



Assessment of Pre-Service Science Teachers Knowledge of ... Abdulrahman, A. O., Et. al. (2026)

Assessment of Pre-Service Science Teachers' Knowledge of In-Vitro-Fertilization and Surrogacy for Teaching Human Reproduction among Colleges of Educations in Kwara State, Nigeria

ABDULRAHMAN, Abdulgafar O.¹

opeyemiayinla2@gmail.com

ARINDE, Odunayo O.²

arindeodunayo99@gmail.com, Ismail_garuba@yahoo.com

ABDULKADIR, Akeem A.¹

GARUBA, Ismaila A.³

ayindeakeem317@gmail.com

¹Department of Integrated Science, School of Science, Kwara State College of Education (Technical), P.M.B. 01 Lafiagi, Kwara State, Nigeria

²Department of Biology Education, School of Science, Kwara State College of Education (Technical), P.M.B. 01 Lafiagi, Kwara State, Nigeria

³Department of Agricultural Science Education, School of Vocational Education, Kwara State College of Education (Technical), Lafiagi, Kwara State, Nigeria

Abstract

This study investigated pre-service science teachers' knowledge of in vitro fertilization (IVF) and surrogacy and examined the implications of their knowledge levels for the teaching of human reproduction in Colleges of Education in Kwara State, Nigeria. The study adopted a descriptive survey research design. A sample of 150 pre-service science teachers (biology education students) was drawn from two Colleges of Education using multi-stage sampling. Data were collected using a researcher-designed questionnaire titled "Pre-Service Science Teachers' Knowledge and Perceptions of IVF and Surrogacy Questionnaire (PSKPIVFSQ)," which comprised four sections covering demographic information, knowledge of IVF (10 items), knowledge of surrogacy (10 items), and perceptions of IVF and surrogacy (15 items on a 4-point Likert scale). The instrument was validated by three experts in science education and educational measurement, and reliability coefficients of 0.78 (KR-20) for IVF knowledge, 0.81 (KR-20) for surrogacy knowledge, and 0.84 (Cronbach's alpha) for perceptions were obtained. Data were analyzed using descriptive statistics (means, standard deviations, frequencies, and percentages), independent samples t-test, and one-way ANOVA at 0.05 level of significance. The findings revealed that the majority of pre-service science teachers had moderate knowledge of IVF (Mean = 4.32/10) and low knowledge of surrogacy (Mean = 3.48/10). Pre-service science teachers expressed an overall positive perception of IVF and surrogacy (Grand Mean = 2.70/4.00), but held negative perceptions regarding the legalization of commercial surrogacy and expressed discomfort about discussing these topics in the classroom. There was no significant difference in knowledge based on gender ($t = 0.874$, $p = 0.384 > 0.05$), but a significant difference was found based on academic level ($F = 4.38$, $p = 0.014 < 0.05$), with NCE III students scoring significantly higher than NCE I students. The study concluded that pre-service science teachers' knowledge of IVF and surrogacy is inadequate for effective teaching of contemporary human reproduction topics. It was recommended that the National Commission for Colleges of Education (NCCE) should update the NCE biology curriculum to include assisted reproductive technologies, and that Colleges of Education should organize workshops, develop relevant instructional materials, and integrate bioethics education into teacher training programmes to enhance pre-service teachers' preparedness to teach human reproduction.

Keywords: Pre-service science teachers, in vitro fertilization, surrogacy, knowledge, human reproduction



Introduction

Advances in biomedical science have profoundly transformed human reproduction over the past four decades. Since the birth of Louise Brown in 1978 — the first baby conceived through in vitro fertilization (IVF)— assisted reproductive technologies (ART) have expanded dramatically, with an estimated eight million babies born worldwide through IVF and related procedures (Carneiro, 2022). These technologies, which include IVF, intracytoplasmic sperm injection (ICSI), gamete donation, and surrogacy, have offered hope to millions of infertile couples globally, including in sub-Saharan Africa where infertility affects approximately 20% of couples (Bello, Akinajo & Olayemi, 2014). In vitro fertilization involves the retrieval of oocytes from a woman's ovaries, their fertilization with sperm in a laboratory setting, and the subsequent transfer of the resulting embryo(s) into the uterus (Kharb, 2006). Surrogacy, on the other hand, is an arrangement in which a woman agrees to carry and deliver a child for another person or couple, and may be traditional (using the surrogate's own egg) or gestational (using the intended mother's or a donor's egg) (Tyuvina & Nikolaevskaya, 2020). Both IVF and surrogacy raise significant scientific, ethical, legal, religious, and socio-cultural questions that continue to generate debate worldwide (Fadare & Adeniyi, 2015). In the Nigerian context, the practice of ART has grown rapidly, particularly within the private healthcare sector (Ajayi & Dibosa-Osador, 2011). However, public knowledge and acceptance of these technologies remain limited. Adeyemi (2020) reported that over 60% of both fertile and infertile respondents in Lagos State had no knowledge of ART. Similarly, Oche et al. (2018) documented widespread perceptions and misperceptions about IVF among women of reproductive age in Sokoto, Northern Nigeria. These knowledge gaps are not confined to the general public; even among health professionals such as nurses, studies have found good knowledge of IVF co-existing with negative attitudes toward its application (Obioha, Ikechebelu, Uchenna & Joe-Ikechebelu, 2014).

The implications of these knowledge and perception gaps extend beyond the clinical setting into the educational domain. Science teachers, particularly biology teachers and pre-service science teachers in Colleges of Education, are responsible for teaching human reproduction as part of the senior secondary school biology curriculum. As Vlaardingerbroek (2018) observed, teaching students about human reproduction has become increasingly daunting as assisted reproduction technologies challenge established scientific, social, and legal perceptions of parenthood. Brumby (1986) similarly argued that education has traditionally presented science as a value-free body of knowledge divided into discrete disciplines, resulting in a fragmented approach to teaching human reproduction that leaves students confused and ignorant about fertility and its modern interventions. If science teachers themselves lack adequate knowledge of IVF and surrogacy, or hold misconceptions and culturally influenced negative perceptions about these technologies, they are unlikely to present these topics accurately, objectively, or comprehensively to their students. This is particularly critical in Nigeria's Colleges of Education, which train the majority of teachers who will staff junior and senior secondary schools across the country. Pre-service science teachers' knowledge and perceptions of IVF and surrogacy therefore have direct implications for the quality of reproductive health education delivered in Nigerian schools.

Despite the growing body of research on knowledge and perceptions of ART among infertile couples, health professionals, and university students, there is a conspicuous gap in the literature regarding science teachers' and pre-service science teachers' knowledge and perceptions of IVF and surrogacy, particularly in developing countries like Nigeria. This study therefore seeks to investigate pre-service science teachers' knowledge of in vitro fertilization and surrogacy in Colleges of Education, with a



Assessment of Pre-Service Science Teachers Knowledge of ... Abdulrahman, A. O., Et. al. (2026)

view to understanding the implications for teaching human reproduction. The Nigerian secondary school biology curriculum includes human reproduction as a core topic. However, the curriculum content on reproduction has not kept pace with the rapid advances in reproductive technology. Concepts such as IVF, embryo transfer, surrogacy, gamete donation, and fertility preservation are either absent or mentioned only in passing. This creates a situation where biology teachers may be required to address students' questions about these widely discussed technologies without adequate background knowledge.

Studies have consistently demonstrated that knowledge of ART is low across multiple populations in Nigeria — from the general public (Adeyemi, 2020) to infertile couples (Bello et al., 2014) and even among medical professionals (Obioha et al., 2014). Furthermore, cultural, religious, and ethical concerns significantly shape Nigerians' perceptions of ART. Adamu (2023) found that nearly 90% of Nigerian respondents were negatively disposed to commercial gestational surrogacy, citing Afrocentric ethical objections. Fayokun (2011) similarly reported that while some Nigerians perceive ART as beneficial, others find their utilization offensive to their moral sensibilities. If pre-service science teachers in Colleges of Education share similar knowledge gaps and culturally influenced negative perceptions, the quality of human reproduction instruction in Nigerian secondary schools will be compromised. Yet, no study has specifically examined the knowledge and perceptions of IVF and surrogacy among this critical population. This study addresses this gap.

Literature Review

Knowledge of ART refers to an understanding of its scientific principles, procedures, and outcomes, while perceptions encompass attitudes shaped by cultural, religious, and ethical factors. Globally, ART knowledge is generally low to moderate. Sohrabvand and Jafarabadi (2005) found that 55.7% of infertile patients in Iran had poor ART knowledge. In Nigeria, Adeyemi (2020) reported that over 60% of respondents in Lagos lacked ART awareness, while Bello et al. (2014) found only 35% awareness of surrogacy among women at an infertility clinic. Among health professionals, a disconnection often exists between factual knowledge and attitudes. Obioha et al. (2014) found that while 86.2% of Nigerian nurses correctly defined IVF, they held negative dispositions toward its use by single mothers. Furthermore, perceptions in Nigeria are deeply Afrocentric; Adamu (2023) found that 89.2% of Nigerians opposed commercial gestational surrogacy due to ethical and cultural objections.

Theoretical Framework: PCK and the KAP Model

This study is anchored on Shulman's (1986, 1987) Pedagogical Content Knowledge (PCK) framework. PCK is the specialized knowledge teachers need to transform subject matter into comprehensible instruction. To teach IVF and surrogacy effectively, teachers require more than factual knowledge; they need PCK to navigate the ethical and cultural sensitivities of these topics. Complementarily, the Knowledge-Attitude-Practice (KAP) model posits that knowledge shapes attitudes, which dictate practice. Malina, Roczniowska, and Pooley (2021) empirically demonstrated that greater IVF knowledge correlated with more positive attitudes, independent of moral foundations. Consequently, pre-service teachers' limited knowledge may breed negative attitudes, leading to pedagogical avoidance or biased instruction (Brumby, 1986).

Objective of the Study

The study investigated pre-service science teachers' knowledge of in vitro fertilization (IVF) and surrogacy and also examined the implications of their knowledge levels for the teaching of human reproduction in Colleges of Education in Nigeria. Specifically, the study:



Assessment of Pre-Service Science Teachers Knowledge of ... Abdulrahman, A. O., Et. al. (2026)

1. Assessed the level of knowledge of Pre-service Science Teachers regarding IVF.
2. Assessed the level of knowledge of Pre-service Science Teachers regarding surrogacy.
3. Examined Pre-service Science Teachers' perceptions of IVF and surrogacy.
4. Determined whether gender influences Pre-service Science Teachers' knowledge of IVF and surrogacy.
5. Determined whether academic level (year of study) influences Pre-service Science Teachers' knowledge of IVF and surrogacy.

Research Questions

1. What is the level of knowledge of Pre-service Science Teachers regarding in vitro fertilization (IVF)?
2. What is the level of knowledge of Pre-service Science Teachers regarding surrogacy?
3. What are the perceptions of Pre-service Science Teachers toward IVF and surrogacy?
4. Is there a significant difference in Pre-service Science Teachers' knowledge of IVF and surrogacy based on gender?
5. Is there a significant difference in Pre-service Science Teachers' knowledge of IVF and surrogacy based on academic level?

Research Hypotheses

H₀₁: There is no significant difference in the knowledge of IVF and surrogacy between male and female Pre-service Science Teachers.

H₀₂: There is no significant difference in the knowledge of IVF and surrogacy among Pre-service Science Teachers based on their academic level (NCE I, NCE II, NCE III).

Methodology

The study adopted a descriptive survey research design. The target population comprised all pre-service science teachers (biology education students) in Colleges of Education in Kwara State, Nigeria. A sample of 150 participants was drawn from two Colleges of Education using a multi-stage sampling procedure. Two colleges were purposively selected, followed by stratified random sampling to ensure proportional representation across NCE levels (I, II, III) and gender (Male = 60; Female = 90). Data were collected using the researcher-designed Pre-Service Science Teachers' Knowledge and Perceptions of IVF and Surrogacy Questionnaire (PSKPIVFSQ). The instrument comprised four sections: Section A: Demographic information; Section B: Knowledge of IVF (10 items, scored 0–10). Section C: Knowledge of Surrogacy (10 items, scored 0–10). Section D: Perceptions of IVF and Surrogacy (15 items on a 4-point Likert scale). Knowledge scores were categorized as High (7–10), Moderate (4–6), and Low (0–3). Perception means were benchmarked at 2.50 (≥ 2.50 = Positive, < 2.50 = Negative). Face and content validity were established by three experts in science education and measurement. A pilot study ($n = 30$) yielded reliability coefficients of 0.78 and 0.81 (KR-20) for the IVF and surrogacy knowledge sections, respectively, and 0.84 (Cronbach's alpha) for the perception section. Data were analyzed using SPSS version 26. Descriptive statistics (mean, standard deviation, frequency, percentage) answered the research questions. Independent samples t-test and one-way ANOVA tested the hypotheses at a 0.05 significance level.

Presentation of Results

Research Question 1: What is the Level of Knowledge of Pre-Service Science Teachers Regarding IVF?



Assessment of Pre-Service Science Teachers Knowledge of ... Abdulrahman, A. O., Et. al. (2026)

Table 1

Frequency and Percentage of Pre-Service Science Teachers based on their Level of Knowledge of IVF

Knowledge Level	Score Range	Frequency	Percentage (%)
High	7-10	27	18.0
Moderate	4-6	68	45.3
Low	0-3	55	36.7
Total		150	100.0
Mean = 4.32		SD = 2.14	

Table 1 reveals that the majority of pre-service science teachers (45.3%) had moderate knowledge of IVF, followed by those with low knowledge (36.7%). Only 18.0% demonstrated high knowledge. The overall mean knowledge score of 4.32 out of 10 falls within the moderate range, suggesting that pre-service science teachers possess only a basic understanding of IVF.

Research Question 2: What is the Level of Knowledge of Pre-Service Science Teachers Regarding Surrogacy?

Table 2

Frequency and Percentage of Pre-Service Science Teachers based on their Level of Knowledge of Surrogacy

Knowledge Level	Score Range	Frequency	Percentage (%)
High	7-10	15	10.0
Moderate	4-6	52	34.7
Low	0-3	83	55.3
Total		150	100.0
Mean = 3.48		SD = 2.31	

Table 2 shows that the majority of respondents (55.3%) had low knowledge of surrogacy, while 34.7% had moderate knowledge and only 10.0% had high knowledge. The overall mean knowledge score of 3.48 out of 10 falls within the low range, indicating that pre-service science teachers' knowledge of surrogacy is notably poorer than their knowledge of IVF.

Research Question 3: What Are the Perceptions of Pre-Service Science Teachers Toward IVF and Surrogacy?

Table 3

Mean and Standard Deviation of Pre-Service Science Teachers' Perceptions of IVF and Surrogacy

S/N	Item Statement	Mean	SD	Decision
1	IVF is a scientifically acceptable method of treating infertility	2.87	0.92	Positive
2	IVF should be taught as part of human reproduction in biology classes	2.95	0.88	Positive
3	IVF contradicts God's plan for human reproduction	2.68	1.04	Positive
4	Surrogacy is morally acceptable when a woman cannot carry a pregnancy	2.15	0.96	Negative
5	I would recommend IVF to an infertile couple	2.72	0.91	Positive
6	Commercial surrogacy should be legalized in Nigeria	1.89	0.87	Negative
7	Science teachers should be knowledgeable about IVF and surrogacy	3.21	0.74	Positive
8	IVF children are different from naturally conceived children	1.95	0.93	Negative
9	Surrogacy undermines the sanctity of motherhood	2.78	1.01	Positive

Assessment of Pre-Service Science Teachers Knowledge of ... Abdulrahman, A. O., Et. al. (2026)

10	I am comfortable discussing IVF and surrogacy in the classroom	2.31	0.99	Negative
11	The Nigerian government should fund IVF treatment for infertile couples	2.56	0.94	Positive
12	Surrogacy should only be allowed for married couples	3.05	0.81	Positive
13	Cultural and religious values should guide decisions about IVF and surrogacy	3.12	0.79	Positive
14	I would like to learn more about IVF and surrogacy	3.35	0.68	Positive
15	IVF and surrogacy topics should be included in the NCE biology curriculum	2.89	0.85	Positive
Grand Mean		2.70	0.89	Positive

Decision benchmark: Mean $\geq$ 2.50 = Positive; Mean $<$ 2.50 = Negative

Table 3 reveals that the grand mean perception score is 2.70, which is above the 2.50 benchmark, indicating an overall positive perception of IVF and surrogacy among pre-service science teachers. However, perceptions varied considerably across items. The highest mean score was recorded for Item 14 ("I would like to learn more about IVF and surrogacy"; Mean = 3.35), indicating a strong desire for knowledge. Item 7 ("Science teachers should be knowledgeable about IVF and surrogacy"; Mean = 3.21) also scored highly. Negative perceptions were recorded for four items: Item 6 ("Commercial surrogacy should be legalized in Nigeria"; Mean = 1.89), Item 8 ("IVF children are different from naturally conceived children"; Mean = 1.95), Item 4 ("Surrogacy is morally acceptable when a woman cannot carry a pregnancy"; Mean = 2.15), and Item 10 ("I am comfortable discussing IVF and surrogacy in the classroom"; Mean = 2.31). The negative perception of commercial surrogacy and the discomfort with classroom discussion are particularly noteworthy.

H₀₁: There is no significant difference in the Knowledge of IVF and Surrogacy between Male and Female Pre-Service Science Teachers

Table 4

Independent Samples t-test of Pre-service Science Teachers Knowledge based on Gender

Gender	N	Mean	SD	df	t-value	p-value	Decision
Male	60	8.10	3.52	148	0.874	0.384	Not Significant
Female	90	7.62	3.28				

Significant at $p < 0.05$

Table 5 shows that the mean combined knowledge score for male pre-service science teachers (Mean = 8.10, SD = 3.52) was slightly higher than that of their female counterparts (Mean = 7.62, SD = 3.28). However, the t-test result ($t = 0.874$, $p = 0.384$) indicates that this difference is not statistically significant at the 0.05 level. Therefore, the null hypothesis is retained: there is no significant difference in the knowledge of IVF and surrogacy between male and female pre-service science teachers.

H₀₂: There is no significant difference in the Knowledge of IVF and Surrogacy among Pre-Service Science Teachers based on academic level

Table 5

One-Way ANOVA of Pre-service Science Teachers Knowledge based Academic Level

Source of Variation	Sum of Squares	df	Mean Square	F-value	p-value	Decision
Between Groups	98.42	2	49.21	4.38	0.014	Significant
Within Groups	1651.58	147	11.24			
Total	1750.00	149				

Significant at $p < 0.05$



Assessment of Pre-Service Science Teachers Knowledge of ... Abdulrahman, A. O., Et. al. (2026)

Table 5 shows that the ANOVA result ($F = 4.38$, $p = 0.014$) is significant at the 0.05 level. Therefore, the null hypothesis is rejected: there is a significant difference in the knowledge of IVF and surrogacy among pre-service science teachers based on academic level.

Table 6

Post-Hoc Scheffé Test for Multiple Comparisons

Academic Level (I)	Academic Level (J)	Mean Difference (I-J)	p-value
NCE I	NCE II	-1.24	0.182
NCE I	NCE III	-2.16*	0.011
NCE II	NCE III	-0.92	0.387

* The mean difference is significant at the 0.05 level.

Descriptive statistics by academic level

Academic Level	N	Mean	SD
NCE I	50	6.84	3.15
NCE II	50	8.08	3.42
NCE III	50	9.00	3.51

The post-hoc Scheffé test (Table 7) reveals that the significant difference exist between NCE I and NCE III students, with NCE III students demonstrating significantly higher knowledge scores than NCE I students. The differences between NCE I and NCE II, and between NCE II and NCE III, were not statistically significant.

Discussion of Findings

Knowledge of IVF among Pre-Service Science Teachers

The finding that the majority of pre-service science teachers demonstrated only moderate knowledge of IVF (Mean = 4.32 out of 10), with over a third (36.7%) scoring in the low knowledge range, is consistent with the broader literature on ART knowledge across populations. Adeyemi (2020) found that over 60% of respondents in Lagos had no knowledge of ART. Sohrabvand and Jafarabadi (2005) similarly reported that 55.7% of infertile patients had poor knowledge of ART, with education being the strongest predictor of knowledge. The moderate-to-low knowledge levels found in this study are particularly concerning because these respondents are future biology teachers who will be expected to teach human reproduction to secondary school students. The knowledge gaps identified may be attributable to the NCE biology curriculum's limited coverage of assisted reproductive technologies. While human reproduction is a standard topic, the curriculum does not explicitly address IVF, surrogacy, or other ART procedures. This finding aligns with Brumby's (1986) observation that education has traditionally presented human reproduction in a fragmented manner that does not adequately address modern reproductive technologies.

Knowledge of Surrogacy among Pre-Service Science Teachers

The finding that knowledge of surrogacy was lower than knowledge of IVF (Mean = 3.48 vs. 4.32 out of 10, with 55.3% in the low knowledge category) is noteworthy but not surprising. In the Nigerian literature, Bello et al. (2014) found that while 58.3% of women at an Ibadan infertility clinic were aware of IVF, only 35% were aware of surrogacy. This pattern suggests that IVF receives more public attention and media coverage than surrogacy, which remains a less visible and more culturally sensitive topic in Nigeria. The lower knowledge of surrogacy may also reflect the absence of specific legislation governing surrogacy in Nigeria, which means there are less public discourse and formal education about the practice (Fadare & Adeniyi, 2015). Furthermore, the strong cultural and religious reservations about surrogacy documented by Adamu (2023) — who found 89.2% of



Assessment of Pre-Service Science Teachers Knowledge of ... Abdulrahman, A. O., Et. al. (2026)

Nigerians negatively disposed to commercial gestational surrogacy — may discourage open discussion and information-seeking about the topic.

Perceptions of IVF and Surrogacy

The overall positive perception (Grand Mean = 2.70) masks important variations at the item level. The strong agreement that science teachers should be knowledgeable about IVF and surrogacy (Mean = 3.21) and the expressed desire to learn more (Mean = 3.35) are encouraging findings that suggest pre-service teachers recognize the importance of these topics for their professional development. However, the negative perception of commercial surrogacy (Mean = 1.89) mirrors the broader Nigerian cultural disposition documented by Adamu (2023) and Fayokun (2011). The finding that respondents were uncomfortable discussing IVF and surrogacy in the classroom (Mean = 2.31) is particularly significant for teacher education. This discomfort likely reflects a combination of limited knowledge, cultural sensitivity surrounding reproductive topics, and the absence of pedagogical training on how to handle controversial bioethical issues in the classroom. Macer (1994) found that even biology teachers in Japan expressed significant concern about IVF and genetic engineering, suggesting that professional training does not automatically eliminate cultural reservations. The positive perception that IVF and surrogacy should be included in the NCE biology curriculum (Mean = 2.89) and should be taught as part of human reproduction in biology classes (Mean = 2.95) indicates a receptiveness to curriculum reform, even among respondents who hold culturally influenced reservations about specific applications of these technologies.

Gender and Knowledge of IVF and Surrogacy

The finding of no significant gender difference in knowledge ($t = 0.874$, $p = 0.384$) is consistent with findings from several studies. Ezabadi, Mollaahmadi, Mohammadi, Omani Samani and Vesali (2016) found no statistically significant difference between male and female participants in knowledge of ART ($p = 0.245$). This suggests that in educational settings where male and female students have equal access to the same curriculum and learning resources, gender may not be a significant determinant of knowledge about reproductive technologies. The finding may also indicate that cultural and religious factors influencing ART knowledge operate similarly across genders in the Nigerian context.

Academic Level and Knowledge of IVF and Surrogacy

The significant difference in knowledge based on academic level ($F = 4.38$, $p = 0.014$), with NCE III students scoring higher than NCE I students, is an expected finding that can be attributed to the cumulative effect of academic exposure. Students at higher academic levels have completed more courses in biology, including topics related to reproduction, genetics, and biotechnology. They may also have had more opportunities for personal reading, media exposure, and discussions about contemporary scientific issues. This finding has practical implications: it suggests that knowledge of ART increases with academic progression, but the overall low-to-moderate knowledge levels even at the NCE III level indicate that the existing curriculum is insufficient to produce well-informed teachers on these topics. Patel et al. (2025) similarly found that even among medical students with strong knowledge of age-related fertility, understanding of the financial, ethical, and long-term dimensions of ART was limited, recommending earlier integration of ART education into curricula.

Implications for Teaching Human Reproduction

The findings of this study have several important implications for the teaching of human reproduction in Nigerian colleges of education:

First, the moderate-to-low knowledge levels demonstrated by pre-service science teachers suggest that they are not adequately prepared to address questions about IVF and surrogacy that may arise during classroom instruction on human reproduction. Vlaardingerbroek (2018) warned that teaching



Assessment of Pre-Service Science Teachers Knowledge of ... Abdulrahman, A. O., Et. al. (2026)

human reproduction has become increasingly daunting as ART challenges established paradigms. If teachers lack foundational knowledge, they risk either avoiding the topic entirely or providing inaccurate information.

Second, the discomfort expressed about classroom discussions of IVF and surrogacy suggests a need for pedagogical training that equips pre-service teachers with strategies for handling controversial bioethical topics. This aligns with Shulman's (1986, 1987) concept of Pedagogical Content Knowledge (PCK), which emphasizes that effective teaching requires not just subject matter knowledge but also knowledge of how to represent complex and sensitive content in ways that are accessible and appropriate for students.

Third, the finding that knowledge improves with academic level but remains insufficient even at NCE III suggests a need for deliberate curriculum intervention rather than reliance on incidental learning. Fourth, the strong expressed desire to learn more about IVF and surrogacy provides a foundation for curriculum reform. Pre-service teachers are not resistant to learning about these topics; rather, they lack structured opportunities to do so.

Conclusion

This study investigated pre-service science teachers' knowledge of in vitro fertilization and surrogacy and its implications for teaching human reproduction in Colleges of Education in Nigeria. The findings reveal that pre-service science teachers possess moderate knowledge of IVF and low knowledge of surrogacy, with knowledge levels that are inadequate for effective teaching of contemporary reproductive health topics. While their overall perceptions of IVF and surrogacy are positive, negative perceptions of commercial surrogacy and discomfort with classroom discussion indicate that cultural and ethical concerns remain significant barriers. Gender does not significantly influence knowledge levels, but academic level does, with higher-level students demonstrating better knowledge. Importantly, pre-service science teachers expressed a strong desire to learn more about these technologies and agreed that such topics should be included in the NCE biology curriculum. These findings collectively indicate that deliberate curricular and pedagogical interventions are needed to prepare pre-service science teachers to teach human reproduction in a manner that reflects contemporary scientific realities.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. Curriculum Enrichment: The National Commission for Colleges of Education (NCCE) should review and update the NCE biology education curriculum to include content on assisted reproductive technologies, specifically IVF, surrogacy, gamete donation, and fertility preservation, as part of the human reproduction module
2. Workshop and Seminar Programmes: Colleges of Education should organize regular workshops, seminars, and guest lectures by reproductive health specialists to enhance pre-service science teachers' knowledge of ART and build their confidence in discussing these topics.
3. Pedagogical Training on Controversial Topics: Teacher education programmes should incorporate training on how to handle controversial bioethical topics in the classroom, including IVF, surrogacy, cloning, and genetic engineering, using strategies such as structured debate, case studies, and guided discussion.
4. Development of Instructional Materials: Relevant instructional materials, including textbooks, digital resources, and audiovisual aids on ART, should be developed and made available to pre-service science teachers.



www.foefugusau.com.ng
des@fugusau.edu.ng

DOI: <https://doi.org/10.64348/zije.2026422>

Assessment of Pre-Service Science Teachers Knowledge of ... Abdulrahman, A. O., Et. al. (2026)

5. Integration of Bioethics Education: Colleges of Education should introduce a course or module on bioethics in science education that addresses the ethical, legal, cultural, and religious dimensions of modern biotechnologies including ART.
6. Further Research: Future studies should extend this investigation to in-service biology teachers across multiple states, employ qualitative methods to explore the depth of teachers' understanding and the factors shaping their perceptions, and examine the relationship between teachers' knowledge and their actual classroom instruction on human reproduction.

References

- Adamu, C. (2023). Commercial gestational surrogacy and Afrocentrism: A determination of the Nigerian disposition. *African Journal of Culture, History, Religion and Traditions*, 6(1). <https://doi.org/10.52589/ajchrt-zjdkvj31>
- Adeyemi, N. K. (2020). Knowledge and acceptance of in-vitro fertilization (IVF) in Surulere Local Government Area, Lagos, South-West Nigeria. *Unpublished manuscript*.
- Ajayi, R., & Dibosa-Osador, O. (2011). Stakeholders' views on ethical issues in the practice of in-vitro fertilisation and embryo transfer in Nigeria. *African Journal of Reproductive Health*, 15(3), 73–78. <https://doi.org/10.4314/AJRH.V15I3.71432>
- Bello, F., Akinajo, O. R., & Olayemi, O. (2014). In-vitro fertilization, gamete donation and surrogacy: Perceptions of women attending an infertility clinic in Ibadan, Nigeria. *African Journal of Reproductive Health*, 18(2), 127–133.
- Brumby, M. N. (1986). Education and the new technologies in reproduction. *Clinical Reproduction and Fertility*, 4(6), 385–395.
- Carneiro, M. (2022). Assisted reproductive technologies: When science helps dreams come true and pave the way to inclusion and diversity. *Women & Health*, 62(5), 369–371. <https://doi.org/10.1080/03630242.2022.2087269>
- Ezabadi, Z., Mollaahmadi, F., Mohammadi, M., Omani Samani, R., & Vesali, S. (2017). Identification of reproductive education needs of infertile clients undergoing assisted reproduction treatment using assessments of their knowledge and attitude. *International Journal of Fertility and Sterility*, 11(1), 20–27. DOI: [10.22074/ijfs.2016.4728](https://doi.org/10.22074/ijfs.2016.4728)
- Fadare, J., & Adeniyi, A. (2015). Ethical issues in newer assisted reproductive technologies: A view from Nigeria. *Nigerian Journal of Clinical Practice*, 18(Suppl.), S57–S63. <https://doi.org/10.4103/1119-3077.170823>
- Fayokun, K. (2011). Need for regulation of assisted reproductive techniques in Africa. *Journal of Sustainable Social Development*, 3(1). <https://doi.org/10.4314/jssd.v3i1.67764>
- Kharb, D. (2006). Assisted reproductive techniques: Ethical and legal concerns. *The Internet Journal of Medical Ethics*, 3(1). <https://doi.org/10.5580/2764>
- Macer, D. (1994). Perception of risks and benefits of in vitro fertilization, genetic engineering and biotechnology. *Social Science & Medicine*, 38(1), 23–33. [https://doi.org/10.1016/0277-9536\(94\)90296-8](https://doi.org/10.1016/0277-9536(94)90296-8)
- Malina, A., Roczniowska, M., & Pooley, J. (2021). Contact, moral foundations or knowledge? What predicts attitudes towards women who undergo IVF. *BMC Pregnancy and Childbirth*, 21, 560. <https://doi.org/10.1186/s12884-021-03810-9>
- Obioha, A. J., Ikechebelu, J. I., Uchenna, E. G., & Joe-Ikechebelu, N. N. (2014). Knowledge and attitude of nurses towards in-vitro fertilization: A prospective cohort study. *Obstetrics and Gynecology Cases Reviews*, 1(1), 1–5. <https://doi.org/10.23937/2377-9004/1410005>
- Oche, M. O., Ango, J. T., Gana, G., Oladigbolu, R., Okafoagu, N., Umar, A., Adam, F. A., Oluwatobi, O. J., & Gatawa, A. M. (2018). In vitro fertilization: Perceptions and misperceptions among women of reproductive age group in Sokoto, Nigeria. *Research Journal of Health Sciences*, 6(1), 1–8. <https://doi.org/10.7243/2054-0841-6-1>
- Okonta, P., Ajayi, R., Bamgbopa, K., Ogbeche, R. O., Okeke, C. C., & Onwuzurigbo, K. (2018). Ethical issues in the practice of assisted reproductive technologies in Nigeria: Empirical data



Assessment of Pre-Service Science Teachers Knowledge of ... Abdulrahman, A. O., Et. al. (2026)

- from fertility practitioners. *African Journal of Reproductive Health*, 22(3), 51–59. <https://doi.org/10.29063/ajrh2018/v22i3.6>
- Patel, A. R., Capote, M. M., Manguvo, A., & Mafuvadze, B. (2025). Assessing osteopathic medical students' knowledge, attitude, and perspective on the use of assisted reproductive technologies (ART). *Cureus*, 17(1), e83909. <https://doi.org/10.7759/cureus.83909>
- Sasikala, S., Kubera, N. S., & Ashok, M. (2022). A study to assess the effectiveness of video assisted teaching program on knowledge and attitude regarding assisted reproductive technology among couples attending fertility clinic. *International Journal of Clinical Obstetrics and Gynaecology*, 6(6B), 52–56. <https://doi.org/10.33545/gynae.2022.v6.i6b.1231>
- Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, 15(2), 4–14.
- Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review*, 57(1), 1–22.
- Sohrabvand, F., & Jafarabadi, M (2005). Knowledge and attitudes of infertile couples about Assisted Reproductive Technology. *International Journal of Reproductive BioMedicine*, 3(2), 90–94.
- Tyuvina, N., & Nikolaevskaya, A. O. (2020). Assisted reproductive technologies: Psychoneurological, moral-ethical, and socio-cultural aspects. *Neurology, Neuropsychiatry, Psychosomatics*, 12(5), 104–110. <https://doi.org/10.14412/2074-2711-2020-5-104-110>
- Vlaardingerbroek, B. (2018). Challenges to biology education from new reproductive technologies. *Journal of Biological Education*, 52(2), 198–204. <https://doi.org/10.1080/00219266.2017.1338597>