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Effect of Instructional Simulation Strategy On Secondary School Students' Attitude Towards Biology in Ondo State, Nigeria

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Abstract:

This study aimed to investigate the impact of the Instructional Simulation (INS) strategy on secondary school students' attitudes towards Biology in Ondo State, Nigeria. It specifically assessed the differences in attitudinal mean scores between students exposed to instructional simulation and those using conventional teaching methods, analyzed gender-based variations among students employing instructional simulation, and evaluated differences in attitudinal mean scores between students in rural and urban schools utilizing instructional simulation. The study employed a pre-test, post-test, control group quasi-experimental design with two groups: an experimental group using instructional simulation and a control group using conventional methods. The population consisted of Senior Secondary School Two (SSS II) students offering Biology in public secondary schools in Ondo State. The sample included 151 SSS II students from six public schools, selected through a multistage sampling procedure. Data were collected using the Students' Attitude towards Biology Scale (SATBS). The results showed a significant difference in attitudinal mean scores between students exposed to instructional simulation and those using conventional methods, favouring the former. However, there was no significant difference in attitudinal mean scores between male and female students using instructional simulation, nor was there a significant difference in attitudinal mean scores between students in rural and urban schools using instructional simulation. In conclusion, the use of instructional simulation positively influenced students' attitudes toward Biology,

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irrespective of gender or location. This suggests the need for integrating instructional simulation into Biology curricula and providing professional development for educators to maximize its benefits. Additionally, simulation-based teaching methods can offer cost-effective and gender-neutral solutions to enhance students' learning experiences.

Keywords: Instructional Simulation, Attitude, Biology,

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Introduction

Science serves as the fundamental basis for providing sustainable development to a country by safeguarding human societies against the adverse effects of limited knowledge and information, illiteracy, sickness, and poverty. The technical and scientific improvement of a nation plays a crucial role in its overall development. Science education may be seen as a valuable instrument for the scientific and technical progress of any nation (FRN, 2014). The National Policy on Education, as established by the Federal Republic of Nigeria (FRN, 2014), emphasises the significance of science education in equipping students with the necessary skills to thrive in the contemporary era of science and technology. This is crucial for the advancement of socio-economic and political development. The strategy also highlights the significance of science education as a means of instilling essential scientific knowledge, skills, and competences.

One of the primary aims of Science Education is to cultivate students' enthusiasm for courses within the realm of Science. The study of biology holds a vital position in several scientific disciplines, making it imperative to prioritise the teaching of this subject with utmost seriousness. Biology is an academic discipline that focuses on the scientific investigation of living organisms, encompassing the examination of their anatomical composition, behavioural patterns, geographical distribution, evolutionary origins, and ecological interactions within their respective habitats.

The field of Biology appears to contribute to the enhanced understanding and aesthetic pleasure of the natural world and living organisms. Furthermore, this educational programme equips students with the necessary skills and knowledge to pursue successful professional pathways in several industries, including but not limited to medical, bio-technology, agriculture, and pharmacy. This suggests that Biology has significant importance as a scientific discipline that is essential for pursuing further education in several science-related fields, including Medicine, Pharmacy, Agriculture, Engineering, Food and Nutrition. Therefore, Biology holds a distinctive role within the curriculum of Secondary School Education. The Secondary School Biology Curriculum in Nigeria aims to enhance students' comprehension and enthusiasm for the field of biological sciences. Additionally, it seeks to foster students' capacity to utilise scientific knowledge in various domains such as personal health, community health, and agriculture, among others (Federal Ministry of Education, 2009).

The topic of Biology is included in the curriculum of Senior Secondary School, spanning from S.S.S 1 to S.S.S 3. The aforementioned cohort of students is required to have taken the Basic Science and Technology course during their enrolment in Junior Secondary School (J.S.S 1 – 3). This curriculum is designed to equip them with foundational knowledge and skills necessary for the pursuit of advanced science topics at the Senior Secondary level. The observation has indicated that Biology holds a higher preference among senior secondary school students as a scientific subject due to its comparatively lower reliance on mathematical calculations in comparison to Physics and Chemistry. Hence, it is seen that Biology tends to attract a larger number of students in external examinations, such as the West African Senior School Certificate Examination (WASSCE) and National Examination

Council Senior Certificate Examination (NECO SSCE), compared to Physics and Chemistry. Additionally, this field of study garners significant interest from aspiring students pursuing careers in the medical, engineering, and agricultural sectors.

Attitude is a significant factor that influences an individual's behaviour and communication in certain circumstances, their preferences and aversions, their interpersonal interactions, and most importantly, their responses to personal and global events. According to Michael and Gwyneth (2015), attitude may be defined as an individual's behavioural manifestation that reflects their thoughts and emotions towards a certain object or concept. Attitude pertains to an individual's cognitive and behavioural disposition, with significant ramifications for learners, educators, the immediate social circle of the learner, and the broader educational institution.

Attitudes may be shaped through the influence of opinions or by observing and emulating others such as parents, instructors, peer groups, and friends. Attitude may be defined as an acquired predisposition or inclination of an individual to react favourably or unfavourably towards an item, circumstance, concept, or another human. The acquisition of attitude can be facilitated via the process of learning, and then altered by persuasive efforts employing a range of tactics (Sarmah & Puri, 2014). The disposition towards Biology significantly influences the pedagogy and acquisition of knowledge in the field of Biology. The impact on students' academic achievement in the field of Biology is evident. Typically, the manner in which Biology is portrayed within educational settings and the manner in which students perceive it, despite instructors' intentions to deliver it appropriately, has the potential to disengage a significant number of students from the subject. It is evident that a favourable disposition towards the subject of Biology has the potential to contribute to students' achievements in the field of Biology. The impact of teaching methods on students' performance and attitude towards Biology has been noted as a significant issue. This observation highlights the significance of instructional practises within the context of teaching and learning. The utilisation of traditional teaching methods in secondary school Biology has been identified as a significant contributing factor to students' under-achievement in Biology examinations.

The traditional approach to teaching has been noted for its focus on knowledge transmission, often prioritising rote memorization. This method has faced criticism for its limitations in effectively teaching Biology and other scientific subjects, as it primarily involves a one-way transfer of information from the teacher to the students (Robert, 2011). The conventional educational technique is characterised by a lack of attention on students' ability to develop their own ideas and a lack of emphasis on a stepwise solution process (Robert, 2011). The approach employed does not foster the acquisition of skills necessary for a comprehensive comprehension of biological principles, concepts, and facts, since it mostly relies on a didactic teaching style where students passively listen to the teacher's lectures. The desire to address the limitations of traditional approaches in the instruction and acquisition of knowledge in the field of Biology has prompted the integration of alternative pedagogical strategies. These include the inquiry method, instructional simulation, blended learning, concept mappings, simulations and games, spaced-learning, and problem-based learning, among others (Opara,

2011). These novel approaches are regarded as efficacious instructional techniques that have the potential to enhance students' disposition towards the subject of Biology.

Simulation is defined as the process of creating a model that accurately represents the behaviour and attributes of a system, often achieved via the utilisation of a computer software specifically created for this purpose (Krulik, 2010). Simulation is a pedagogical technique that enables the acquisition of knowledge and skills through the process of representation and practical application within an environment that is favourable to learning (Awodun, 2010). Simulation refers to the act of replicating or imitating a certain environment or activity. Simulation, sometimes referred to as "the act of pretending or deception," is a commonly used term in several contexts. Simulation is a technique that entails the use of a model, which is a simplified representation of reality. This model serves to minimise the intricacy of a real-life scenario by selectively including just the fundamental aspects relevant to the intended learning objectives (Awodun, 2010).

The term "making replicas or representations of machines for demonstration or analysis of problems" refers to a process that effectively depicts real-life or imaginary circumstances. Simulation is a computer-assisted technique employed to simplify real-life scenarios, so facilitating the management of classroom environments, supporting students who may be hesitant or resistant to learning, stimulating intellectually advanced youngsters, and streamlining administrative tasks.

Simulation has the potential to assist students in the identification and comprehension of the components that govern a system, as well as in the prediction of its future behaviour. The integration of technology in the classroom can facilitate the inclusion of elements from the world or cosmos that may otherwise be cost-prohibitive, hazardous, abstract, challenging, or temporally inaccessible due to their rapid or slow occurrence. The integration of simulations in the pedagogical practises of Biology has the potential to enhance comprehension of intricate and complex topics, as it empowers students to construct their own knowledge. According to the findings of Umoke and Nwafor (2014), the utilisation of simulations as an instructional tool in scientific education has been shown to provide favourable outcomes and offer learners the opportunity to actively change variables or parameters, therefore enabling them to examine the resulting repercussions.

Instructional simulation encompasses instructional components that facilitate a learner's exploration, navigation, or acquisition of additional knowledge pertaining to a system or environment that is typically not attainable by ordinary experimentation. According to Eskrootchi and Oskrochi (2010), instructional simulations integrate visual and interactive learning experiences, facilitate the practical application of information, and offer a simplified depiction of real-world systems. Simulation can take several forms, such as role plays, games, and computer programmes, which aim to foster active engagement among students in the context of a Biology classroom. Simulation refers to the act of replicating, substituting, or copying an original entity or the manifestation of actions that are not genuine. The use of instructional simulations in the field of Biology facilitates the comprehension of complex and abstract ideas by providing students with the opportunity to engage in experimental exploration of the factors that constitute these notions. The utilisation of instructional

simulation in the field of Biology facilitates the cultivation of students' individual comprehension of key topics within the discipline.

The use of instructional simulation inside Biology classes offers a valuable opportunity for students to cultivate their Biology proficiency. By immersing students in simulated environments that mirror real-world settings, this approach facilitates the transformation of abstract concepts into tangible and comprehensible knowledge. By adopting this approach, students may engage in a purposeful and enduring learning experience, so enhancing their preparedness for future educational endeavours, including university education and their subsequent professional pursuits. The instructional simulation environment offers a medium for the practical application of acquired knowledge within a specific context. Through interactions within this environment, individuals are able to uncover new knowledge, hence facilitating the development of cognitive abilities and the accumulation of knowledge (Shama, 2011).

Research has also indicated that students' perception of Biology may be impacted by their gender. Gender is a sociocultural concept that encompasses the assignment of duties, attitudes, and values that are seen suitable for individuals based on their biological sex. Gender refers to the condition or characteristic of being male or female, encompassing the categories of man or woman, as well as boy or girl (Yang, 2010). From an alternative perspective, the societal position an individual occupies influences their gender identity.

The term "school location" refers to the specific geographic place or vicinity in which a school is established. This hamlet has the potential to be classified as either urban or rural. The attitude of kids might be impacted by the geographical location of their residence or the location of the school. In a study conducted by Olueh (2016), an examination was undertaken to assess the scholarly contributions of various academics pertaining to the influence of school location on student attitude. The findings of this investigation revealed notable disparities in the attitudes of students attending urban and rural schools.

The main purpose of the study was to examine the effect of Instructional Simulation (INS) strategy on secondary school students' attitude towards Biology in Ondo State, Nigeria. The study specifically examined:

i. the difference in the attitudinal mean scores of students exposed to instructional simulation strategy and conventional method in Biology;
ii. the difference in the attitudinal mean scores of male and female students exposed to instructional simulation strategy; and
iii. the difference in the attitudinal mean scores of students exposed to instructional simulation strategy in rural and urban schools in Biology

Research Hypotheses

The following null hypotheses were generated for this study.

1. There is no significant difference in the attitudinal mean scores of students exposed to instructional simulation strategy and conventional method in Biology
2. There is no significant difference in the attitudinal mean scores of male and female students exposed to instructional simulation strategy.

3. There is no significant difference in the attitudinal mean scores of students exposed to instructional simulation strategy in rural and urban schools in Biology.

Literature Review

The term "simulation" originates from the Latin word "similis," which conveys the concept of acting in a manner that is similar to, resembling, or pretending to be something else. Furthermore, simulations can take several forms, including computerised games as well as intricate role-playing scenarios (Moore, 2009). According to Awodun (2010), simulations provide students the opportunity to apply theoretical knowledge, cultivate critical abilities, and offer a respite from the routine activities of reading and class preparation.

Simulation offers an added advantage by incorporating a realistic element into the students' learning experience. Simulation is an instructional instrument that facilitates student learning by enabling the practical application of theoretical concepts and the exercise of decision-making skills inside a simulated corporate environment. The use of simulation approaches, wherein students are afforded the opportunity to assume novel classroom roles, serves to enhance classroom discourse, active engagement, and the application of acquired knowledge.

Researchers have observed that the utilisation of simulation approaches in instructional settings across various educational levels is highly regarded for its motivating effect. The ability of simulation to generate motivation in learners is a notable characteristic that contributes to its widespread acceptance in many educational contexts. When a teaching approach effectively fosters motivation, it may significantly mitigate other challenges that may arise. According to Watson (as cited in Awodun, 2010), the utilisation of simulation approaches, which enable students to assume different classroom roles, has been found to enhance classroom conversation, foster active involvement, and facilitate the transfer of learning.

According to Balleck (2012), the implementation of active learning strategies such as simulations, student presentations, and problem-solving scenarios might enhance students' comprehension and preparedness. Despite the acknowledgement by researchers of the positive impact of employing active learning methods, specifically through simulation techniques, on the acquisition of knowledge, educators across various educational levels continue to face challenges in ensuring that this acquisition, facilitated by the integration of active methodologies in the classroom, translates into comprehension and long-term retention. Consequently, the aim is for formal instruction to serve as a foundation for fostering a culture of lifelong learning (Yusuf, 2010).

Instructional simulation refers to a computer-based programme or system that is utilised for the purpose of delivering educational teaching. In recent times, certain computer software has been developed to incorporate functionalities that promote activities beyond the basic drill-and-practice exercises. These functionalities include simulations, graphing, and even modelling (Benson, 2011; Yusuf, 2010). The utilisation of computers and software programmes to impart concepts or skills is a fundamental aspect of the subject of Educational Technology, also referred to as instructional simulation.

The use of computers as instructional material has produced a substantial and noteworthy impact on many group-learning endeavours. One potential use of simulations is their

utilisation in the facilitation and organisation of group-based learning activities. In this context, simulations can serve as a means to effectively guide and organise the group-learning process. This platform facilitates the means by which a collective of learners engage in interactions and acquire information, explore simulated scenarios, and perhaps foster creativity. Learners in collaborative settings derive benefits not just from the feedback provided by the computer, but also from the feedback exchanged among their peers.

According to Eskrootchi and Oskrochi (2010), instructional simulations integrate visual and interactive learning modalities, facilitating the practical application of information and offering a simplified portrayal of real-world systems. Instructional simulation, facilitated by computer technology, is employed to replicate real-life scenarios (simulations) in order to enhance classroom management, provide assistance to hesitant learners, engage intellectually advanced students, and streamline administrative tasks. Simulation utilises certain elements of a real-life scenario.

The application of instructional simulation in the field of Biology involves the provision of authentic real-life scenarios that facilitate the practical application of biological principles. The utilisation of instructional simulations in the teaching and learning of Biology facilitates the comprehension of abstract and challenging ideas by providing students with the opportunity to conduct experiments on the variables that constitute those concepts. The utilisation of instructional simulation in the field of Biology facilitates the cultivation of students' individual comprehension of fundamental ideas.

The use of instructional simulation in Biology classes has been seen to offer a conducive learning environment for students, enabling them to improve their Biology abilities. This is achieved by involving students in scenarios that simulate real-world settings, so facilitating the transformation of abstract concepts into tangible and comprehensible forms. By using this approach, students would be able to engage in a purposeful and enduring learning experience, therefore enhancing their preparedness for future educational endeavours. The instructional simulation environment offers a platform for the application of information within a specific context. Through interactions within this environment, individuals can find new knowledge, hence facilitating the development of cognitive abilities and the accumulation of knowledge.

Gender is a socially and culturally formed notion that assigns certain qualities and functions to individuals based on their biological sex, namely male and female, within a given community. The idea of gender, similar to class and ethnicity, possesses several social constructs (Nzewi, 2010). Gender and gender stereotypes are pervasive in all facets of human effort inside Nigeria. According to Nzewi (2010), sex role-stereotypes may be defined as the categorization of human activities based on societal norms and expectations on what is seen suitable for each gender.

The societal practise of arbitrarily assigning responsibilities and expectations based on sex (male and female) has led to the misunderstanding that science is inherently 'masculine' and exclusively associated with males. According to Oludipe (2012), there exists a conventional perception in Nigeria where some occupations and professions are commonly associated with

males, such as medicine, engineering, and architecture, while others are predominantly seen as women's domains, including nursing, catering, and typing.

In a similar vein, Nzewi (2010) posited that the sociocultural environment in Nigerian households often influences the inclination of females into non-scientific fields and subjects. In many households, guys are often assigned duties that are perceived as complicated and challenging, whereas girls are expected to undertake tasks that are comparatively simpler and less demanding. As a result, a smaller proportion of girls choose to pursue science topics, leading to a disparity in the gender distribution within the field, favouring males. This study aims to provide a scholarly contribution to the ongoing academic discourse and debate around the impact of gender on students' attitudes. It seeks to achieve this by examining the influence of the instructional simulation technique.

The term "school location" refers to the specific geographic location or vicinity in which a school is positioned. This hamlet has the potential to be classified as either urban or rural. The disposition of students can be significantly impacted by the geographical location of their residence or the setting of their educational institution. According to Nwagbo and Chukelu (2011), students attending rural schools tend to display a pessimistic attitude towards the subject of Biology. This may be attributed to the disparity in federal financing between rural and urban/suburban schools, which therefore restricts the educational opportunities available to rural students in the field of Biology. The geographical placement of educational institutions is a significant determinant that influences students' perspectives and dispositions towards the discipline of Biology. According to Olasesan and Akaje (2018), there is a considerable impact of school location on students' attitudes. The researchers propose that the government should address the disparity between rural and urban areas by allocating trained mathematics instructors, instructional resources, and social facilities to rural regions. This approach is expected to foster a more positive attitude towards Biology. However, previous studies conducted by Ezeudu (2013) and Bosede (2010) have demonstrated that the geographical location does not have a significant impact on the attitudes of students.

Methodology

This study adopted a pre-test, post-test, control group quasi experimental design in which two groups (one experimental and one control) were involved. Instructional simulation strategy and conventional method formed the independent variables while attitude of students formed the dependent variable for the study. The population of the study comprised all Senior Secondary School Two (SSS II) students offering Biology in all the public secondary schools in Ondo State, Nigeria.

The sample for the study consisted of 151 SSS II students offering Biology drawn from 6 public secondary schools in Ondo State. The sample was selected using multistage sampling procedure.

Students' Attitude Towards Biology Scale (SATBS) was used for collecting the data for the study. The instrument consists of Sections A and B. Section A sought for student's personal information and school location while Section B consists of 30 items covering the disposition of the students to Biology. The items are rated on a 4-point Likert rating Scale type of Strongly

Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). The scoring key of SATBS is as follows: SA = 4, A = 3, D = 2, SD = 1 for positive responses and the reverse for the negative items. The validity of SATBS was done through the advice of qualified and experienced Biology educators to determine its suitability in terms of language of presentation, clarity of ideas, relevance and applicability to the study.

The internal consistency of the instrument was carried out through a pilot study. The instrument was administered on 30 SSS 2 students in one of the schools outside the sample area. The data collected were analysed using Kuder-Richardson (Kr-20) which yielded reliability co-efficient value of 0.86. The reliability coefficient was high enough to affirm the instrument reliable and hence used for this study.

To carry out the research in the schools, the researcher obtained permission from the authorities of the six schools. The study was carried out in three phases namely pre-treatment, treatment, and post-treatment stages. The data collected through the instruments were analysed using descriptive and inferential statistics. The hypotheses were tested using t-test at 0.05 level of significance.

Result

Hypothesis 1: There is no significant difference in the attitudinal mean scores of students exposed to instructional simulation strategy and conventional method in Biology

Table 1: t-test analysis difference in the attitudinal mean scores of students exposed to instructional simulation strategy and conventional method

Variations	N	Mean	SD	Df	t_{cal}	P
instructional simulation strategy	74	88.34	2.79	149	22.946*	0.000
Conventional	77	77.22	3.14			

*p<0.05

Table 1 shows that the t-cal value of 22.946 is significant because the P value (0.000) < 0.05. This implies that null hypothesis is rejected. Hence, there is significant difference in the attitudinal mean scores of students exposed to instructional simulation strategy and conventional method in Biology. Students exposed to instructional simulation strategy exhibited positive attitude to Biology than those exposed to conventional method.

Hypothesis 2: There is no significant difference in the attitudinal mean scores of male and female students exposed to instructional simulation strategy.

Table 2: t-test analysis for gender difference in attitudinal mean scores of students exposed to Instructional Simulation (INS)

Variations	N	Mean	SD	Df	t_{cal}	P
Male	36	87.81	3.06	72	1.614	0.111
Female	38	88.84	2.44			

P>0.05

Table 2 shows that the t-cal value of 1.614 is not significant because the P value (0.111) > 0.05. This implies that null hypothesis is not rejected. Hence, there is no significant difference

in the attitudinal mean scores of male and female students exposed to instructional simulation strategy.

Hypothesis 3: There is no significant difference in the attitudinal mean scores of students exposed to instructional simulation strategy in rural and urban schools in Biology.

Table 3: t-test analysis for difference in attitudinal mean scores of students exposed to Instructional Simulation (INS) based location

Variations	N	Mean	SD	Df	t_{cal}	P
Urban	42	87.86	3.02	72	1.720	0.090
Rural	32	88.97	2.35			

P>0.05

Table 3 shows that the t-cal value of 1.720 is not significant because the P value (0.090) > 0.05. This implies that null hypothesis is not rejected. Hence, there is no significant difference in the attitudinal mean scores of students exposed to instructional simulation strategy in rural and urban schools in Biology.

Discussion

The results of the study indicated a statistically significant disparity in the average attitudinal scores between students who were exposed to Instructional Simulation (INS) and those in the Control Group (COG) following the intervention. The Instructional Simulation (INS) technique proved to be a more successful strategy in improving students' attitude towards the subject of Biology. The findings indicate that the use of instructional simulation as a teaching technique is more effective in enhancing students' performance in Biology at the secondary school level compared to the conventional teaching method commonly used in the country. The conclusion of this finding suggests that the traditional instructional approach lacks sufficient efficacy in fostering a favourable shift in students' attitudes towards the field of Biology. This conclusion is consistent with the study findings of Awodun and Oyeniyi (2018) which suggest that the use of simulation teaching technique might help alleviate students' negative attitude towards Biology and other science topics. Simulation might potentially enhance the concreteness and meaningfulness of the learning process. While simulation has been extensively utilised in the fields of physical sciences and medicine, this study establishes its significance in the context of biology training.

The findings of the study indicated that there was not a statistically significant disparity in the mean attitudinal ratings between male and female students who were subjected to Instructional Simulation (INS). According to Dauda (2015) and Adoke (2015), their study examined the impact of instructional simulation method on students' attitudes. The findings indicated that instructional simulation technique was more successful than other teaching techniques and did not exhibit any gender bias. The results of this study are intriguing as they indicate the absence of any interaction or justification for segregating biology teaching based on gender. The discovery is consistent with the findings of Maduagwuna (2012). The findings of these research indicate that there is no significant correlation between the method used and gender in relation to students' learning outcomes. This finding suggests that the

utilisation of simulation methods in scientific classrooms is not only successful, but also offers a cost-efficient solution.

There was no statistically significant disparity observed in the mean attitudinal ratings of students who were exposed to Instructional Simulation (INS), when analysed based on their geographical location. This discovery aligns with the previous research conducted by Awodun (2010). The findings indicate that inside virtual educational environments, students engage in experiential learning and exhibit similar attitudes regardless of their geographical location.

Conclusion

Based on the findings of this study, it could be concluded that the use of instructional simulation enhanced students' attitude towards Biology than the conventional strategy while the instructional simulation strategy was not gender biased and potent in all locations.

Recommendations

Based on the findings of this study, the following recommendations were made.

1. Integration of Instructional Simulation: Educational institutions and educators should consider integrating instructional simulation into their Biology curriculum. The results suggest that this teaching method can have a positive impact on students' attitudes towards the subject.
2. Professional Development: Teachers and instructors should receive adequate training and professional development opportunities to effectively implement instructional simulations in the classroom. This will ensure that the potential benefits of this teaching strategy are fully realized.
3. Gender-Neutral Approach: The study found that instructional simulation is not gender-biased, making it an inclusive teaching method suitable for both male and female students. Schools and educators should actively promote and encourage the use of instructional simulation to create a more equitable learning environment.
4. Location-Independent: The study demonstrated that instructional simulation was effective in all locations studied. Therefore, educational institutions in various geographical settings can adopt this strategy without concerns about its efficacy across different regions.
5. Continuous Assessment: Regular assessment and evaluation of the implementation of instructional simulation should be conducted to ensure its continued effectiveness. Feedback from students and educators should be considered to make necessary improvements and adaptations to the teaching method.
6. Resource Allocation: Schools and educational organizations should allocate resources for the development and acquisition of instructional simulation tools and software. Investing in the necessary technology and resources is essential to successfully implement this teaching strategy.
7. Research and Collaboration: Further research and collaboration among educational institutions, researchers, and curriculum developers can help refine and expand the use of instructional simulation in Biology education. Sharing best practices and innovative approaches can lead to continued improvements in teaching methods.

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