



## Modelling the Influence of Learning Environment on Attrition Intention among Female Distance Learners in Nigeria

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### Abstract

**Background:** Female distance learners in Nigeria experience disproportionately high attrition rates compared to men. Although distance education offers flexibility, the ways in which specific aspects of the learning environment shape female students' decisions to persist or withdraw remain underexplored. **Objective:** This study investigated the influence of six learning environment dimensions on attrition intention among this vulnerable population. **Methods:** A cross-sectional survey design was employed. Data from 433 female students across three Nigerian universities was analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM). **Results:** Of the three dimensions, only the learning process dimension yielded a significant predictor. Specifically, student autonomy was negatively related to attrition intention ( $\beta = -0.228$ ,  $p = 0.001$ ), while active learning and all other constructs under social support and content relevance showed no significant effects. The model demonstrated modest predictive power ( $Q^2 = 0.045$ ). **Conclusion:** The findings underscore the critical importance of fostering student autonomy to mitigate attrition. Empowering female learners with greater control over their learning processes is a pivotal strategy for improving retention in Nigerian distance education, potentially outweighing the influence of other environmental factors.

**Keywords:** Attrition Intention; Distance Learning; Female Learner; Higher Education; Learning Environment

### Introduction

Distance education has emerged as a critical pathway for expanding access to higher education in Nigeria, particularly for women who face numerous socio-cultural and economic barriers to traditional classroom-based learning. This mode of education offers flexibility and convenience, but female learners in Nigeria's distance education programs experience disproportionately high attrition rates compared to their male counterparts. A study by Adamu *et al.* (2024) reveals that more female distance learners withdraw before completing their programmes, compared to 30% of male students. This persistent gender gap in retention underscores the need to examine how various aspects of the learning environment influence female students' decisions to continue or abandon their studies.

The distance learning environment encompasses interconnected institutional, technological, social, and personal factors (Adewale, 2024; Adewale & Tahir, 2022). Nigerian female learners face unique challenges across all dimensions. Institutional factors such as inadequate academic advising, delayed feedback from instructors, and a lack of tailored support services often leave female students feeling isolated and unsupported (Akande, 2022). Technological barriers compound these challenges, with

many women facing limited access to reliable internet connectivity and digital devices, particularly in rural areas where only 48% of the population has stable internet access (Yila & Azeez, 2018). Furthermore, significant digital literacy gaps hinder effective participation in online learning platforms, creating additional obstacles for female learners (Chigbundu & Oluwabiya, 2023).

Beyond institutional and technological constraints, socio-cultural expectations and economic realities create additional pressures, forcing many women to balance academics with substantial domestic responsibilities without adequate support (Stead *et al.*, 2023). Financial constraints present another major barrier, as women in Nigeria typically have less independent access to the resources needed to sustain their education, including computers, internet data, and transportation costs for occasional physical meetings (World Bank, 2025). These intersecting challenges create a complex web of factors that influence female students' decisions to persist or withdraw from distance education programmes.

Despite growing recognition of these issues, there remains a paucity of research that systematically models how different dimensions of the learning environment collectively influence attrition intentions among female distance learners in Nigeria. Most existing studies have examined these factors in isolation, leaving a gap in understanding their relative importance and interactive effects. This study addresses this gap by developing a comprehensive model that assesses the combined impact of institutional, technological, and socio-cultural factors on female students' attrition intentions. The findings will provide valuable insights for policymakers and educational institutions seeking to develop targeted interventions that improve retention rates and ensure more equitable access to distance education for women in Nigeria.

### **Research Questions**

This study was guided by the following research questions:

1. How do social support dimensions (instructor support and student interaction) influence attrition intention among female distance learners in Nigeria?
2. To what extent do content relevance dimensions (personal relevance and authentic learning) affect attrition intention?
3. What is the impact of learning process dimensions (active learning and student autonomy) on attrition intention?

### **Literature Review and Hypotheses Development**

The learning environment is a critical factor in shaping persistence in distance education. For female learners in Nigeria, who face additional cultural, economic, and infrastructural challenges, these environmental factors may be particularly influential. Drawing from Walker and Fraser's (2005) framework, this study examines three broad dimensions of the learning environment – social support, content relevance, and learning process – and their role in predicting attrition intention.

#### **Social Support Dimensions**

Instructor support is central to student motivation and satisfaction. Supportive instructors provide guidance, timely feedback, and encouragement, all of which reduce isolation and strengthen students' connection to their programmes (Hernández *et al.*, 2022; Zhang, 2022). Prior research shows that autonomy-supportive teaching can enhance motivation and life satisfaction (Hernández *et al.*, 2022), while ineffective or absent support often undermines persistence (Aloia, 2020). Yet in Nigeria, where instructors are often constrained by heavy workloads and limited technology, students may struggle to access this support (Akande, 2022).

Peer interaction and collaboration also contribute to persistence by fostering community and reducing isolation. Group activities and shared learning experiences strengthen social presence and a sense of belonging (Halim *et al.*, 2024; Yang & Romero-Hall, 2024). However, for many Nigerian women, poor connectivity and domestic responsibilities make regular collaboration burdensome, potentially limiting

its positive effects. Thus, while social support is theoretically meant to reduce attrition, its impact may vary depending on context. Based on the literature, the following hypothesis was formulated:

**H1:** Social support dimensions (instructor support and student interaction) are negatively associated with attrition intention.

### **Content Relevance Dimensions**

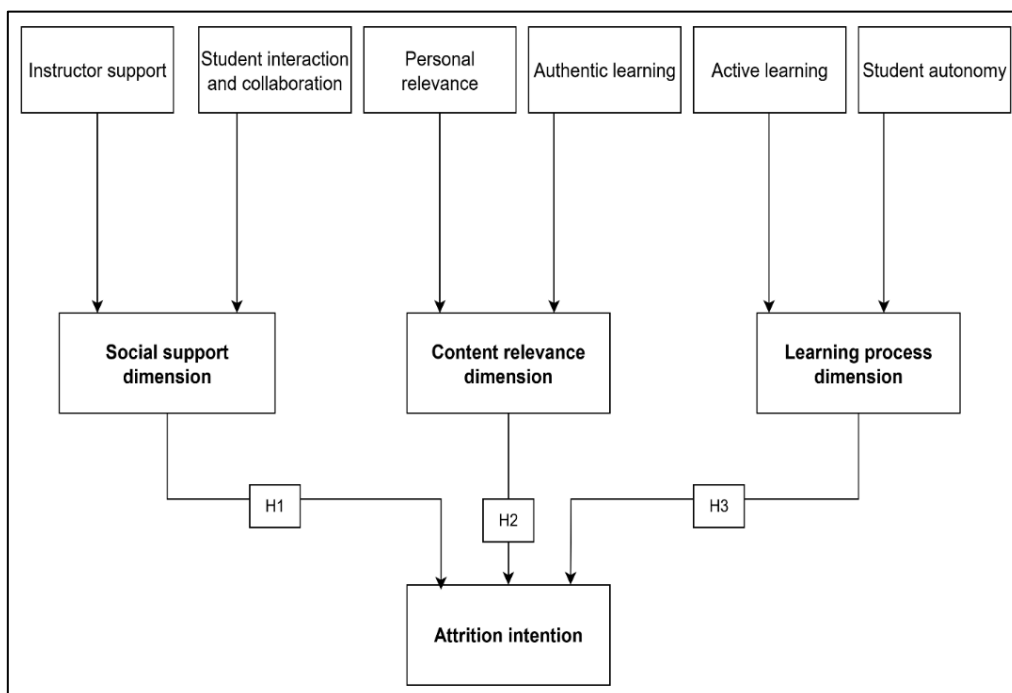
The relevance material strongly influences engagement. When learners perceive personal connections between coursework and their goals, they show greater persistence and emotional investment (Cheng *et al.*, 2024; Kelly *et al.*, 2024). Similarly, authentic learning experiences, tasks that mirror real-world applications, have been shown to deepen understanding and promote long-term retention (Hagenkötter *et al.*, 2024; Wu & Xu, 2025). For Nigerian female learners, however, these benefits may be less impactful if access to content is disrupted by financial, cultural, or infrastructural barriers. Based on the literature, it is hypothesised that:

**H2:** Content relevance dimensions (personal relevance and authentic learning) are negatively associated with attrition intention.

### **Learning Process Dimensions**

Active learning strategies, which require student participation and engagement, are widely associated with improved outcomes (Cheng *et al.*, 2024; Joseph Lobo, 2017). However, these strategies are often resource-intensive and depend on reliable technology, which many Nigerian women lack. Student autonomy, on the other hand, has consistently been linked to persistence in distance education. Moore's (1993) theory of transactional distance identifies autonomy as a central factor in overcoming the psychological gaps inherent in remote learning. Studies indicate that autonomy fosters self-regulation, ownership, and resilience (Hernandez, 2012; Núñez-Regueiro *et al.*, 2025; Rickert *et al.*, 2024). For Nigerian women balancing domestic and academic responsibilities, autonomy provides the flexibility to adapt learning schedules to complex daily demands. Based on the literature, it is hypothesised that:

**H3:** Learning process dimensions (active learning and student autonomy) are negatively associated with attrition intention.



**Figure 1: Conceptual Framework**

### **Theoretical Foundation**

This study draws on two complementary theories to explain persistence among female distance learners in Nigeria: the Student Integration Model by Tinto (1975) and the Theory of Transactional Distance by Moore (1993). Tinto's model, developed in the context of traditional universities, argues that student persistence depends on both academic and social integration. When learners feel connected to their institution through supportive faculty, peer networks, and effective services, they are more likely to remain enrolled. Although designed for on-campus settings, this model is valuable in distance education, where institutional support and social belonging are often limited yet remain critical to student success (Rovai, 2002).

Moore's theory, by contrast, was designed specifically for distance learning. It highlights three key variables: dialogue (interaction between instructors and learners), structure (the rigidity of course design), and autonomy (students' ability to self-direct learning). The theory suggests that higher autonomy can compensate for reduced dialogue or rigid structures, making it particularly relevant in low-resource contexts where communication barriers are common (Van Zoonen & Sivunen, 2022). By integrating these perspectives, this study examines six constructs grouped into three dimensions – social support, content relevance, and learning process – to better understand how learning environments influence attrition intentions among female distance learners.

### **Research Methodology**

#### **Research Design**

This study employed a quantitative, cross-sectional survey design to investigate the influence of the learning environment on attrition intention among female distance learners in Nigeria. A survey was considered appropriate because it provided an avenue to test hypothesised relationships across several constructs within a large population at a single point in time. The analysis was grounded in Bean's Attrition Intention Theory, which emphasises the role of environmental, academic, and psychological factors in determining whether learners persist in or withdraw from their programmes.

#### **Population and Sample**

The population comprised female students enrolled in distance learning programmes in universities located in northern Nigeria. This region was purposively selected due to its higher reported attrition risks among women, which are linked to socio-cultural expectations, economic pressures, and infrastructural challenges.

A multi-stage sampling technique was adopted. In the first stage, three universities with well-established distance learning centres were purposively chosen. In the second stage, proportionate stratified sampling was applied to capture students across all academic levels (100–400 level). Within each stratum, simple random sampling was used to ensure fair representation. Out of 450 distributed questionnaires, 433 valid responses were retrieved, representing a 96.2% response rate. This exceeded the minimum sample size requirements for Partial Least Squares Structural Equation Modelling (PLS-SEM), which recommends at least 10 participants per indicator for robust statistical analysis (Hair *et al.*, 2021).

#### **Demographic Characteristics of Respondents**

Respondents represented a diverse academic spread: 34.2% were in year four, 17.6% in year three, 16.9% in year five, 12.7% in year one, 9.5% in year six, and 9.2% in year two. Regarding marital status, 61.9% were single, 37.2% married, and less than 1% divorced. In terms of programme type, 13.9% were pursuing certificate programmes, 10.2% diploma, 60.7% bachelor's degrees, and 15.2% postgraduate programmes. This distribution reflects a heterogeneous group of female learners navigating different academic and personal contexts.

### **Instrumentation**

Data were collected using a structured questionnaire adapted from validated scales. The Distance Education Learning Environments Survey (DELES) developed by Walker and Fraser (2005) was modified to capture six constructs across three dimensions:

- a) Social support: Instructor support; student interaction and collaboration.
- b) Content relevance: Personal relevance; authentic learning.
- c) Learning process: Active learning; student autonomy.

Each construct was measured using three to six items on a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5).

Attrition intention was measured using an 11-item scale adapted from Christo and Oyinlade (2015), which assessed whether students had considered withdrawing from their programmes. This multi-item approach strengthened construct validity and reliability.

### **Validity and Reliability**

To ensure validity, the instrument underwent expert review by three specialists in distance education and educational psychology. A pilot study with 60 female learners was also conducted to check clarity, cultural sensitivity, and ease of understanding.

Construct validity and reliability were assessed using SmartPLS version 4.0. Factor loadings for indicators exceeded the recommended threshold of 0.60 (Fornell & Larcker, 1981), with only one item (instructor support, DELES1) falling slightly below but retained due to theoretical importance. Cronbach's alpha values exceeded 0.70, confirming internal consistency. Composite Reliability (CR) values were also above 0.70, while Average Variance Extracted (AVE) values surpassed 0.50, confirming convergent validity.

Discriminant validity was established through the Fornell-Larcker criterion and the Heterotrait-Monotrait ratio (HTMT), both of which yielded acceptable results (Henseler *et al.*, 2015).

### **Data Collection Procedure**

The study received ethical clearance from the participating universities before data collection commenced. Questionnaires were administered electronically through the universities' learning management systems as well as through class-based WhatsApp groups to maximise reach. Participation was entirely voluntary, and respondents were assured of anonymity and confidentiality. Informed consent was obtained before the commencement of the survey, and participants were allowed to withdraw at any stage without any consequences.

### **Data Analysis**

Data were analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM) with SmartPLS 4.0. This method was selected because it is particularly suited for exploratory models with complex relationships and does not assume multivariate normality (Sarstedt *et al.*, 2021). Analysis was conducted in two stages:

i) *Measurement Model Evaluation*: Reliability and validity of constructs were tested through indicator loadings, Cronbach's alpha, Composite Reliability, and AVE. Discriminant validity was assessed using HTMT ratios, and multicollinearity was checked with the Variance Inflation Factor (VIF). Model fit was evaluated using the Standardised Root Mean Square Residual (SRMR), with values below 0.08 indicating good fit.

ii) *Structural Model Evaluation*: Hypotheses were tested by estimating path coefficients, t-values, and p-values through bootstrapping with 10,000 resamples. Model explanatory power was assessed using the coefficient of determination ( $R^2$ ), predictive relevance using Stone-Geisser's  $Q^2$  values, and effect sizes using Cohen's  $f^2$ .

## Ethical Considerations

The study adhered to institutional ethical guidelines. Respondents were assured that their participation was voluntary and that their responses would remain confidential. No identifying information was collected, and data were used strictly for academic purposes.

## Results

### Overview of Analysis

Data was analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM) in SmartPLS 4.0. The analysis followed the two-stage approach recommended by Hair *et al.* (2021): first, assessing the measurement model to establish validity and reliability, and second, evaluating the structural model to test hypothesised relationships. The results are presented below.

### 1. Measurement Model Evaluation

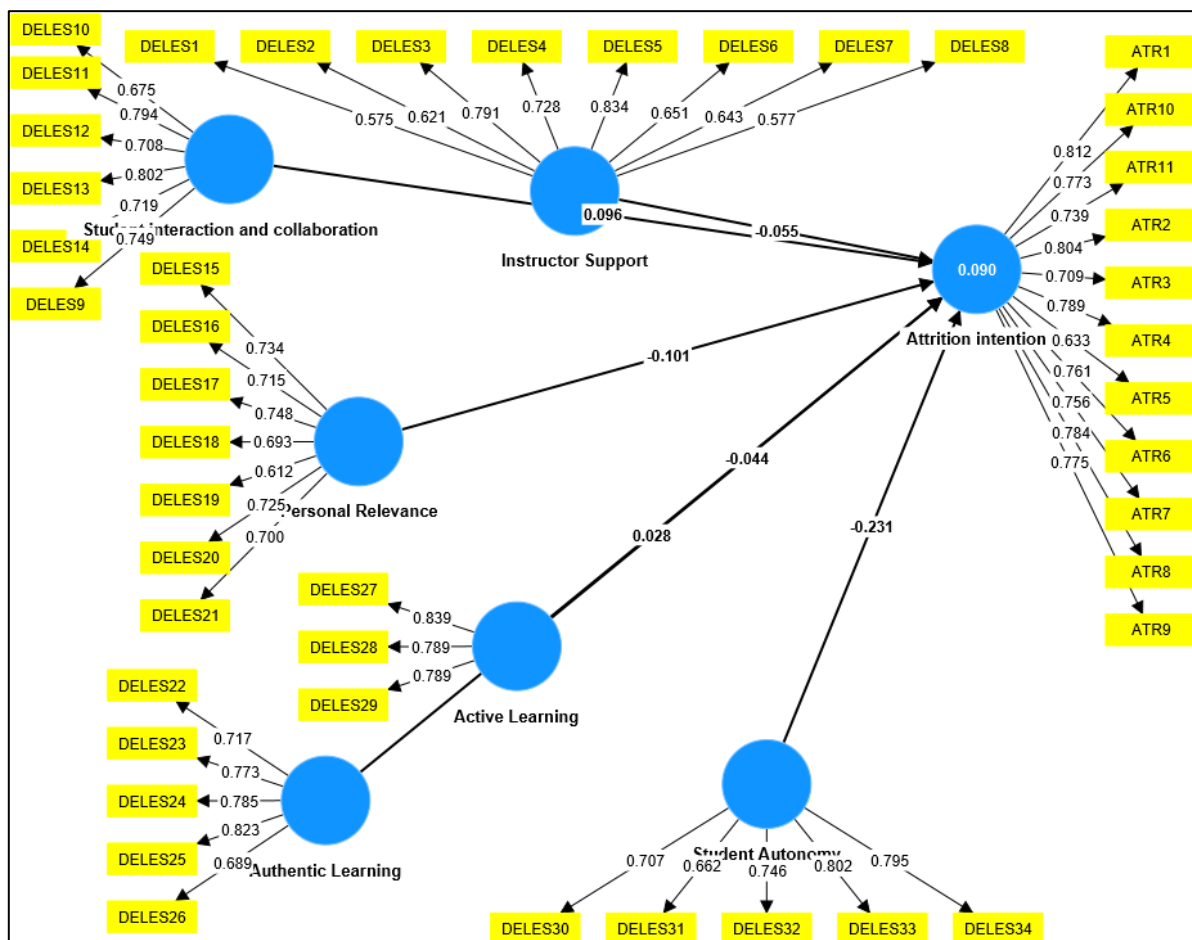
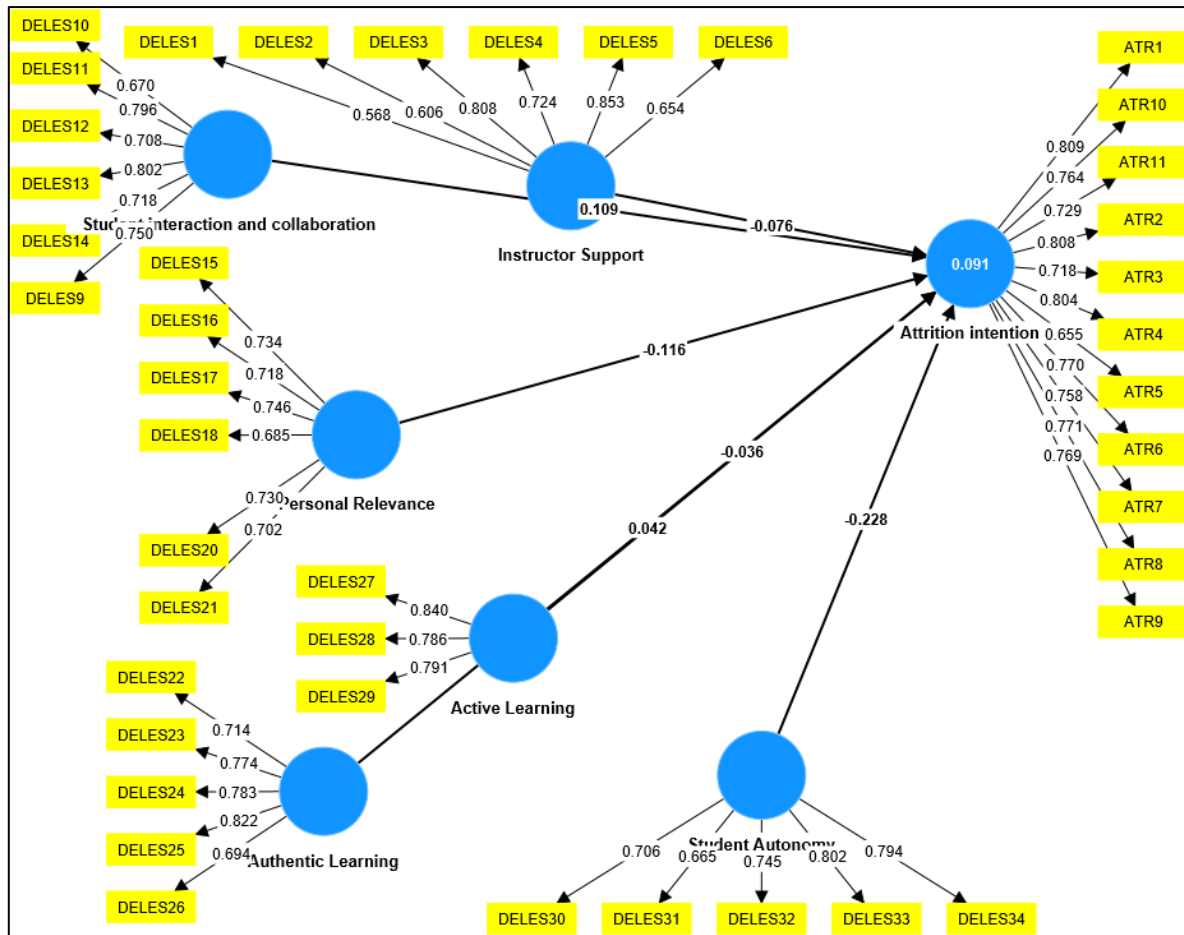


Figure 1: Hypothetical Model

Figure 2 presents the factor loadings of the items based on the six dimensions of learning environment in distance learning and attrition intention. The outcome indicates that not all the items measured up to the threshold of 0.60. This necessitated respecifying the hypothetical model after the affected items had been deleted.



**Figure 2: Respecified Hypothetical Model**

After deleting items that did not reach the threshold of 0.60 factor loadings, a respecified hypothetical model was presented in Figure 3.

**Table 1: Assessment of Construct Reliability and Convergent Validity**

| Construct                   | Indicator | Factor loading | CA    | CR    | AVE   |
|-----------------------------|-----------|----------------|-------|-------|-------|
| Instructor Support          | DELES 1   | 0.568          | 0.826 | 0.857 | 0.504 |
|                             | DELES 2   | 0.606          |       |       |       |
|                             | DELES 3   | 0.808          |       |       |       |
|                             | DELES 4   | 0.724          |       |       |       |
|                             | DELES 5   | 0.853          |       |       |       |
|                             | DELES 6   | 0.654          |       |       |       |
| Interaction & Collaboration | DELES 9   | 0.750          | 0.840 | 0.880 | 0.551 |
|                             | DELES 10  | 0.670          |       |       |       |
|                             | DELES 11  | 0.796          |       |       |       |
|                             | DELES 12  | 0.708          |       |       |       |
|                             | DELES 13  | 0.802          |       |       |       |
|                             | DELES 14  | 0.718          |       |       |       |
| Personal Relevance          | DELES 15  | 0.734          | 0.815 | 0.865 | 0.518 |
|                             | DELES 16  | 0.718          |       |       |       |
|                             | DELES 17  | 0.746          |       |       |       |
|                             | DELES 18  | 0.685          |       |       |       |
|                             | DELES 20  | 0.730          |       |       |       |
|                             | DELES 21  | 0.702          |       |       |       |
| Authentic Learning          | DELES 22  | 0.714          | 0.817 | 0.871 | 0.576 |
|                             | DELES 23  | 0.774          |       |       |       |
|                             | DELES 24  | 0.783          |       |       |       |
|                             | DELES 25  | 0.822          |       |       |       |
|                             | DELES 26  | 0.694          |       |       |       |

|                     |          |       |       |       |       |
|---------------------|----------|-------|-------|-------|-------|
|                     | DELES 23 | 0.774 |       |       |       |
|                     | DELES 24 | 0.783 |       |       |       |
|                     | DELES 25 | 0.822 |       |       |       |
|                     | DELES 26 | 0.694 |       |       |       |
| Active Learning     | DELES 27 | 0.840 | 0.738 | 0.848 | 0.650 |
|                     | DELES 28 | 0.786 |       |       |       |
|                     | DELES 29 | 0.791 |       |       |       |
| Student Autonomy    | DELES 30 | 0.706 | 0.802 | 0.861 | 0.554 |
|                     | DELES 31 | 0.665 |       |       |       |
|                     | DELES 32 | 0.745 |       |       |       |
|                     | DELES 33 | 0.802 |       |       |       |
|                     | DELES 34 | 0.794 |       |       |       |
| Attrition Intention | ATR1     | 0.809 | 0.928 | 0.937 | 0.579 |
|                     | ATR2     | 0.808 |       |       |       |
|                     | ATR3     | 0.718 |       |       |       |
|                     | ATR4     | 0.804 |       |       |       |
|                     | ATR5     | 0.655 |       |       |       |
|                     | ATR6     | 0.770 |       |       |       |
|                     | ATR7     | 0.758 |       |       |       |
|                     | ATR8     | 0.771 |       |       |       |
|                     | ATR9     | 0.709 |       |       |       |
|                     | ATR10    | 0.764 |       |       |       |
|                     | ATR11    | 0.729 |       |       |       |

The reliability and convergent validity of constructs were evaluated through factor loadings, Cronbach's Alpha (CA), Composite Reliability (CR), and Average Variance Extracted (AVE). As shown in Table 1, most items loaded above the 0.60 threshold, confirming their relevance to the constructs (Fornell & Larcker, 1981). One indicator of instructor support (DELES1 = 0.568) fell slightly below the threshold but was retained due to its theoretical significance.

CA values ranged from 0.738 to 0.928, exceeding the recommended 0.70 level, while CR values ranged between 0.848 and 0.937, confirming internal consistency. AVE values were all above 0.50, indicating that more than half the variance in each construct was explained by its indicators. Together, these results confirm acceptable levels of construct reliability and convergent validity.

**Table 2: Discriminant Validity - Heterotrait-Monotrait Ratio (HTMT)**

| Construct           | ACL   | ATR   | IS    | PR    | SA    | SIC   |
|---------------------|-------|-------|-------|-------|-------|-------|
| Active Learning     |       |       |       |       |       |       |
| Attrition intention | 0.228 |       |       |       |       |       |
| Authentic Learning  | 0.802 | 0.192 |       |       |       |       |
| Instructor Support  | 0.598 | 0.162 | 0.725 |       |       |       |
| Personal Relevance  | 0.797 | 0.235 | 0.843 | 0.673 |       |       |
| Student Autonomy    | 0.897 | 0.291 | 0.775 | 0.622 | 0.800 |       |
| Student interaction | 0.705 | 0.136 | 0.736 | 0.618 | 0.828 | 0.702 |

Discriminant validity was examined using the Heterotrait-Monotrait (HTMT) ratio. As displayed in Table 2, all HTMT values were below the conservative threshold of 0.85 (Henseler *et al.*, 2015), confirming that each construct was empirically distinct. The highest HTMT value was observed between student autonomy and active learning (0.897), indicating conceptual closeness but still within acceptable limits. Attrition intention showed low correlations with other constructs (0.136–0.291), reinforcing its distinctiveness as the outcome variable.



**Table 3: Collinearity**

|         |       |
|---------|-------|
| ATR1    | 2.571 |
| ATR10   | 2.396 |
| ATR11   | 1.978 |
| ATR2    | 2.626 |
| ATR3    | 1.854 |
| ATR4    | 2.459 |
| ATR5    | 1.874 |
| ATR6    | 2.346 |
| ATR7    | 2.224 |
| ATR8    | 2.268 |
| ATR9    | 2.502 |
| DELES1  | 1.537 |
| DELES10 | 1.678 |
| DELES11 | 1.964 |
| DELES12 | 1.844 |
| DELES13 | 1.919 |
| DELES14 | 1.621 |
| DELES15 | 1.599 |
| DELES16 | 1.435 |
| DELES17 | 1.804 |
| DELES18 | 2.054 |
| DELES19 | 1.840 |
| DELES2  | 1.747 |
| DELES20 | 1.517 |
| DELES21 | 1.448 |
| DELES22 | 1.502 |
| DELES23 | 1.827 |
| DELES24 | 1.864 |
| DELES25 | 1.787 |
| DELES26 | 1.494 |
| DELES27 | 1.362 |
| DELES28 | 1.595 |
| DELES29 | 1.507 |
| DELES3  | 1.782 |
| DELES30 | 1.519 |
| DELES31 | 1.449 |
| DELES32 | 1.604 |
| DELES33 | 1.637 |
| DELES34 | 1.602 |
| DELES4  | 1.871 |
| DELES5  | 1.735 |
| DELES6  | 1.406 |
| DELES7  | 1.688 |
| DELES8  | 1.454 |
| DELES9  | 1.668 |

Collinearity was assessed using the Variance Inflation Factor (VIF); all values were well below the conservative threshold of 5.0, indicating no multicollinearity issues (Kock & Lynn, 2012). As presented in Table 3, all VIF values for the measured items ranged from 1.362 to 2.626, well below the conservative threshold of 3.0 recommended for PLS-SEM analyses (Hair *et al.*, 2021). This confirms the absence of significant multicollinearity, affirming that each construct contributed unique explanatory power to the model without redundancy.

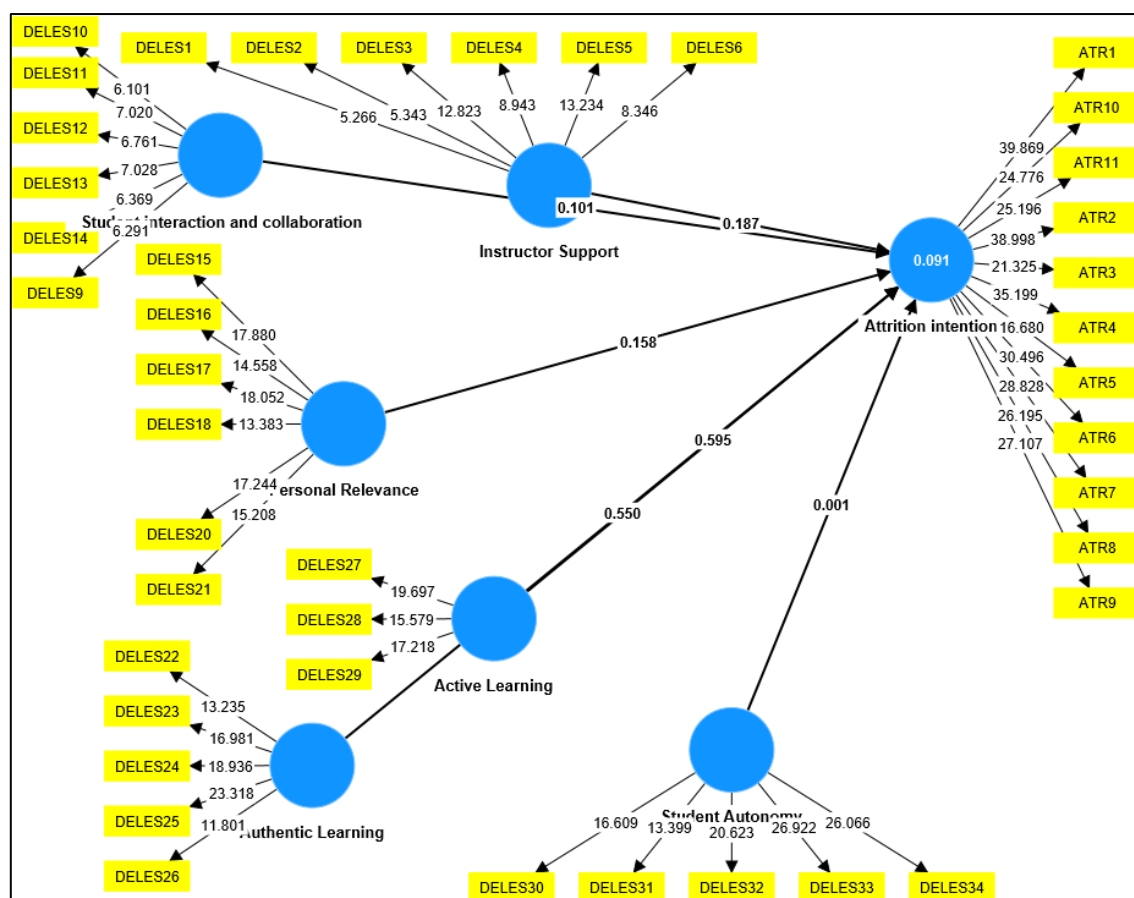
**Table 4: Measurement Model Fit**

|                | Saturated Model | Estimated Model | Remarks   |
|----------------|-----------------|-----------------|-----------|
| SRMR < 0.08    | 0.059           | 0.059           | Supported |
| d_ ULS < HI 95 | 3.147           | 3.147           | Supported |
| d_ G < HI 95   | 0.996           | 0.996           | Supported |

The Standardised Root Mean Square Residual (SRMR) was used to assess model fit. Both the saturated and estimated models produced an SRMR value of 0.059, below the 0.08 cut-off, indicating a good fit. Additional indices, d\_ ULS (3.147) and d\_ G (0.996), also fell within acceptable confidence intervals, suggesting no significant model misspecification (Table 4).

## 2. Structural Model Evaluation

The structural model tested the hypothesised relationships between learning environment constructs and attrition intention. Bootstrapping with 10,000 resamples was used to generate path coefficients, t-values, and p-values. Results are summarised in Table 5 and Figure 4.

**Figure 3: Structural Model****Table 5: Relationship of Variables in the Model**

| Paths       | B      | SD    | T     | P     | Remarks           |
|-------------|--------|-------|-------|-------|-------------------|
| IS -> ATR   | -0.076 | 0.057 | 1.321 | 0.187 | H1b not supported |
| SI&C -> ATR | 0.109  | 0.066 | 1.640 | 0.101 | H1b not supported |
| PR -> ATR   | -0.116 | 0.082 | 1.413 | 0.158 | H2a not supported |
| AuL -> ATR  | 0.042  | 0.071 | 0.597 | 0.550 | H2a not supported |
| AL -> ATR   | -0.036 | 0.069 | 0.531 | 0.595 | H3a not supported |
| SA -> ATR   | -0.228 | 0.069 | 3.320 | 0.001 | H3b Supported     |

Note: IS= Instructor Support; SI&C = Student Interaction & Collaboration; PR= Persona Relevance; AuL= Authentic Learning, AL = Active Learning; SA= Student Autonomy

Table 5 and Figure 4 present the results of the structural model analysis, which tested the hypothesised relationships between learning environment factors and attrition intention. Contrary to H1 and H2, social support and content relevance dimensions showed no significant effect on attrition intention. However, supporting H3, the analysis revealed a nuanced result within the learning process dimensions; student autonomy was a strong, significant negative predictor ( $\beta = -0.228$ ,  $p = 0.001$ ), while active learning was not significant. This indicates that providing learners with control over their process is a primary factor in reducing withdrawal consideration. These non-significant relationships may reflect the unique challenges faced by female distance learners in Nigeria, where factors such as limited internet access and socio-cultural constraints could attenuate the potential benefits of these learning environment dimensions.

**Table 6: Predictive Relevance ( $Q^2$ )**

| Constructs          | SSO      | SSE      | $Q^2 (=1-SSE/SSO)$ |
|---------------------|----------|----------|--------------------|
| Attrition intention | 4763.000 | 4546.676 | 0.045              |

Note: SSO= Total sum of square; SSE= Sum of square due to error

Stone-Geisser's  $Q^2$  values further confirmed the model's predictive capacity. As shown in Table 6, attrition intention had a  $Q^2$  value of 0.045, indicating small predictive relevance.

**Table 7: Predictive Performance ( $Q^2$ predict, RMSE, MAE)**

|                     | $Q^2$ Predict | RMSE  | MAE   |
|---------------------|---------------|-------|-------|
| Attrition intention | 0.055         | 0.975 | 0.780 |

Additional predictive performance metrics were computed. Table 7 reports a  $Q^2$  predict of 0.055, an RMSE of 0.975, and an MAE of 0.780. These suggest moderate prediction errors, which are common in social science research but also highlight the need for incorporating additional contextual variables in future models.

**Table 8: Effect Size of Exogenous Constructs**

| Exogenous Construct                   | $f^2$ | Effect Size       |
|---------------------------------------|-------|-------------------|
| Active Learning                       | 0.001 | Very small effect |
| Authentic Learning                    | 0.001 | Very small effect |
| Instructor Support                    | 0.004 | Very small effect |
| Personal Relevance                    | 0.005 | Very small effect |
| Student Autonomy                      | 0.024 | Small effect      |
| Student interaction and collaboration | 0.006 | Very small effect |

Effect size calculations (Table 8) revealed that student autonomy had a small but meaningful effect ( $f^2 = 0.024$ ), while all other constructs demonstrated very small effects ( $f^2 < 0.01$ ). This reinforces the conclusion that autonomy was the only substantive predictor of attrition intention.

## Discussion

This study sought to answer three core questions regarding the influence of the learning environment on attrition intention. First, regarding social support dimensions (RQ1), the results indicate that neither instructor support nor student interaction and collaboration significantly predicted attrition intention. Second, for content relevance dimensions (RQ2), the analysis showed that personal relevance and authentic learning did not have a significant effect. Finally, concerning learning process dimensions (RQ3), the findings revealed a nuanced outcome: while active learning was not significant, student autonomy emerged as a strong, significant negative predictor of attrition intention. Therefore, the answer to the primary investigation is that among the factors studied, autonomy in the learning process is the most critical lever for reducing attrition in this specific context.

This study explored three dimensions of the learning environment: social support, content relevance, and learning process. shape attrition intention among female distance learners in Nigeria. Using PLS-SEM, the results showed that student autonomy was the only significant predictor of attrition intention,

while instructor support, peer interaction, personal relevance, authentic learning, and active learning had no significant effects. The model's modest predictive power ( $Q^2 = 0.045$ ) suggests that other contextual factors also play an important role.

The negative association between autonomy and attrition intention underscores the importance of learner control in distance education. Moore's (1993) Theory of Transactional Distance identifies autonomy as essential for navigating limited interaction and rigid structures. For Nigerian women, autonomy is especially critical because they often balance studies with childcare, employment, and domestic obligations (Stead *et al.*, 2023). Flexibility to decide when and how to study allows them to integrate education into their daily routines. Similar findings from Hernández *et al.* (2022) and Núñez-Regueiro *et al.* (2025) show that autonomy fosters self-regulation and persistence. These results suggest that policies promoting flexible deadlines, offline study options, and choice in assessments may be more effective in supporting female learners than traditional interventions.

The finding that instructor support did not significantly affect attrition intention diverges from studies highlighting its role in student persistence (Aloia, 2020; Zhang, 2022). In Nigeria, systemic barriers, such as limited internet access, delayed feedback, and large class sizes, reduce the effectiveness of instructor support (Akande, 2022). Tinto's (1975) model stresses the role of integration, but when support is inaccessible, its influence weakens. This distinction between the existence of support and its accessibility is critical. Without timely, low-bandwidth communication channels, the theoretical benefits of support remain unrealised.

Similarly, peer interaction did not predict persistence, despite evidence elsewhere that learning communities enhance retention (Halim *et al.*, 2024; Yang & Romero-Hall, 2024). For many Nigerian women, synchronous collaboration is unrealistic due to unstable connectivity and competing domestic responsibilities. Rather than fostering community, mandatory group activities may increase stress. These findings suggest that peer networks in resource-limited settings should emphasise asynchronous and optional collaboration rather than compulsory interaction.

Contrary to expectations, personal relevance and authentic learning were not significant. Prior research shows that relevant content enhances motivation and persistence (Cheng *et al.*, 2024; Kelly *et al.*, 2024), while authentic tasks deepen understanding and engagement (Wu & Xu, 2025; Hagenkötter *et al.*, 2024). However, in this context, structural barriers may overshadow these benefits. When students struggle with connectivity or lack the resources to consistently access materials, the motivational advantages of relevance and authenticity are diminished. This suggests a hierarchy of needs: until basic access is secured, higher-order design improvements may have limited impact on persistence.

Active learning, long celebrated for improving engagement (Joseph Lobo, 2017; Cheng *et al.*, 2024), also failed to predict attrition intention. In low-resource contexts, strategies requiring high levels of participation and technological access may exclude students who cannot engage consistently. This finding highlights the risk of transferring best practices from well-resourced environments without adaptation. Instead, institutions could explore hybrid approaches, combining active strategies with flexible, offline-compatible options.

### **Study Implications**

These findings contribute to the refinement of persistence theories. Tinto's (1975) emphasis on social and academic integration may be less applicable where infrastructural challenges limit access to support and interaction. By contrast, Moore's (1993) theory is strongly reinforced: autonomy appears central to persistence in environments with high transactional distance. This suggests that theoretical models should account for contextual constraints, recognising autonomy as a stronger predictor in under-resourced settings.

The results offer three main lessons for practice. First, institutions should prioritise autonomy-supportive policies, such as flexible deadlines, modular course designs, and offline study options. Second, support systems, both instructor and peer, must be redesigned for accessibility, using low-bandwidth tools like SMS, WhatsApp, or voice notes to ensure inclusion. Third, policy interventions are essential: subsidised

internet, affordable devices, and childcare support would enable women to exercise autonomy effectively. Curriculum innovations in relevance and authenticity remain valuable but may only improve persistence once structural barriers are reduced.

## Conclusion

The study shows that for Nigerian female distance learners, autonomy is the decisive factor in reducing attrition intentions, while other commonly studied aspects of the learning environment appear less influential. Persistence in this context depends less on interaction or curriculum design and more on the flexibility to fit learning into complex lives. By foregrounding autonomy and addressing systemic barriers, institutions and policymakers can develop strategies that better support women in higher education.

## Limitations and Future Scope

The model explained only a small proportion of attrition intention, indicating that unmeasured variables, such as socio-economic status, mental health, or cultural expectations, may exert stronger influences. The cross-sectional design also prevents causal claims, and the focus on three northern universities may limit generalisability. Future studies should adopt longitudinal or mixed methods designs to capture evolving attrition dynamics and incorporate variables such as financial stress and digital literacy.

## Conflict of Interest

The authors affirm that there are no conflicting objectives.

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