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Validation of an Artificial Intelligence-Powered Website for Learning Cardiovascular Biology in Nigeria

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Abstract: Artificial intelligence-powered websites (AI-PWs) can improve learning through personalised and adaptive experiences, yet few validated tools exist for teaching cardiovascular biology in Nigeria. This study assessed the usability, technical structure, and instructional design quality of an AI-PW from educational technologists, informatics professionals, and instructional designers. Three validation instruments were used (reliability coefficients 0.72–0.86). Descriptive statistics and analysis of variance ($\alpha = 0.05$) were used. Findings showed positive ratings across all expert groups. Educational technologists confirmed usability and instructional alignment ($\bar{x} = 4.01 > 3.50$). Informatics professionals validated its structural and technical adequacy ($\bar{x} = 3.95 > 3.50$). Instructional designers rated the website as well-developed and pedagogically coherent ($\bar{x} = 4.02 > 3.50$). No significant difference was observed among the three groups' evaluations. The study concludes that the AI-PW met key standards of usability, technical soundness, and instructional design, demonstrating its suitability as a digital learning tool for cardiovascular biology.

Keywords: artificial intelligence; AI-powered website; cardiovascular biology; digital learning; expert validation

INTRODUCTION

As artificial intelligence (AI)-driven platforms continue to transform digital learning environments, the need to evaluate their usability, technical strength, and instructional design has become increasingly important. Unlike traditional educational materials, AI-powered websites function as interactive systems whose effectiveness depends not only on the accuracy of their content but also on how well users can navigate, engage with, and learn from their features. Ensuring that such digital platforms are intuitive, stable, and pedagogically coherent requires systematic validation from experts in educational technology, informatics, and instructional design (Campo et al., 2021; Karanfiloğlu & Bulut, 2025; Van der Giesen et al., 2020).

Usability evaluation forms a core component of this process. The ease with which learners access information, move through the interface, and interact with embedded AI tools significantly affects learning outcomes (Wu, 2025). Poor interface design or inaccessible features can undermine even high-quality content. Educational technologists therefore play a vital role in assessing factors such as simplicity, responsiveness, navigation structure, and overall user experience. Their feedback helps determine whether the platform supports effective learning or introduces barriers that hinder engagement (Yaseen et al., 2025).

Technical validation is equally crucial in AI-powered systems. Informatics professionals evaluate the structural stability of the website, its data handling, system reliability, and the integrity of its AI components (Ileana et al., 2025). Assessing security, algorithmic behaviour, backend performance, and system optimisation ensures that the platform functions consistently and safely,

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especially in contexts where students rely on AI-generated information. These reviews help safeguard technical quality, prevent malfunctions, and strengthen trust in the platform's dependability (Nastoska et al., 2025).

Instructional design evaluation adds another dimension to the validation process. Instructional designers examine whether the learning structure, sequence of information, visual layout, and interactive elements align with established pedagogical principles (Hong et al., 2025). They assess the clarity of learning pathways, the cognitive load imposed on students, and how effectively the platform supports meaningful understanding. Approaches such as cognitive task analysis further reveal how users mentally process and respond to the AI-generated materials, guiding improvements in design and learning flow (Saxena et al., 2023; Skulmowski & Xu, 2022).

To support these expert evaluations, structured methods such as iterative review cycles, design-based assessments, and consensus-building techniques help refine the system until it meets recognised educational and technological standards (Deterding & Waters, 2021; Wang et al., 2023). These processes enable repeated adjustments across usability, technical stability, and instructional alignment, leading to a more polished and effective AI-powered learning environment.

Together, the input from educational technologists, informatics professionals, and instructional designers establishes a comprehensive understanding of the website's performance beyond content accuracy alone. Their combined evaluations ensure that the AI-powered platform is not only instructive, but also usable, technically sound, and pedagogically coherent—qualities essential for supporting learning in cardiovascular biology in a digital context (Chun et al., 2025).

Purpose of the Study

The purpose of this study was to validate the usability, technical structure, and instructional design of an AI-powered website for learning Cardiovascular Biology.

Research Questions

1. What rating do educational technologists give to the usability of the developed artificial intelligence-powered website for learning cardiovascular biology?
2. How do informatics professionals grade the structure of the developed artificial intelligence-powered website for learning cardiovascular biology?
3. How do instructional designers appraise the developed artificial intelligence-powered website for learning cardiovascular biology?

Hypothesis

Ho_1: There is no significant difference in the rating of educational technologists, informatics professionals and instructional designers of the developed artificial intelligence-powered website for learning cardiovascular biology.

METHOD

This phase of the study followed an integrated Research and Development (R&D) approach supported by Agile methodology to develop and validate the AI-powered website for learning cardiovascular biology. The R&D model provided a structured process, while Agile allowed iterative refinement of the platform's usability, technical structure, and instructional design.

The validation involved educational technologists, informatics professionals, and instructional designers from two universities in Ilorin, Kwara State. Purposive sampling was used to select experts who were qualified and available to participate. Three researcher-designed instruments were used: the Educational Technologist Validation Form (ETVF), the Informatics Professionals Validation Form (IPVF), and the Instructional Designers Validation Form (IDVF). Each instrument contained fifteen items rated on a five-point scale from Excellent to Very Poor.

Face and content validity of the instruments were ensured through reviews by the researcher's supervisor and senior lecturers from the relevant departments. Trial testing conducted with experts outside the main study produced reliability coefficients of 0.86 for the ETVF, 0.72 for the IPVF, and 0.76 for the IDVF. These values confirmed that the instruments were internally

consistent. Data were collected through printed questionnaires distributed by research assistants and through online Google Forms shared with participants. The completed instruments were analysed using descriptive statistics to summarise expert ratings and one-way ANOVA to determine whether differences existed among educational technologists, informatics professionals, and instructional designers at the 0.05 level of significance.

RESULTS & DISCUSSION

Research Question 1: What rating do educational technologists give to the usability of the developed artificial intelligence-powered website for learning cardiovascular biology?

Table 1. Educational technologists' ratings for the validation of the AI-powered website

Item	5	4	3	2	1	Mean	Std. Dev
To what extent do you find the website's interface user-friendly for navigating through cardiovascular biology content?	1	6	0	0	0	4.14	.37
How intuitive is the website's design in facilitating an efficient learning experience for cardiovascular biology concepts?	1	4	2	0	0	3.86	.69
In your opinion, does the website provide effective multimedia elements to enhance the engagement of users in learning cardiovascular biology?	1	6	0	0	0	4.14	.38
How well does the website utilize interactive features to promote user engagement in cardiovascular biology education?	2	5	0	0	0	4.29	.49
To what extent does the website incorporate adaptive learning technologies to personalize the user experience in cardiovascular biology?	1	5	1	0	0	4.00	.58
Do you perceive any challenges or difficulties in using the website for educational purposes in cardiovascular biology?	2	1	4	0	0	3.14	.38
How well does the website integrate with other educational technologies or platforms commonly used in the field of cardiovascular biology?	2	4	1	0	0	3.86	.69
In your professional judgment, how suitable is the website's user interface and design for educational purposes in cardiovascular biology?	1	6	0	0	0	4.14	.38
To what extent does the website provide clear instructions and guidance for users navigating through cardiovascular biology content?	1	5	1	0	0	4.00	.58
Overall, how would you rate the usability of the website for learning cardiovascular biology?	2	5	0	0	0	4.29	.49
How well does the website accommodate different learning styles and preferences in cardiovascular biology education?	1	4	2	0	0	3.71	.49
To what extent does the website foster collaborative learning experiences among users studying cardiovascular biology?	3	3	1	0	0	4.14	.69
How current and up to date do you find the technological features and functionalities of the website in the context of cardiovascular biology education?	4	3	0	0	0	4.57	.53
In your opinion, does the website offer a seamless integration of technology to enhance the learning experience for cardiovascular biology?	0	7	0	0	0	4.00	.00
Considering your expertise, how likely are you to recommend this website as a valuable educational resource for learning cardiovascular biology?	1	4	2	0	0	3.86	.69
	Grand Mean					4.01	

Key: 5 = Excellent, 4 = Good, 3 = Fair, 2 = Poor, 1 = Very Poor. Benchmark: 3.50.

Table 1 shows the ratings provided by educational technologists concerning the usability of the developed AI-powered website for learning cardiovascular biology. The item "How current and up to date do you find the technological features and functionalities of the website in the

context of cardiovascular biology education?" received the highest mean rating of 4.57, reflecting a strong consensus among the specialists that the website's technological components are modern and effective for educational purposes. Items such as "How well does the website utilize interactive features to promote user engagement in cardiovascular biology education?" and "Overall, how would you rate the usability of the website for learning cardiovascular biology?" both received high mean ratings of 4.29, indicating that the specialists found the website's interactive features and overall usability to be excellent.

The item "In your opinion, does the website provide effective multimedia elements to enhance the engagement of users in learning cardiovascular biology?" received a mean rating of 4.14, suggesting that the multimedia content is well-received and considered effective in enhancing user engagement. Additionally, items like "To what extent do you find the website's interface user-friendly for navigating through cardiovascular biology content?" and "To what extent does the website provide clear instructions and guidance for users navigating through cardiovascular biology content?" received ratings of 4.14 and 4.00, respectively, indicating that the website's interface and instructional guidance are considered user-friendly and effective.

Conversely, the item "Do you perceive any challenges or difficulties in using the website for educational purposes in cardiovascular biology?" received the lowest mean rating of 3.14. The item "How well does the website accommodate different learning styles and preferences in cardiovascular biology education?" received a mean rating of 3.71. Overall, the grand mean of 4.01 exceeds the benchmark mean of 3.50, suggesting that educational technologists rate the usability of the developed AI-powered website for learning cardiovascular biology as good to excellent.

When evaluating the degree of agreement or variability in the evaluations given by the educational technologists, the standard deviation (Std. D) is an important consideration. It aids in the understanding of the data in the following ways: Strong consensus among the experts is indicated by a low standard deviation. A greater standard deviation indicates that their perspectives are varied due to variations in individual experiences or expectations. Low Standard Deviation (High Agreement): The item with the lowest standard deviation (Std. D = 0.00) and mean of 4.00 is "In your opinion, does the website offer a seamless integration of technology to enhance the learning experience for cardiovascular biology?" This indicates that everyone agrees that the website integrates technology seamlessly. For example, "How user-friendly do you think the website's interface is?" (Std. D = 0.37) and "Are there useful multimedia components on the website?" Additionally, there is relatively little variation (Std. D = 0.38), indicating broad agreement with the multimedia content's efficacy and usability.

However, questions like "How intuitive is the website's design?" have a moderate standard deviation (moderate agreement; Std. D = 0.69), as well as "To what extent does the website support various learning styles?" There is moderate variability (Std. D = 0.49). This suggests that although most respondents concur that the design is usable, there are some disagreements over how intuitive it is and how well it accommodates different learning styles. Higher Standard Deviation (Lower Agreement): The mean (3.14) and standard deviation (Std. D = 0.38) of the item "Do you perceive any challenges or difficulties in using the website?" are both low. This implies that although answers were consistent, experts perceive difficulties to be significant. Item like, "How likely are you to recommend this website given your expertise?" (Std. D = 0.69) show more variability, reflecting a broader range of opinions on its recommendability.

The standard deviation highlights the strengths: Items with minimal variability (e.g., smooth technological integration, user-friendly design) are evident strengths of the website, demonstrating continuous positive feedback. Areas that need improvement: To satisfy a variety of user demands, there may be gaps that need to be filled, as shown by more variability in questions like "How well does the website accommodate different learning styles?". A strong overall usability grade is shown by the grand mean of 4.01, which is higher than the criterion of 3.50. The item-by-item standard deviations show: High Consistency: There is considerable agreement on favourable factors including multimedia components and interface design, as seen by the fact that several items have

standard deviations below 0.50. Moderate to Low Variability: Items with moderate standard deviations suggest areas for improvement in aspects like accommodating different learning styles and point to places where experiences may differ.

While overall ratings are positive, consistent feedback in areas like multimedia effectiveness and user-friendliness highlights key strengths, and higher variability in certain aspects signals areas for further improvement to enhance the website's usability. The standard deviation in Table 1 helps to clarify the consensus and variability in the evaluations of the educational technologists.

Research Question 2: How do informatics professionals grade the structure of the developed artificial intelligence-powered website for learning cardiovascular biology?

Table 2. Informatics professionals' ratings for the validation of the AI-powered website

Item	5	4	3	2	1	Mean	Std. Dev
To what extent do you find the website's interface user-friendly for navigating through cardiovascular biology content?	0	5	2	0	0	3.71	.49
How intuitive is the website's design in facilitating an efficient learning experience for cardiovascular biology concepts?	3	4	0	0	0	4.43	.53
In your opinion, does the website provide effective multimedia elements to enhance the engagement of users in learning cardiovascular biology?	3	2	2	0	0	4.14	.89
How well does the website utilize interactive features to promote user engagement in cardiovascular biology education?	1	6	0	0	0	4.14	.38
To what extent does the website incorporate adaptive learning technologies to personalize the user experience in cardiovascular biology?	2	3	2	0	0	4.00	.82
Do you perceive any challenges or difficulties in using the website for educational purposes in cardiovascular biology?	3	3	1	0	0	4.29	.76
How well does the website integrate with other educational technologies or platforms commonly used in the field of cardiovascular biology?	3	2	2	0	0	4.14	.89
In your professional judgment, how suitable is the website's user interface and design for educational purposes in cardiovascular biology?	0	3	4	0	0	3.43	.53
To what extent does the website provide clear instructions and guidance for users navigating through cardiovascular biology content?	1	3	3	0	0	3.71	.77
Overall, how would you rate the usability of the website for learning cardiovascular biology?	2	5	0	0	0	4.29	.49
How well does the website accommodate different learning styles and preferences in cardiovascular biology education?	2	5	0	0	0	3.57	.98
To what extent does the website foster collaborative learning experiences among users studying cardiovascular biology?	1	4	2	0	0	3.86	.69
How current and up to date do you find the technological features and functionalities of the website in the context of cardiovascular biology education?	1	4	2	0	0	3.86	.69
In your opinion, does the website offer a seamless integration of technology to enhance the learning experience for cardiovascular biology?	1	5	1	0	0	4.00	.58
Considering your expertise, how likely are you to recommend this website as a valuable educational resource for learning cardiovascular biology?	0	5	2	0	0	3.71	.49
	Grand Mean					3.95	

Key: 5 = Excellent, 4 = Good, 3 = Fair, 2 = Poor, 1 = Very Poor. Benchmark: 3.50.

Table 2 presents the ratings provided by informatics professionals concerning the structure of the developed AI-powered website for learning cardiovascular biology. The item "How intuitive

is the website's design in facilitating an efficient learning experience for cardiovascular biology concepts?" received the highest mean rating of 4.43. Items such as "Do you perceive any challenges or difficulties in using the website for educational purposes in cardiovascular biology?" and "Overall, how would you rate the usability of the website for learning cardiovascular biology?" both received high mean ratings of 4.29.

The item "How well does the website utilize interactive features to promote user engagement in cardiovascular biology education?" received a mean rating of 4.14, reflecting a positive assessment of the website's interactive elements in engaging users. Additionally, the item "How well does the website integrate with other educational technologies or platforms commonly used in the field of cardiovascular biology?" also received a rating of 4.14. On the other hand, the item "In your professional judgment, how suitable is the website's user interface and design for educational purposes in cardiovascular biology?" received a lower mean rating of 3.43.

The item "How well does the website accommodate different learning styles and preferences in cardiovascular biology education?" received a mean rating of 3.57, indicating that while the website is somewhat accommodating to different learning styles, there is potential for enhancing its adaptability to diverse learner needs. Overall, the grand mean of 3.95 exceeds the benchmark mean of 3.50, suggesting that informatics professionals grade the structure of the developed AI-powered website for learning cardiovascular biology as good.

The standard deviation provides valuable insight into areas of consensus and divergence among informatics professionals. Lower variability highlights strengths in interactive features and usability, while higher variability underscores areas requiring further refinement, such as accommodating diverse learning styles and enhancing integration with educational platforms. The consistency of the informatics experts' assessments of the AI-powered website's structure is revealed by the standard deviation in Table 2. While a higher standard deviation indicates a range of perspectives, a lower standard deviation indicates a stronger consensus among the experts. "How well does the website utilize interactive features to promote user engagement in cardiovascular biology education?" has the lowest standard deviation (high consensus) (Std. D = 0.38). This shows that professionals strongly believe that the website uses interactive features to engage users.

In a similar vein, the product "Generally, how would you rate the usability of the website for learning cardiovascular biology?" Consistent evaluations are shown by (Std. D = 0.49), indicating a consensus regarding the website's usability. Items such as "How intuitive is the website's design in facilitating an efficient learning experience for cardiovascular biology concepts?" have a moderate standard deviation (moderate consensus; Std. D = 0.53); and "Do you perceive any challenges or difficulties in using the website for educational purposes in cardiovascular biology?" Although there is considerable difference, most people think that the design is simple to use and has few difficulties (Std. D = 0.76). "How well does the website accommodate different learning styles and preferences in cardiovascular biology education?" is a question with a higher standard deviation (low consensus). Significant differences in views are shown in (Std. D = 0.98), indicating that the website's capacity to accommodate different learning styles may need to be improved to satisfy the needs of all experts.

Items like "How well does the website integrate with other educational technologies or platforms commonly used in the field of cardiovascular biology?" (Std. D = 0.89) also show some disagreement, indicating room for improvement in integration capabilities. The grand mean of 3.95 exceeds the benchmark of 3.50, but the varying standard deviations highlight areas where refinement is needed to address differing expert perspectives, especially on adaptability and integration.

Research Question 3: How do instructional designers appraise the developed artificial intelligence-powered website for learning cardiovascular biology?

Table 3 presents the ratings provided by instructional designers concerning the instructional design quality of the AI-powered website for learning Cardiovascular Biology. The item "How well does the website integrate formative assessments and feedback mechanisms within the instructional design for cardiovascular biology content?" received the highest mean rating of 4.71. The item

"To what extent does the website support the creation of personalized learning paths for users studying cardiovascular biology?" also received a high mean rating of 4.57, highlighting the website's effectiveness in offering personalised learning experiences tailored to individual user needs.

Table 3. Instructional designers' ratings for the validation of the AI-powered website

Item	5	4	3	2	1	Mean	Std. Dev
How well does the website align with established principles of curriculum design in the context of cardiovascular biology education?	2	3	0	2	0	3.71	1.25
To what extent does the instructional content on the website align with recognized curriculum standards for cardiovascular biology?	2	2	3	0	0	3.86	0.90
In your professional opinion, how effectively does the website address diverse learning styles and preferences within the framework of instructional design?	2	3	1	1	0	3.86	1.07
How well does the website incorporate interactive elements and multimedia to enhance instructional engagement in cardiovascular biology learning?	4	2	1	0	0	4.43	0.79
To what extent does the website support the creation of personalized learning paths for users studying cardiovascular biology?	4	3	0	0	0	4.57	0.53
Do you find the instructional design of the website conducive to fostering collaborative learning and knowledge-sharing among users in cardiovascular biology education?	2	4	1	0	0	4.14	0.69
How well does the website integrate formative assessments and feedback mechanisms within the instructional design for cardiovascular biology content?	5	2	0	0	0	4.71	0.49
In your professional judgment, how well does the website's instructional design support adaptability to emerging trends and advancements in education technology related to cardiovascular biology?	2	3	2	0	0	4.00	0.82
To what extent does the instructional design of the website cater to the needs of educators in implementing effective teaching strategies for cardiovascular biology?	3	3	0	1	0	4.14	1.07
Overall, how would you rate the instructional design of the website for learning cardiovascular biology within the scope of your expertise?	3	2	2	0	0	3.57	1.40
How well does the instructional design consider cultural and diverse factors in the context of cardiovascular biology education?	3	2	1	1	0	4.00	1.15
To what extent does the instructional design promote active learning and critical thinking skills in cardiovascular biology education?	4	3	0	0	0	4.57	0.53
In your opinion, does the instructional design of the website effectively utilize technology to support instructional goals in cardiovascular biology education?	1	3	3	0	0	3.71	0.76
How well does the instructional design support the accessibility and inclusiveness of the website for users with diverse learning needs in cardiovascular biology?	2	2	0	3	0	3.43	1.40
Considering your expertise, how likely are you to recommend this website as an effective instructional resource for learning cardiovascular biology based on its design?	0	5	1	1	0	3.57	0.79
	Grand Mean					4.02	

Key: 5 = Excellent, 4 = Good, 3 = Fair, 2 = Poor, 1 = Very Poor. Benchmark: 3.50.

Additionally, the website was highly rated on its incorporation of interactive elements and multimedia to enhance instructional engagement, with a mean rating of 4.43. Conversely, some areas were rated lower. The item "How well does the instructional design support the accessibility and inclusiveness of the website for users with diverse learning needs in cardiovascular biology?" received a mean rating of 3.43.

Similarly, the item "Overall, how would you rate the instructional design of the website for learning cardiovascular biology within the scope of your expertise?" received a mean rating of 3.57. Despite these lower ratings in certain areas, the website's instructional design was well-rated in terms of supporting adaptability to emerging trends and advancements in educational technology, with a mean rating of 4.00. This suggests that the website is viewed as being forward-looking in its design, with the ability to accommodate future developments in the field. Overall, the grand mean rating of 4.02 surpasses the benchmark of 3.50, indicating that instructional designers generally appraise the website's instructional design positively.

In Research Question 3, the ratings provided by instructional designers reveal significant insights about the quality of the website's instructional design. The standard deviations for each item show how consistent or inconsistent the participants' evaluations were. The Standard Deviation (*SD*) contributes to the interpretation of the data. Items with a low SD such as "How well does the website integrate formative assessments and feedback mechanisms within the instructional design for cardiovascular biology content?" (*SD* = 0.49), as well as "To what extent does the website support the creation of personalised learning paths for users studying cardiovascular biology?" (*SD* = 0.53) both had relatively low standard deviations but high mean scores (4.71 and 4.57, respectively). This implies that the instructional designers consistently agreed that these aspects of the website were highly effective. The experts' great agreement with the website's efficacy in these areas is seen in the low standard deviations, which show that there was a minimal difference in the ratings.

The question, "How well does the website incorporate interactive elements and multimedia to enhance instructional engagement in cardiovascular biology learning?" has a moderate standard deviation. (*SD* = 0.79), and "To what extent does the instructional design promote active learning and critical thinking skills in cardiovascular biology education?" High ratings were given to (*SD* = 0.53) (4.43 and 4.57, respectively). However, the moderate standard deviations indicate some variation in opinions among the instructional designers. While most experts rated these aspects positively, there were slight differences in how they appraised the website's capacity to engage users and promote active learning.

The following items had higher standard deviations: "How well does the instructional design support the accessibility and inclusiveness of the website for users with diverse learning needs in cardiovascular biology?" (*SD* = 1.40) and "Considering your expertise, how likely are you to recommend this website as an effective instructional resource for learning cardiovascular biology based on its design?" (*SD* = 0.79). These items had mean ratings of 3.43 and 3.57, respectively, indicating that some instructional designers rated these aspects favourably while others did not. The higher standard deviation for the accessibility and inclusivity item, in particular, highlights a significant diversity of opinion, suggesting that some instructional designers felt the website could do more in addressing these areas. Items with low standard deviations indicate a strong agreement among the instructional designers on the effectiveness of certain features, like formative assessments, personalised learning paths, and multimedia engagement; items with higher standard deviations indicate areas of disagreement or differing opinions, like the website's accessibility and inclusivity. Overall, the standard deviations offer insight into the consistency of ratings across various aspects of instructional design.

Grand Mean and Standard Deviation. The website's instructional design is generally rated favourably, as seen by the grand mean of 4.02 for the instructional design ratings, which is much higher than the benchmark of 3.50. The standard deviations among the categories, however, show where the instructional designers' views diverged significantly, particularly about inclusivity and accessibility as well as the overall efficacy of the website's design. The standard deviations in this

case show how much the instructional designers agreed or disagreed with their assessments of the website's instructional design. Larger standard deviations suggest more diverse viewpoints on other elements, offering important insight into areas where the website's design should be improved, whereas smaller standard deviations show great agreement on the usefulness of features.

Ho1: There is no significant difference in the ratings of the developed artificial intelligence-powered website for learning cardiovascular biology among educational technologists, informatics professionals, and instructional designers.

Table 4. Summary of ANOVA showing differences in the ratings of the developed artificial intelligence-powered website for learning cardiovascular biology among educational technologists, informatics professionals, and instructional designers

ANALYSIS OF VARIANCE						
Model	Sum of Squares	df	Mean Square	F	Sig.	Remark
Between Groups	12.095	2	6.048	.343	.714	Not Rejected
Within Groups	317.714	18	17.651			
Total	329.810	20				

Table 4 shows the difference in the ratings of the developed artificial intelligence-powered website for learning cardiovascular biology among Educational Technologists, Informatics professionals, and Instructional designers. The ANOVA results show that there was no significant difference in the ratings of the developed AI-powered website for learning Cardiovascular Biology among Educational Technologists, Informatics professionals, and Instructional designers ($F(2, 18) = 0.34$, $p = .714$). Hence, the null hypothesis was not rejected.

Discussion

Research question 1 determined how educational technologists validated the usability of the developed artificial intelligence-powered website. It was observed that educational technologists rated the developed AI-powered website to be in conformity with the acceptable standards and procedure in the field of educational technology. This validation indicates that the website is well-aligned with the current expectations and procedures in the field of educational technology, enhancing its credibility as an educational tool. This finding supports the study by Olumorin et al. (2021), which emphasised the importance of expert validation in ensuring that educational tools meet established criteria for usability and effectiveness. According to Olumorin et al., thorough evaluation by specialists is crucial for confirming that a technology aligns with best practices and pedagogical standards, thereby enhancing its educational value and user experience.

Research question 2 explored how informatics professionals validated the structure of the developed artificial intelligence-powered website for learning cardiovascular biology. The informatics professionals rated the structure of the developed AI-powered website to be in conformity with the acceptable standards and procedure in the field of computer science. This suggests that the AI-powered website is well-structured and aligns with the technical standards of computer science, ensuring its reliability and functionality. This validation indicates that the website's design and architecture are solid, making it a reliable platform for educational purposes. This finding supports the study by Murdiyanto et al. (2023), who emphasised the critical role of expert validation in web-based platforms. Their research demonstrated that expert validation ensures the system's appropriateness and readiness for educational use, confirming that the AI-powered website is technically sound and suitable for implementation in educational settings.

Also, Bernardes and Caliri (2020) described the construction and validation of a website for educational use in nursing. Their emphasis on systematic stages, including analysis, design, development, and evaluation, supports the idea that the website's design and architecture align with the rigorous standards of Computer Science.

Research question 3 examined the validation of the developed artificial intelligence-powered website for learning cardiovascular biology by instructional designers. It was revealed

that instructional designers rated the website as well-aligned with the established principles of curriculum design in the context of cardiovascular biology education. This finding implies that the AI-powered website is not only academically sound but also suitable for integration into existing educational curricula, ensuring that it effectively supports the structured learning of cardiovascular biology. This finding aligns with the study of Abramenka-Lachheb et al. (2021), whose study of instructional designers' use of informal learning highlighted the critical role that instructional designers play in assessing and refining digital learning materials. They ensure these resources meet educational standards and effectively contribute to the learning process within specific curricular contexts. The earlier study of Torrisi-Steele and Drew (2013) highlighted the critical role of instructional designers in evaluating and ensuring that educational website materials are pedagogically sound and aligned with curriculum standards. Bolliger and Martin (2018) also emphasise the importance of aligning educational technology with curriculum design principles to enhance the effectiveness of learning tools in higher education.

CONCLUSION

This study validated the usability, technical structure, and instructional design quality of the BeeNCardiac AI-powered website through expert evaluations by educational technologists, informatics professionals, and instructional designers. The experts confirmed that the platform is user-friendly, technically reliable, and pedagogically well-structured for learning cardiovascular biology. Their consistent positive ratings across the three professional groups indicate that the website meets essential standards of digital learning system design. Generally, the findings establish BeeNCardiac as a technically sound and instructionally effective AI-powered learning platform suitable for educational use in Nigeria.

DECLARATIONS

Author Contributions. Conceptualization, E.O.B. and C.O.O.; methodology, E.O.B. and C.O.O.; investigation, E.O.B.; formal analysis, C.O.O.; data curation, C.O.O.; writing—original draft, E.O.B.; writing—review and editing, C.O.O.; supervision, E.O.B. and C.O.O.

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Ethical Clearance and Informed Consent. The study was approved by the research ethics committee of the authors' university. Participation was voluntary and anonymous, and informed consent was obtained from all participants before they answered the questionnaire.

Conflict of Interest. The authors declare no conflict of interest.

Data Availability Statement. The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declaration of AI Use. The authors did not use generative AI or AI-assisted tools in the preparation of this manuscript.

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