics. The statistical significance of these differences, as indicated by the ANOVA, suggests that curriculum effectiveness varies among students, and targeted interventions may be necessary to address the concerns of those with lower perceptions. These results agreed with Crouch et al. (2018), Hernandez et al. (2014), and Kralova and Svetlikova-Martauzova (2017), who advocated that student engagement and motivation influence their perception of the subject.

Further insights were gathered regarding students' educational insights. A clear division was observed, with 57.52% of students reporting good educational insights, while 42.48% expressed poor

insights. This substantial difference underscores the varying depth of understanding and educational outcomes related to the biophysics curriculum. The results suggest that students with a firmer grasp of the subject and view it favourably also tend to derive more meaningful educational insights (Abdulhakim, 2024; Slavich & Zimbardo, 2012).

Lastly, the correlation between student perception levels and their education insights demonstrates a statistically significant association ($p < 0.0001$). Students with good education insights were likelier to have high perceptions of the curriculum, with 37.25% in the high perception category, compared to only 7.19% of students with poor insights; these results constantly agree with (So & Brush, 2008). Conversely, students with poor education insights were concentrated in the low and medium perception levels, which agreed with (Hanson et al., 2020; Shehnaz & Sreedharan, 2011; Yang et al., 2013). Those results are also confirmed by Gafarovich (2024), who identified that integrative teaching strategies enhance students' reflections and foster their critical thinking, which was also agreed with (Lam et al., 2020).

This correlation implies that improving students' engagement and addressing areas of dissatisfaction, such as teaching methods and engagement, could lead to more positive educational outcomes and overall perceptions (Abdulhakim, 2024).

Conclusion and Implications

This research offers valuable perspectives on students' views and educational experiences of the biophysics program at the Faculty of Medicine at Duhok University. The results show that although many students have a favourable opinion of biophysics and its importance for their future professional paths, a notable number are dissatisfied, mainly due to teaching styles and involvement. The strong connection between how students view things and their understanding of topics indicates that students who actively participate in their studies and have a favourable view of them tend to receive more educational advantages.

The findings suggest that although most students highly esteem the current biophysics curriculum, it does not completely cater to the requirements of every learner. The significant variations in levels of perception emphasise the specific areas of the curriculum that need focus, especially regarding teaching techniques and student involvement. Enhancing these areas could improve the overall learning experience and result in more consistent educational results. In addition, the close connection between favourable views and valuable educational perspectives highlights the importance of creating settings that allow students to interact with and value the material. Achieving this goal involves implementing interactive and engaging teaching methods, providing personalised learning assistance, and emphasising practical uses of biophysics in the real world.

Suggestions for Further Research

While this study offers valuable findings, it also opens several avenues for further research. One potential direction is to conduct a longitudinal study that tracks students' perceptions and educational insights to understand better how their engagement with biophysics evolves throughout their medical education. This may offer a deeper understanding of the lasting effects of the curriculum and how initial perceptions influence future academic and professional achievements. Moreover, further studies could investigate how well specific strategies, like implementing active learning methods, problem-based learning, or blended learning approaches, enhance student involvement and contentment. Examining how these teaching alterations affect students' views and educational understandings might provide practical strategies for improving the course content. Another area of interest would be to expand the study to include

multiple institutions, enabling a comparative analysis across different educational contexts and identifying best practices for biophysics instruction in medical schools.

Ultimately, qualitative research could enhance these quantitative results by delving deeper into students' encounters and difficulties with the biophysics curriculum. Conducting focus groups or interviews with students may reveal more factors influencing their perceptions and lead to more detailed recommendations for curriculum development.

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Abdulhakim, H. (2024). Enhancing biophysics education through the integration of critical thinking methodology. *Proceedings of International Conference on Educational Discoveries and Humanities, 3*(5), 39–42. https://econferenceseries.com/index.php/icedh/article/view/4449

Awidi, I. T., & Klutsey, J. Q. (2024). Using Online Critical Reflection to Enhance Students' Confidence, Motivation, and Engagement in Higher Education. *Technology, Knowledge and Learning*. https://doi.org/10.1007/s10758-024-09751-4

Bialek, W. (2012). *Biophysics: Searching for principles*. Princeton University Press.

Boud, D., Keogh, R., & Walker, D. (2013). *Reflection: Turning experience into learning*. Routledge.

Chai, Z. (2024). Exploring the Importance of Practice and Leadership on Teaching and Learning in Higher Education. In G. Morris & S. Kozuch (Eds.), *Developments and Future Trends in Transnational Higher Education Leadership* (pp. 149–169). IGI Global Scientific Publishing. https://doi.org/10.4018/979-8-3693-2857-6.ch009

Crouch, C. H., Wisittanawat, P., Cai, M., & Renninger, K. A. (2018). Life science students' attitudes, interest, and performance in introductory physics for life sciences: An exploratory study. *Physical Review Physics Education Research, 14*(1), 010111. https://doi.org/10.1103/PhysRevPhysEducRes.14.010111

De Bie, G. (2016). *Analysis of a foundational biomedical curriculum: Exploring cumulative knowledge-building in the rehabilitative health professions* [Unpublished PhD thesis]. Rhodes University. https://core.ac.uk/download/pdf/145038435.pdf

Farrell, T. S. C. (2022). 1 Reflection on Reflective Practice. In Z. Tajeddin & A. Watanabe (Eds.), *Teacher Reflection* (pp. 3–19). Multilingual Matters. https://doi.org/10.21832/9781788921022-005

Fook, J. (2019). Reflective models and frameworks in practice. *Methodologies for practice research: Approaches for professional doctorates* (pp. 57–76). Sage Publications. http://digital.casalini.it/9781526453310

Gafarovich, N. E. (2024). Enhancing biophysics education through an integrative methodological approach. *Ta'limning zamonaviy transformatsiyasi, 6*(2), 29–32. https://pedagoglar.org/index.php/03/article/view/1405

Geschwind, G., Alemani, M., Fox, M. F., Logman, P., Tufino, E., & Lewandowski, H. (2024). Development of a global landscape of undergraduate physics laboratory courses. *Physical Review Physics Education Research, 20*(2), Article 020117. https://doi.org/10.1103/PhysRevPhysEducRes.20.020117

Hanson, B. S., Brown, C. P., Laurent, H., Hughes, M. D., & Dougan, L. (2020). Hierarchical biomechanics: Student engagement activities with a focus on biological physics. *Physics Education, 55*(2), Article 025015. https://doi.org/10.1088/1361-6552/ab687e

Hegaze, I., von Kemenade, E., von Duure, M., Ali, D., Moustafa, H., & Elfaramawy, Z. (2014). An Approach in Medical Biophysics Learning Style Using Problem-Based Learning Method. *Journal of Research & Method in Education, 4*(1), 69–74. https://www.academia.edu/download/32740955/pbl2.pdf

Hernandez, C., Ravn, O., & Forero-Shelton, M. (2014). Challenges in a physics course: Introducing student-centred activities for increased learning. *Journal of University Teaching & Learning Practice, 11*(2), Article 8. https://files.eric.ed.gov/fulltext/EJ1040737.pdf

Jalili, M., Mirzazadeh, A., & Azarpira, A. (2008). A survey of medical students' perceptions of the quality of their medical education upon graduation. *Annals Academy of Medicine Singapore, 37*(12), 1012–1018. https://annals.edu.sg/pdf/37VolNo12Dec2008/V37N12p1012.pdf

Khafizova, A. A., Galimov, A. M., Kharisova, S. R., Grebenshchikova, L. Y., Yagudina, R. I., & Smirnova, L. M. (2023). The impact of healthcare digitalization on the medical education curricula and programs: Points of convergence and divergence. *Contemporary Educational Technology, 15*(4), Article ep479. https://doi.org/10.30935/cedtech/13768

Kralova, E., & Svetlikova-Martauzova, L. (2017). Motivation of Medical Students to Study Sciences. New trends and Issues. *Proceedings on Humanities and Social Sciences, 4*(8), 103–108. https://pdfs.semanticscholar.org/a37d/8f22d85ab8552129252bd2a8f84ba852ebf9.pdf

Lam, G., Gill, N., & Ghaemi, R. (2020). Semi-structured design and problem-based experiential learning in a first-year biomedical engineering laboratory course. In *Proceedings of the Canadian Engineering Education Association (CEEA) Conference*. Concordia and McGill Universities. https://doi.org/10.24908/pceea.vi0.14132

Mamatqulova, M. (2024). Enhancing medical education: The vital role of biophysics. *Ekonomika i sotsium*, (4-1(119), 1320–1323. https://cyberleninka.ru/article/n/enhancing-medical-education-the-vital-role-of-biophysics

Markkanen, P., Välimäki, M., Anttila, M., & Kuuskorpi, M. (2020). A reflective cycle: Understanding challenging situations in a school setting. *Educational Research, 62*(1), 46–62. https://doi.org/10.1080/00131881.2020.1711790

Mello, L. V., & Wattret, G. (2021). Developing transferable skills through embedding reflection in the science curriculum. *Biophysical Reviews, 13*(6), 897–903. https://doi.org/10.1007/s12551-021-00852-3

Meredith, D. C., & Bolker, J. A. (2012). Rounding off the cow: Challenges and successes in an interdisciplinary physics course for life science students. *American Journal of Physics, 80*(10), 913–922. https://doi.org/10.1119/1.4733357

Mohamad, M. M., Sulaiman, N. L., Sern, L. C., & Salleh, K. M. (2015). Measuring the validity and reliability of research instruments. *Procedia-Social and Behavioral Sciences, 204*, 164–171. https://doi.org/10.1016/j.sbspro.2015.08.129

Moloney, M., Pope, J., & Donnellan, A. (2023). The Mentor's Role in Nurturing Reflective Practice. In M. Moloney, J. Pope, & A. Donnellan (Eds.), *Professional Mentoring for Early Childhood and Primary School Practice* (pp. 141–160). Springer International Publishing. https://doi.org/10.1007/978-3-031-37186-8_8

Mussarat, U., Zainub, A., Hanif, R., Ayub, S., Naureen, F., & Inam, T. (2022). Reflection—an effective strategy for outcome-based learning in basic medical sciences. *Journal of the Pakistan Medical Association, 72*(4), 639–642. https://www.academia.edu/download/100479250/11198.pdf

National Research Council (U.S.) (Ed.). (2003). *Bio 2010: Transforming undergraduate education for future research biologists*. National Academies Press.

Nitz, S., Ainsworth, S. E., Nerdel, C., & Prechtl, H. (2014). Do student perceptions of teaching predict the development of representational competence and biological knowledge?. *Learning and Instruction, 31*, 13–22. https://doi.org/10.1016/j.learninstruc.2013.12.003

Parthasarathy, R. (2015). 'The physics of life,' an undergraduate general education biophysics course. *Physics Education, 50*(3), 358–366. https://doi.org/10.1088/0031-9120/50/3/358

Rubin, A., & Riznichenko, G. Y. (2014). *Mathematical biophysics*. New York: Springer. https://doi.org/10.1007/978-1-4614-8702-9

Shehnaz, S. I., & Sreedharan, J. (2011). Students' perceptions of educational environment in a medical school experiencing curricular transition in United Arab Emirates. *Medical teacher*, *33*(1), e37–e42. https://doi.org/10.3109/0142159X.2011.530312

Slavich, G. M., & Zimbardo, P. G. (2012). Transformational teaching: Theoretical underpinnings, basic principles, and core methods. *Educational Psychology Review, 24*, 569–608. https://doi.org/10.1007/s10648-012-9199-6

So, H.-J., & Brush, T. A. (2008). Student perceptions of collaborative learning, social presence and satisfaction in a blended learning environment: Relationships and critical factors. *Computers & Education, 51*(1), 318–336. https://doi.org/10.1016/j.compedu.2007.05.009

Van Ness, G. R., & Widenhorn, R. (2012). Engaging the community through an undergraduate biomedical physics course. *American Journal of Physics, 80*(12), 1094–1098. https://doi.org/10.1119/1.4753933

Widhiarso, W., & Ravand, H. (2014). Estimating reliability coefficient for multidimensional measures: A pedagogical illustration. *Review of Psychology, 21*(2), 111–121. https://hrcak.srce.hr/147109

Yang, Z., Becerik-Gerber, B., & Mino, L. (2013). A study on student perceptions of higher education classrooms: Impact of classroom attributes on student satisfaction and performance. *Building and environment, 70*, 171–188. https://doi.org/10.1016/j.buildenv.2013.08.030