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Research Article

Evaluating Students' User Experience on Student Management Information Systems

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Studies evaluating students' UX of applications that will influence their continuance use of educational systems in Higher Educational Institutions (HEIs) have not been sufficiently addressed in the African region, specifically in Ghana. Thus, conducting a study on students' UX of systems in HEIs will enhance students' interest in continuing to use such systems. Therefore, this study examines students' user experience (UX) and how it impacts their continued use of the Student Management Information System (SMIS). The study proposed a research model by integrating user experience questionnaire (UEQ) constructs with continuance intention to use. The study adopted an online questionnaire to collect data from 415 students at Koforidua Technical University (KTU). The partial least square-structural equation model (PLS-SEM) method was used to evaluate the proposed model's reliability, validity, and relationship among the constructs. The UEQ data analysis tool was used in analysing the data. The study's findings showed that attractiveness, perspicuity, efficiency, stimulation, and novelty significantly influenced students' continuance intention to use the SMIS. However, dependability did not significantly affect students' continuance intention to use the SMIS. Also, the study's findings on the benchmark results showed that attractiveness, perspicuity, and stimulation were categorized as good, while dependability, efficiency, and novelty were categorized as excellent. These findings offer valuable insights for UX designers and developers aiming to create engaging and intuitive SMIS solutions. Also, it will provide students feedback on system UX that can be incorporated into future release updates. Furthermore, this research contributes significantly to the understanding of student UX with SMIS in developing country HEIs and its impact on continued usage.

1. Introduction

Technology plays a vital role in the digitalization of models and processes in the educational sector. Institutions leverage technology to manage administrative procedures and integrate it as a tool to assist in teaching and learning activities. Computerised systems provide value to HEIs by generating meaningful, reliable, timely, and accessible information [1]. These systems collect data on students and staff. The data are analysed to generate reports that help make strategic decisions regarding students, courses, programmes, departments, and staff. Accreditation and other regulatory bodies use the statistical data to monitor the activities and assess the effectiveness of HEIs. Students use their management information systems to register their courses and hostels online and check the course timetables and exam schedules. They also use the systems to access their results and transcripts. SMIS helps to efficiently manage students' personal information and academic details and optimize the institution's management processes to enhance productivity [2–5].

When users interact with websites, software systems, applications, and products, an experience is created based on the user's feelings [6]. The development of user applications

has shifted from centering around technology to focusing on user-centricity. Developers engage in UX research to improve the UX of applications. The user experience may vary based on the type of application and the platform/device running the app. Developers and system analysts utilise some techniques to develop apps to meet the users' needs, personas, empathy maps, wireframes, and prototypes [6]. A UX evaluation is necessary to measure the application's usability and user satisfaction. Feedback from the evaluation is used to improve the application's effectiveness and efficiency and enhance the user's experience [7–9]. UX design activities should be incorporated into the development process and even after completion.

Continuous exploration of user needs will help to continually improve the user experience. A poorly designed SMIS interface becomes a source of frustration, and the student discontinues using the application. An application that matches the student's experience maintains the interest to continue using the app to derive value and enhance their productivity [10]. Similarly, the UX of applications significantly impacts the intention and continuance use of the application. Mirmehdi [11] developed a structural model to analyse and test the dimensions among users of branded apps. The research also investigated the dimensions of the user experience of branded apps and their effects on the continuance intention of use.

Research has been conducted widely in several countries to evaluate the UX of applications. Some of these countries include Germany [12, 13], Indonesia [14–17], Kuwait [10], Saudi Arabia, and Jordan [9]. However, studies evaluating UX of applications have not been sufficiently addressed in the African region, specifically in Ghana. Also, few studies have been conducted on using UX to examine the students' continuance use of a system. Thus, conducting a study on students' UX of SMIS in HEIs such as technical universities will enhance students' interest in continuing to use the SMIS. Also, it will provide students feedback on SMIS UX that can be incorporated into future release updates of the SMIS. In addition, it will provide management of HEIs with valuable insights on key UX characteristics that need to be considered when investing in SMIS. Therefore, this study sought to investigate students' experience of using the SMIS, an SMIS deployed at KTU. In addition, a research model based on UX characteristics is proposed to test how UX characteristics significantly impact students' intention to continue using the SMIS.

The rest of the article is organized as follows. Section 2 reviews the related literature. Section 3 presents the research model and hypotheses. Sections 4 and 5 present the research methodology and results. Section 6 presents discussion and implications. Section 7 and 8 present limitations and conclusion.

2. Related Studies

Several studies have been conducted to evaluate the UX of systems or applications. A study was conducted by Salehudin et al. [17] to investigate the UX of multimedia for professional teacher education. The result from the study showed that attractiveness, efficiency, dependability, stimulation, and novelty were rated as excellent. In contrast, the scale of perspicuity was rated above average according to the interval benchmark of UEQ. In addition, all scores are above 0.8, which shows that the evaluation of UX is positive.

In another study by Laksono et al. [18], they evaluated students' UX by using a UEQ scale and a sharable content object reference model, that is, a learning management system (LMS). Their findings from the UEQ scale showed that attractiveness, dependability, stimulation, and novelty were rated as bad, whereas perspicuity and efficiency were rated below average. Similarly, the results showed that interaction and content were rated as bad, whereas management was rated as below average. Their findings showed that students had poor UX. Also, Ali and Ramlie [19] conducted a study on students' UX of learning with a hologram tutor. Their results showed that attractiveness, efficiency, perspicuity, dependability, stimulation, and novelty obtained positive mean scores. Thus, their findings showed that students' learning experience with a hologram tutor was promising and positive. Similarly, AlGothami and Saeed [20] evaluated the UX of end-users of the COVID-19 mobile application. Their findings showed that attractiveness, perspicuity, efficiency, dependability, stimulation, and novelty obtained positive mean scores above 0.80. Thus, end-users were generally satisfied with their UX, while using the mobile application.

Bayu and Setiawan [14] suggested that attractiveness, efficiency, perspicuity, dependability, stimulation, and novelty significantly influenced users' experience on the enterprise resource planning. In addition, their findings also showed that dependability, stimulation, and novelty were rated in the excellent category, while perspicuity, attractiveness, and efficiency were rated in the good category. In general, the enterprise resource planning met users' expectations. Martin and Mauritsius [21] conducted a study on UX on an e-commerce application in Indonesia. Their results showed that attractiveness, dependability, stimulation, novelty, and task success significantly influence the application's use. Mlekus et al. [22] examined UX characteristics that positively influenced technology acceptance. Their findings suggested that perspicuity and dependability positively influenced perceived ease of use, while stimulation significantly impacted behavioral intention.

In their work, Saleh et al. [9] evaluated UX on LMS. Their findings showed that attractiveness, perspicuity, efficiency, dependability, stimulation, and novelty have positive mean scores, with perspicuity having the highest positive mean score. Their results indicated that end-users had a positive experience with the LMS. In addition, they compared UX on LMS to benchmark datasets of other software and applications. Their results showed that, except for dependability that had an above average score, attractiveness, perspicuity, efficiency, stimulation, and novelty were all ranked as good. In general, the LMS has adequate UX to be accepted and used. Saleh et al. [23] in their study observed that attractiveness, perspicuity, efficiency, dependability, stimulation, and novelty have high positive mean scores. Compared with the UEQ benchmark datasets, attractiveness, efficiency, dependability, and stimulation were all considered excellent. Novelty and perspicuity were categorized as good. Thus, the application's UX evaluation had a positive impression, and end-users were generally satisfied in using the application. Similarly, Kushendriawan et al. [24] conducted a study that

evaluated the UX of a mobile health application. Their results indicated that attractiveness, perspicuity, efficiency, novelty, stimulation, and dependability all had positive mean score values. In comparison with the UEQ benchmark datasets, attractiveness, efficiency, dependability, novelty, perspicuity, and stimulation were all categorized as good. This result indicates that the overall quality of the application is high, and end-users are generally satisfied with their UX.

Also, Martono [25] investigated UX on a monitoring information system. The results showed that attractiveness, perspicuity, efficiency, novelty, stimulation, and dependability all had high positive mean score values, with novelty having the highest mean score value. In addition, they compared UX on the monitoring system to benchmark datasets of other software and applications. Their results showed that, except for attractiveness that had an above average score, perspicuity, efficiency, and stimulation were ranked as good. In addition, the novelty was rated as excellent. In general, the design of the monitoring system met the user's expectations. In a research conducted by Gunawan et al. [26], their findings showed that all the six scales, namely, attractiveness, perspicuity, dependability, stimulation, novelty, and efficiency, obtained an average score of above 2.0. In addition, the benchmark comparison of their application and the benchmark datasets showed that all six scales were categorized as excellent. Thus, the system meets users' expectations.

A study was carried out by Paramitha et al. [16] to evaluate a web-based system's user interface and UX. The results showed that attractiveness, perspicuity, efficiency, and novelty were categorized as good, while dependability and stimulation were categorized as above average and excellent, respectively. The findings from the study indicated that the UX of the web-based application is good. Results of a similar study conducted to evaluate the usability of a mobile-based application using UEQ showed that attractiveness, perspicuity, efficiency, dependability, stimulation, and novelty obtained high positive mean scores [26]. Also, compared to the benchmark dataset, attractiveness and stimulation were categorized as excellent. Efficiency, dependability, and novelty were categorized as good, while perspicuity was categorized as above average. In general, the application was accepted by the end-users. Several of the reviewed studies focused on evaluating the UX of systems. However, few studies focused on how UX can influence continuance intention to use a system. Moreover, not many studies have been conducted on evaluating UX in educational systems such as SMIS and its continuance usage. In addition, studies examining UX on educational systems in HEIs in Africa, specifically in the Ghanaian HEIs, have not been adequately addressed. Therefore, this study sought to evaluate UX on SMIS and how it impacts the continuance use of such a system within a Ghanaian HEI context.

3. Research Model and Hypotheses

3.1. Research Model. Amoroso and Chen [28] defined continuance intention as "the level of the strength of one's intention to continuously perform a specified behavior, which is a proxy of actual continuous use of an information system or technology." This study defines the continuous intention to use the SMIS as the student's willingness to continue using the SMIS. As demonstrated by some studies [28–32], the continuous intention construct is crucial for defining how a technology or system is utilised after it has been adopted. Thus, this study adopts continuance intention as a dependent variable to explain students' continuance use of SMIS. UX is the key to develop a bond between a user and a product, system, or service [33]. In addition, UX is considered a determining factor for the success of a technology [33]. In measuring UX, Laugwitz et al. [34] developed a UEQ. Furthermore, users' overall impression of a product can be measured quickly and easily by using UEQ, which is a fast and direct measurement of UX [13]. In addition, results from several studies have shown that UEQ is a reliable measurement instrument for measuring UX [19].

Thus, as shown in Figure 1, we propose a research model using UEQ constructs. The proposed research model, which examines the continuance intention of students to use the SMIS, integrated the continuous intention construct with the UEQ constructs.

3.2. Hypotheses

3.2.1. Attractiveness (ATT). Schrepp et al. [13] defined attractiveness as the "overall impression of the product." Do users like or dislike it? Is it attractive, enjoyable, or pleasing? This study defines attractiveness as a student's overall impression of the SMIS. Ali and Ramlie [19] observed in their findings that students perceived the hologram tutor attractive after interacting with it. Similarly, AlGothami and Saeed [20] observed that the participants perceived the application as attractive. In a study by Udjaja and Lailany [35], the respondents felt that the Android-based game was attractive. Also, Martin and Mauritsius [21] noted that attractiveness positively influenced the Tokopedia application's use. In the study conducted by Saleh et al. [9], it was observed that participants believed that the learning management system was attractive. We hypothesize that

> *H1*. Attractiveness will have a significant effect on the continuance intention of students to use the SMIS

3.2.2. Perspicuity (PER). In this study, perspicuity is defined as how students can easily get familiar with the SMIS. PER, considered a pragmatic quality, was found to significantly influence the perceived ease of use of a system [22]. Similarly, perspicuity significantly influences users' UX of a system [14]. Also, Ali and Ramlie [19] found that the hologram tutor was easy for students to get used to. AlGothami and Saeed [20] in their study found that participants could easily get familiar with the application. Similarly, Udjaja and Lailany [35] found that respondents were able to easily get familiar with the Android-based game. Findings from Saleh et al. [9] showed that participants found it easier to use the LMS. Therefore, we hypothesize that

> *H2*. Perspicuity will significantly affect the continuance intention of students to use the SMIS

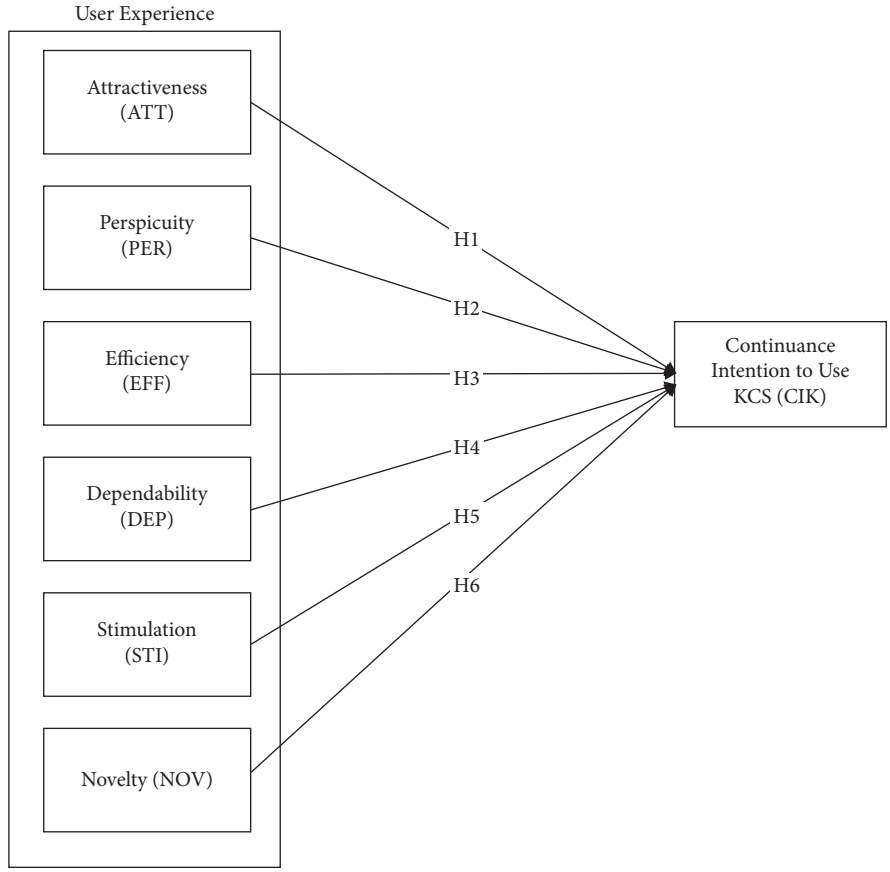

Figure 1: Research model.

3.2.3. Efficiency (EFF). Efficiency is defined in this study as to how students can solve their tasks using the SMIS without unnecessary effort. Bayu and Setiawan [14] in their study's result indicated that efficiency influenced the UX of a system. Also, Hussain et al. [36] observed that efficiency significantly affected the use of mood tracker applications. Similarly, students indicated that interacting with the hologram tutor and completing a learning task were without any unnecessary effort [19]. AlGothami and Saeed [20] noted in their study that participants completed the task by using the application without any unnecessary effort. Similarly, Saleh et al. [9] noted that participants considered the LMS efficient. Hence, we hypothesize that

H3. Efficiency will significantly affect the continuance intention of students to use the SMIS

3.2.4. Dependability (DEP). Dependability is defined in this study as how students feel in control of the interaction with the SMIS. Mlekus et al. [22] identified that dependability positively affected the perceived ease of use of a system. Also, Bayu and Setiawan [14] noted that dependability affects the UX of a system. Similarly, it was observed that participants felt in control of the interaction with the application AlGothami and Saeed [20]. Findings from Martin and Mauritsius [21] showed that dependability influenced respondents' use of the Tokopedia application. Krisnawati et al. [37] in their study noted that users felt in control of the interaction with the online exam system. Therefore, it is hypothesized that

H4. Dependability will significantly impact the continuance intention of students to use the SMIS

3.2.5. Stimulation (STI). Stimulation is defined as "Is it exciting and motivating to use the product? Is it fun to use?" [13]. In this study, we define stimulation as how students are excited or motivated to use the SMIS. Bayu and Setiawan [14] observed in their findings that stimulation had a positive effect on the UX of a system. Similarly, the results from the study conducted by Ali and Ramlie [19] showed that students were excited and motivated to use the hologram tutor. Findings by AlGothami and Saeed [20] showed that participants were excited and motivated to use the application. Similarly, stimulation was observed to have a positive effect on the use of the Tokopedia application [21]. Also, it was observed from the study conducted by Saleh et al. [9] that participants were motivated to use the LMS. Thus, we hypothesize that

H5. Stimulation significantly affects the continuance intention of students to use SMIS

3.2.6. Novelty (NOV). Schrepp et al. [13] defined novelty as "Is the product innovative and creative? Does it capture users' attention?" In this study, we define novelty as how

students consider the SMIS innovative and creative. Mlekus et al. [22] in their study's result suggested that novelty significantly impacted users' behavioral intention to use a system. Similarly, novelty was found to have a significant effect on the user experience of a system (Bayu and Setiawan [14]). Also, Ali and Ramlie [19] noted that students considered the hologram tutor to be innovative and creative. The application which was considered innovative and creative by participants in a study conducted by the authors in references [20, 21] showed that novelty had a positive impact on the use of the Tokopedia application. Thus, the following hypothesis is proposed:

H6. Novelty significantly affects students' continuance intention to use SMIS

4. Research Methodology

4.1. Measurement Instrument. In this study, the UEQ, a measurement instrument developed originally by Laugwitz et al. [34], that has been tested and widely acknowledged as a valid test for measuring user experience by several studies, was adopted to collect data. There are two sections in the questionnaire. The first section presents the demographic profile of the responders. It comprises four items reflecting gender, age, the faculty to which a student belongs, and the student's education level. The second section has the six main UEQ constructs, which consist of twenty-six items, with each item consisting of two terms with opposite meanings. In addition, there is a construct measuring students' continuance intention to use SMIS, which has five items. The six main constructs of UEQ consist of attractiveness, perspicuity, efficiency, dependability, stimulation, and novelty. Attractiveness consists of the following six items: annoying/enjoyable, good/bad, unlikable/pleasing, unpleasant/pleasant, attractive/unattractive, and friendly/unfriendly [13]. Perspicuity has four items, which consist of the following items: understandable/understandable, easy to learn/difficult to learn, complicated/easy, and clear/confusing [13]. Also, efficiency has the following four items: fast/slow, inefficient/efficient, impractical/practical, and organized/cluttered [13]. Similarly, dependability has the following four items: unpredictable/predictable, obstructive/supportive, secure/not secure, and meets expectations/does not meet expectations [13]. Stimulation has the following four items: valuable/inferior, boring/exciting, not interesting/interesting, and motivating/demotivating [13]. The novelty consists of the following four items: creative/dull, inventive/conventional, usual/leading-edge, and conservative/innovative [13]. In all, there are thirty-one items measuring all constructs on a seven-point Likert scale. Before the data collection, twenty-five students and colleagues with expertise in measurement instruments examined the questionnaire to ensure that it was well-structured. The UEQ measurement instrument was modified to make the questions easier to comprehend and accommodate the context within which students use the SMIS. The underlying constructs of the UEQ measurement instrument were, however, maintained.

4.2. Data Collection. User-driven evaluations of software's usability and quality frequently employ questionnaires [20]. Thus, an online questionnaire was adopted to collect data to evaluate students' continuance intention to use the SMIS and their UX. The online questionnaire survey was designed based on UEQ and distributed via students' social media platforms. One recommended method for carrying out online surveys is convenience sampling [38]. Thus, convenience sampling was used in this study. The data were collected at KTU during the second semester of the academic year 2021/2022. The online survey was completed by 415 students from different faculties at different levels of study.

According to Hair et al. [39], "the minimum sample size should be ten times the maximum number of arrowheads pointing at a latent variable anywhere in the PLS path model." In our study, the proposed research model has six arrowheads pointing at our latent variable. As a result, 60 should be the minimum sample size when applying the 10 times rule. However, our sample size of 415 is sufficient and exceeds the study's minimum sample size requirement when using the PLS path model. Of the 415 respondents, 236 (56.87%) were females and 179 (43.13%) were males. In addition, most respondents were between the ages of 17 and 24. Also, most respondents were pursuing a Higher National Diploma programme. Table 1 provides the respondents' profiles.

4.3. Data Analysis. The study used the PLS-SEM method and the UEQ data analysis tool (Excel) to evaluate the model. The PLS-SEM method was used to evaluate the measurement model's reliability and validity. In addition, the PLS-SEM method was used to test the relationships among the constructs in the proposed research model. The UEQ data analysis tool (Excel) was also employed in analysing the UEQ data in terms of mean, variance, Guttman's Lambda-2 coefficients, and benchmarks.

5. Results

5.1. Measurement Model. Cronbach's alpha coefficient (α), composite reliability (CR), Guttman's Lambda-2 coefficient (λ-2), average variance extracted (AVE), and the Fornell–Larcker criterion were used to examine the model's reliability and validity. The reliability of the measurement model was evaluated using α, CR, and λ-2. It has been recommended by the authors in reference [40] that α values between 0.6 and 0.7 are deemed acceptable. In addition, values of α that are 0.8 or higher are considered a good level. Also, the authors in [39] stated that CR values that are more than or equal to 0.70 could be regarded as acceptable. Similarly, λ-2 values greater than 0.70 are acceptable [41, 42]. Table 2 shows that the values of α are more than 0.8. Similarly, from Table 2, we see that the values of CR are greater than 0.70. Also, from Table 3, the values for λ-2 are greater than 0.70. Consequently, the proposed model is reliable. AVE was used to test the measurement model's validity. A value of 0.50 or higher for the AVE is considered acceptable [39]. All AVE values in Table 2 are above 0.60. Thus, the proposed model's convergent validity is established.

Table 1: Demographic profile of respondents.

Variables		Frequency	Percentage (%)
Gender	Female	236	56.87
	Male	179	43.13
Age	17–24	277	66.75
	25–34	130	31.33
	35–44	7	1.69
	45 and above	1	0.24
Faculty	Faculty of Applied Sciences and Technology	246	59.28
	Faculty of Engineering	4	0.96
	Faculty of Business and Management Studies	160	38.55
	Faculty of Built and Natural Environment	1	0.24
	Faculty of Health and Allied Sciences	4	0.96
Educational level	Bachelor of Technology (BTech)	67	16.14
	Higher National Diploma (HND)	299	72.05
	Diploma	49	11.81

Table 2: Construct reliability and validity.

Construct	α	CR	AVE
ATT	0.900	0.922	0.663
CIK	0.920	0.944	0.807
DEP	0.965	0.975	0.906
EFF	0.954	0.967	0.880
NOV	0.963	0.973	0.899
PER	0.835	0.890	0.671
STI	0.887	0.922	0.746

Table 3: Reliability of Guttman's Lambda-2 coefficient.

Construct	λ-2
ATT	0.900
DEP	0.965
EFF	0.952
NOV	0.962
PER	0.849
STI	0.886

According to the authors in reference [39], the Fornell–Larcker criterion for determining the discriminant validity of a measurement model requires the square root of AVE of a construct be greater than the correlations of other constructs below that particular construct. Table 4 shows that the square root of the AVE for any construct is higher than the correlations for any constructs that are beneath it. This proves that the proposed model's discriminant validity is established.

5.2. Structural Model. After validating the measurement model, the structural model was analysed and the relationships among the constructs in the proposed research model were examined. The results of the structural model test are shown in Table 5 and Figure 2. Out of the six hypotheses, five are supported, while one of them is not supported. Attractiveness ($\beta = 0.386$, $p < 0.01$) is positively related to students' continuance intention to use SMIS, and thus H1 is supported. Perspicuity ($\beta = -0.213$, $p < 0.10$) was found to significantly influence students' continuance intention to use SMIS, and thus H2 is supported. Efficiency ($\beta = -0.410$, $p < 0.05$) proves to be a significant determinant of continuous intention to use SMIS, which supports H3. However, dependability ($\beta = 0.043$, $p > 0.10$) did not significantly influence students' continuous intention to use SMIS. Consequently, H4 was not supported. Stimulation ($\beta = 0.434$, $p < 0.01$) and novelty ($\beta = 0.559$, $p < 0.01$) were positively related to continuance intention to use the SMIS. Hence, H5 and H6 were supported. From Figure 2, ATT, PER, EFF, DEP, STI, and NOV explained 47.6% of the variance in continuance intention to use SMIS.

Table 4: Discriminant validity of Fornell–Larcker criterion.

Constructs	ATT	CIK	DEP	EFF	NOV	PER	STI
ATT	0.815						
CIK	0.601	0.898					
DEP	0.277	0.356	0.952				
EFF	0.299	0.345	0.402	0.938			
NOV	0.284	0.376	0.566	0.653	0.948		
PER	0.801	0.485	0.198	0.233	0.225	0.819	
STI	0.778	0.607	0.241	0.259	0.251	0.539	0.864

5.3. UEQ Benchmark Results

5.3.1. Mean and Variance of UEQ Scales. Table 6 and Figure 3 show the results obtained from the mean and variance UEQ scales. ATT has a mean and variance value of 1.521 and 1.81, respectively. Also, DEP has a mean value of 1.850 and a variance value of 0.62. Similarly, EFF has 2.028 and 0.53 for mean and variance values, respectively. The mean value for NOV is 1.811, while the variance value is 0.66. Also, PER has a mean and a variance value of 1.570 and 1.99, respectively. STI has a mean value of 1.468 and a variance value of 1.86.

5.3.2. Benchmark Score. UEQ provides a benchmark dataset of 452 evaluations updated regularly [12, 13]. The data obtained after evaluating SMIS for user experience were analysed in comparison to the benchmark scores of other

Table 5: Results of the structural model analysis.

Hypothesis	Path	Path coefficient (β)	T-statistics	P value (p)	Hypothesis results
H1	ATT-->CIK	0.386***	3.981	0.000	Supported
H2	PER-->CIK	−0.213*	2.154	0.031	Supported
H3	EFF-->CIK	−0.410**	2.921	0.004	Supported
H4	DEP-->CIK	0.043	0.375	0.708	Not supported
H5	STI-->CIK	0.434***	4.177	0.000	Supported
H6	NOV-->CIK	0.559***	4.510	0.000	Supported

***Significant level at $p < 0.01$; **significant level at $p < 0.05$; *significant level at $p < 0.10$.

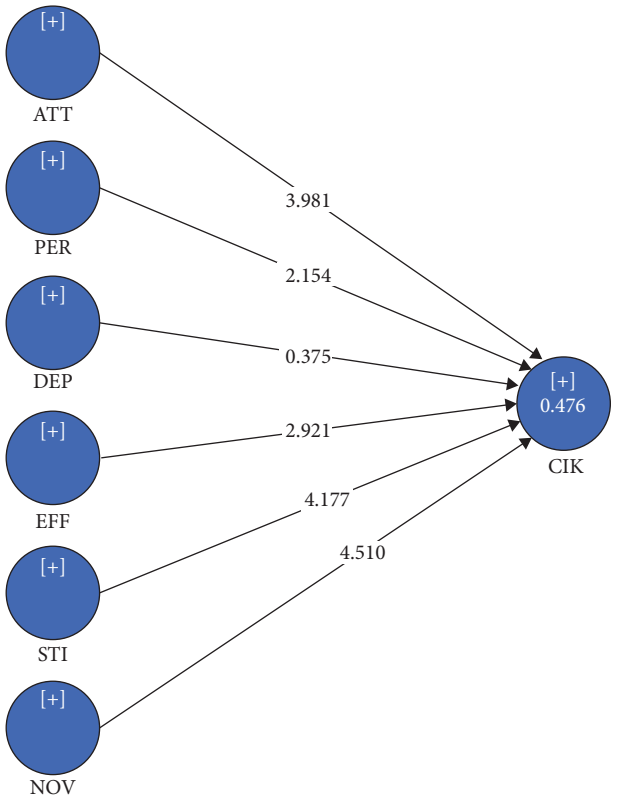

Figure 2: Structural model.

Table 6: Mean and variance of UEQ scales.

UEQ scales	Mean	Variance
ATT	1.521	1.81
DEP	1.850	0.62
EFF	2.028	0.53
NOV	1.811	0.66
PER	1.570	1.99
STI	1.468	1.86

established products to ascertain the quality of the system. The results from the analysis indicate that the system had a good and excellent user experience rating, as shown in Figure 4. The results from Table 7 show that DEP, EFF, and NOV were rated excellent with mean scores of 1.850, 2.028, and 1.811, respectively. Also, ATT, PER, and STI were rated good with mean scores of 1.521, 1.570, and 1.468, respectively.

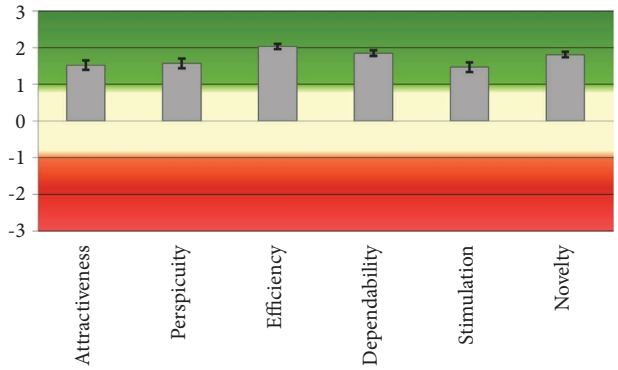

Figure 3: Graph of mean values of UEQ scales.

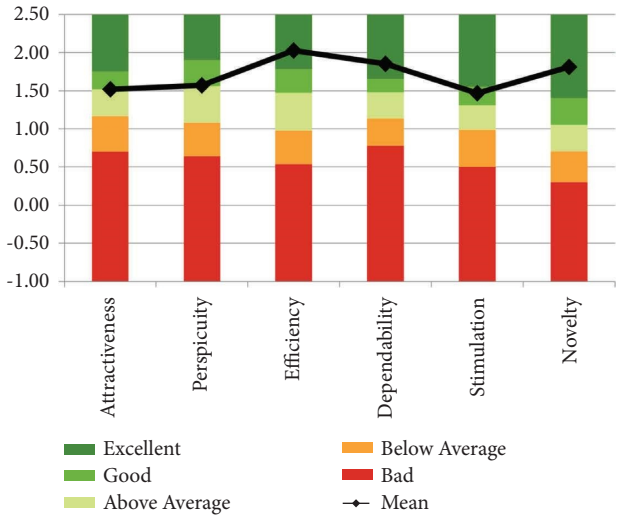

Figure 4: Benchmark score of SMIS.

6. Discussion and Implications

The study aimed to investigate UEQ constructs influencing students' continuous use of SMIS in a Ghanaian technical university. In addition, the study also examined the UX of SMIS. The proposed research model used constructs from the UEQ and incorporated continuous intention to use constructs. The constructs from the UEQ have shown from prior studies to be a reliable measurement instrument in measuring UX [19]. Consequently, our findings have shown that constructs from the UEQ significantly influence students' continuance intention to use SMIS. Except for

Table 7: Benchmark comparison interpretation of SMIS.

UEQ scales	Mean	Comparison to benchmark
ATT	1.521	Good
DEP	1.850	Excellent
EFF	2.028	Excellent
NOV	1.811	Excellent
PER	1.570	Good
STI	1.468	Good

dependability, all other constructs were significant in determining students' continuance use of SMIS. Also, the findings on examining the UX of SMIS showed that DEP, EFF, and NOV were rated excellent, while ATT, PER, and STI were rated good.

This study's findings indicate that the relationship between ATT and CIK (Continuance Intention to use KCS SMIS) is significant for the students' continuous intention to use SMIS. This finding suggests that students' overall impressions of the SMIS would positively influence their continuance intention to use the SMIS. Thus, confirming the findings of some previous research [9, 19–21, 35]. Also, the findings of the UX of SMIS showed that attractiveness, which is the overall impression a student has of the SMIS, was rated good. This finding shows that 10% of the results in the benchmark dataset were better than the evaluated ATT of SMIS. However, 75% of the benchmark dataset results were worse off compared to the ATT of SMIS. Thus, the UX of SMIS can be considered satisfactory. Also, ATT obtained a positive mean score of 1.521, which implies that students had a positive impression and were generally satisfied with the SMIS.

Similarly, this research showed that the relationship between PER and CIK is significant. This finding implies that when students easily get familiar with the SMIS, they will continue to use the SMIS. This result corroborates the findings of previous research [9, 19, 20, 22, 35, 36]. PER, which explains how students can easily get familiar with the SMIS, was rated as good. This implies that 10% of the results in the benchmark dataset were better than the evaluated PER of SMIS. However, 75% of the results from the benchmark dataset were worse off as compared to the PER of SMIS. Furthermore, the findings showed that PER had a positive mean score of 1.570. Thus, students considered their UX of SMIS satisfactory.

In this study, there is a significant relationship between EFF and CIK, and the findings showed that EFF positively influenced the continuance intention of students to use the SMIS. Therefore, when students assert that they can solve their tasks using the SMIS without unnecessary effort, they will continue to use the SMIS. This result is consistent with prior research [9, 14, 19, 20, 36]. Also, the findings of the UX on SMIS showed that EFF was categorized as excellent. This result showed that the evaluated EFF of SMIS is among the top 10% of the results from the benchmark dataset. Similarly, EFF obtained the highest positive mean score value of 2.028. This demonstrates that the SMIS provides sufficient students' UX to be successful.

Also, the study's results showed that the relationship between DEP and CIK is not significant for the students' continuance intention to use the SMIS. This relationship's insignificance suggests that students have had control of interaction with other similar systems that did not inure to their benefits. Thus, their ability to be in control of the interaction with the SMIS does not necessarily influence their continuance use of the SMIS. Thus, this finding is inconsistent with previous research findings [14, 19–22]. DEP, which explains whether students feel they are in control of the interaction with the SMIS, was categorized as excellent. This result showed that the evaluated DEP of the SMIS is among the top 10% of the results from the benchmark dataset. In addition, the results indicated that DEP had a positive value of 1.850. This demonstrates that the SMIS provides sufficient UX to be successful. This implies that students felt generally satisfied with the UX on SMIS.

Similarly, this study's findings indicated that STI positively influenced CIK. This result shows that when students are excited and motivated to use the SMIS, they will continue to use it. This finding corroborates the results of previous research [9, 14, 19, 20, 21]. Findings of the UX on SMIS indicated that STI was categorized as good. This implies that 10% of the results in the benchmark dataset were better than the evaluated STI of SMIS. However, the evaluated STI of the SMIS was better than 75% of the results from the benchmark dataset. Furthermore, the results showed that STI obtained a positive mean score of 1.468. Thus, students opined that they had adequate UX on SMIS to continue its usage.

The study's findings showed that novelty positively influenced students' continuance intention to use the SMIS. This result suggests that if students consider the SMIS to be innovative and creative, it will significantly affect their intention to continue using such a system. This finding confirms the findings of previous research [14, 19–22]. NOV, which explains how students consider the SMIS to be creative and innovative was rated as excellent. This result showed that the evaluated NOV of the SMIS is among the top 10% of the results from the benchmark dataset. This demonstrates that the SMIS provides sufficient UX to be successful. Also, NOV obtained a positive mean score of 1.811. This implies that students had positive UX on SMIS.

The study's outcome provides some practical implications for UX designers, developers, and management of technical universities to consider in ensuring continuous usage of SMIS. The results showed that attractiveness significantly influenced students' continuous intention to use the SMIS. Similarly, the UX findings showed that attractiveness was rated good. Thus, UX designers and developers must ensure that they design and develop SMIS that will be more attractive, enjoyable, and pleasing to the students. Also, the findings showed that perspicuity positively impacted students' intention to continue using the SMIS. In addition, it was rated as good. Thus, UX designers are encouraged to design front-end interfaces that are visually appealing and engaging to users.

Furthermore, UX designers and developers should ensure that they provide SMIS that is not complex to interact with. Rather such systems should have easy-to-use interfaces that will

enable students to easily get familiar with such systems. Similarly, efficiency has been shown to be important in significantly influencing students' intention to continue using the SMIS. In addition, it was rated as excellent. It is important for development teams to ensure that the functionalities of SMIS are efficient and perform the necessary tasks without much effort. Therefore, UX designers and developers should provide a system enabling students to accomplish a learning task without much effort. In addition, they should provide help functionalities and system user manuals that can assist students in performing learning tasks effortlessly. The study also revealed that stimulation positively affects students' continuance intention to use the SMIS. Also, UX findings showed that it was rated good. It implies that when students are excited and motivated about using the SMIS, they will continue using the SMIS. Thus, the management of technical universities must create some excitement and awareness about the SMIS via social media platforms, university websites, and posters. In addition, management should consider instituting some reward mechanisms that will motivate students to continue using the system. The study also showed that novelty positively impacted students' continued use of the SMIS.

Consequently, UX designers and developers must ensure that they provide an innovative and creative SMIS. Management of technical universities must ensure that when they request for SMIS, such a system must have key UX characteristics such as attractiveness, perspicuity, efficiency, stimulation, and novelty as part of the user requirement specification document. End-users are vital elements in the value of systems and should be more involved during the development. Thus, the management must ensure that there is a collaboration between the development team and students during the design and development of the SMIS. Prototypes of systems could be designed to elicit feedback from students during the development process. In addition, students must be involved in evaluating the system after it has been deployed.

From a theoretical perspective, by utilizing the UEQ constructs as a base model and incorporating continuance intention to use, we proposed a research model that can be used to examine continuance intention to use SMIS. The study's findings provide researchers from other developing countries the opportunity to replicate this study in examining continuance intention to use SMIS from the context of UX characteristics. Also, the study contributes to the body of knowledge on the continued use of SMIS using UX characteristics from the perspective of Ghanaian higher educational institutions (HEIs). Furthermore, the study also contributes to the literature on evaluating SMIS based on UX characteristics. Thus, researchers from other developing countries can replicate this study by adopting UX characteristics to evaluate SMIS.

7. Limitations

Our study has some limitations that could be addressed through further research to improve its findings. We discovered that using convenience sampling resulted in an unbalanced distribution of respondents from different faculties, potentially affecting the overall representation of respondents in the study area. Therefore, findings from this study cannot be generalized to reflect all the faculties in the study area. We recommend that future studies should explore other sampling techniques that will address a well-balanced representation of respondents in the target study area. The continuance use of the SMIS might not only depend on the scales of UEQ, but other factors could influence the continuance use of the system. We also recommend that future studies explore other factors with the UEQ to examine the continuance use of the system.

8. Conclusion

With the increasing number of HEIs in developing countries investing in the implementation and deployment of SMIS, there is a need for the management of such institutions to ensure that such systems meet the expectations of students, which will then lead to their continuance usage. Thus, this study sought to examine students' continuance intention to use SMIS using UEQ and evaluated students' UX on SMIS. A research model for examining the continuance intention to use SMIS was proposed and validated. The study's findings showed that attractiveness, perspicuity, efficiency, stimulation, and novelty influenced students' continuance intention to use the SMIS. However, dependability was insignificant in influencing students' continuance intention to use the SMIS. Furthermore, in evaluating students' UX on SMIS, dependability, efficiency, and novelty were rated excellent, while attractiveness, perspicuity, and stimulation were rated as good. The findings from the study provide UX designers and developers insights into designing and developing a more attractive, enjoyable, and not complex SMIS that is pleasing and easy to interact with. Also, the findings show that UX designers and developers should provide user guides to assist students in performing learning tasks effortlessly. The findings also show that the management of HEIs should create some excitement and awareness about the use of SMIS via social media platforms, university websites, and posters. In addition, the management of HEIs should institute mechanisms for rewarding students who continue using the SMIS and they should ensure continuous collaboration between the SMIS developers, the ICT department, and the student body. Furthermore, the findings of the study also contribute to the literature on students' user experience on SMIS in HEIs and its continuance usage.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

[1] P. J. Goldstein and R. N. Katz, "Academic analytics: the uses of management information and technology in higher education," *Education*, vol. 8, 2005.

[2] A. M. Abubakar, H. Elrehail, M. A. Alatailat, and A. Elçi, "Knowledge management, decision-making style and organizational performance," *Journal of Innovation & Knowledge*, vol. 4, no. 2, pp. 104–114, 2019.

[3] E. Bayangan-Cosidon, "Student information system for kalinga state university-rizal campus," *Journal of Management and Commerce Innovations*, vol. 4, no. 1, pp. 330–335, 2016.

[4] Y. Chu, "Construction of student personal information management system relying on computer," *Journal of Physics: Conference Series*, vol. 1915, no. 4, 2021.

[5] C. Gürkut and M. Nat, "Important factors affecting student information system quality and satisfaction," *Eurasia Journal of Mathematics, Science and Technology Education*, vol. 14, no. 3, pp. 923–932, 2018.

[6] J. Sriarunrasmee and C. Anutariya, "The development of one stop service online system based on user experience design and AGILE method," in *Proceedings of the 2020 11th International Conference on E-Education*, New York, NY, USA, June 2020.

[7] K. L. Norman and E. Panizzi, "Levels of automation and user participation in usability testing," *Interacting with Computers*, vol. 18, no. 2, pp. 246–264, 2006.

[8] A. M. Saleh, A. B. Al-Badareen, and O. Enaizan, "Automated user experience tool development for mobile application," *International Journal of Advanced Science and Technology*, vol. 29, no. 6, pp. 4929–4940, 2020.

[9] A. M. Saleh, H. Y. Abuaddous, I. S. Alansari, and O. Enaizan, "The evaluation of user experience of learning management systems using UEQ," *International Journal of Emerging Technologies in Learning*, vol. 17, no. 7, pp. 145–162, 2022.

[10] A. Al-Hunaiyyan, R. Alhajri, B. Alghannam, and A. Al-Shaher, "Student information system: investigating user experience (UX)," *International Journal of Advanced Computer Science and Applications*, vol. 12, 2021, https://www.ijacsa.thesai.org/.

[11] S. M. Mirmehdi, "Examining the role of user experience with branded apps in continuance use intention," *International Journal of Electronic Customer Relationship Management*, vol. 13, no. 1, pp. 81–97, 2021.

[12] M. Schrepp, A. Hinderks, and J. Thomaschewski, "Applying the User Experience Questionnaire (UEQ) in Different Evaluation Scenarios," *Design, User Experience, and Usability. Theories, Methods, and Tools for Designing the User Experience: Third International Conference, DUXU 2014, Held as Part of HCI International 2014*, Springer, Berlin, Germany, 2014.

[13] M. Schrepp, A. Hinderks, and J. Thomaschewski, "Construction of a benchmark for the user experience questionnaire (UEQ)," *International Journal of Interactive Multimedia and Artificial Intelligence*, vol. 4, pp. 40–44, 2017.

[14] A. F. Bayu Ck and J. Setiawan, "Analysis of user experience resource planning with user experience questionnaire framework (case study: universitas multimedia nusantara)," *Journal of Multidisciplinary Issues*, vol. 1, no. 2, pp. 42–61, 2021.

[15] Erlangga, Y. Wihardi, and E. Nugraha, "User experience evaluation by using a user experience questionnaire (UEQ) based on an artificial neural network approach," in *Proceedings of the 2021 3rd International Conference on Research and Academic Community Services: Sustainable Innovation in Research and Community Services for Better Quality of Life*, New Delhi, India, July 2021.

[16] A. I. I. Paramitha, G. Rasben Dantes, and G. Indrawan, "The evaluation of web based academic progress information system using heuristic evaluation and user experience questionnaire (UEQ)," in *Proceedings of the 2018 Third International Conference on Informatics and Computing (ICIC)*, Palembang, Indonesia, August 2018.

[17] M. Salehudin, E. Nurbayani, and R. Toba, "User experience (UX) of multimedia; program of auto play media studio for teacher professional education (PPG)," *International Journal of Education*, vol. 5, no. 2, pp. 111–121, 2020.

[18] M. Q. Laksono, S. S. Kusumawardani, and R. Ferdiana, "Evaluating user experience on e-learning using the user experience questionnaire (ueq) with additional functional scale," in *Proceedings of the CONRIST 2019-International Conferences on Information System and Technology*, Munich, Germany, June 2020.

[19] A. Z. M. Ali and M. K. Ramlie, "Examining the user experience of learning with a hologram tutor in the form of a 3D cartoon character," *Education and Information Technologies*, vol. 26, no. 5, pp. 6123–6141, 2021.

[20] S. S. AlGothami and S. Saeed, "Digital transformation and usability: user acceptance of tawakkalna application during COVID-19-19 in Saudi Arabia," *Public Administration and Information Technology*, vol. 7, pp. 95–109, 2021.

[21] D. J. A. Martin and T. Mauritsius, "The effect of user experience on the use of tokopedia E-commerce applications," *International Journal of Emerging Technology and Advanced Engineering*, vol. 12, no. 3, pp. 99–106, 2022.

[22] L. Mlekus, D. Bentler, A. Paruzel, A.-L. Kato-Beiderwieden, and G. W. Maier, "How to raise technology acceptance: user experience characteristics as technology-inherent determinants," *Gruppe Interaktion Organisation Zeitschrift Für Angewandte Organisationspsychologie (GIO)*, vol. 51, no. 3, pp. 273–283, 2020.

[23] A. M. Saleh, H. Y. Abuaddous, O. Enaizan, and F. Ghabban, "User experience assessment of a COVID-19 tracking mobile application (AMAN) in jordan," *Indonesian Journal of Electrical Engineering and Computer Science*, vol. 23, no. 2, pp. 1120–1127, 2021.

[24] M. A. Kushendriawan, H. B. Santoso, P. O. H. Putra, and M. Schrepp, "Evaluating user experience of a mobile health application' halodoc' using user experience questionnaire and usability testing," *Jurnal Sistem Informasi*, vol. 17, no. 1, pp. 58–71, 2021.

[25] T. K. Martono, "Analysis on user experience using ueq method in the information system of web-based child development monitoring," in *Proceedings of the International Conference on Science, Technology and Environment*, Jawa Tengah, Indonesia, May 2020.

[26] I. M. A. O. Gunawan, G. Indrawan, and Sariyasa, "User experience evaluation of academic progress information systems using retrospective think aloud and user experience questionnaire," *Journal of Physics: Conference Series*, vol. 1810, no. 1, pp. 1–8, 2021.

[27] S. Kusrini, A. Setyanto, I. M. A. Agastya, H. Priantoro, Fadlurahman, and K. Chandramouli, "User evaluation of mobile based smart mango pest identification," in *Proceedings of the 2020 8th International Conference on Cyber and IT Service Management*, Pangkal Pinang, Indonesia, June 2020.

[28] D. L. Amoroso and Y. A. N. Chen, "Constructs Affecting Continuance intention in consumers with mobile financial

apps: a dual factor approach," *Journal of Information Technology Management*, vol. 28, no. 3, 2017.

[29] J. K. Chen, K. C. Shu, and H. H. Lee, "Examining E-learning systems success continuance intention user by integrating TAM and DMIS model," in *Proceedings of the 2019 Portland International Conference on Management of Engineering and Technology (PICMET)*, Portland, OR, USA, June 2019.

[30] A. Tella and G. Olasina, "Predicting users' continuance intention toward E-payment system," *International Journal of Information Systems and Social Change*, vol. 5, no. 1, pp. 47–67, 2014.

[31] L. Y. K. Wang, S. L. Lew, S. H. Lau, and M. C. Leow, "Usability factors predicting continuance of intention to use cloud e-learning application," *Heliyon*, vol. 5, no. 6, Article ID e01788, 2019.

[32] B. Wu and X. Chen, "Continuance intention to use MOOCs: integrating the technology acceptance model (TAM) and task technology fit (TTF) model," *Computers in Human Behavior*, vol. 67, pp. 221–232, 2017.

[33] A. Hidayat and V. G. Utomo, "User experience measurement of adaptive online module system using user experience questionnaire," *Journal of Physics: Conference Series*, vol. 1918, no. 4, pp. 1–6, 2021.

[34] B. Laugwitz, T. Held, and M. Schrepp, "Construction and evaluation of a user experience questionnaire," *USAB*, vol. 5298, pp. 63–76, 2008.

[35] Y. Udjaja and S. Lailany, "Wacana bencana: android-based natural disaster simulation game," *International Journal of Emerging Technology and Advanced Engineering*, vol. 12, no. 4, pp. 103–114, 2022.

[36] A. Hussain, E. Mkpojiogu, I. Hussein, O. Muhi, and M. Yosri, "The effectiveness, efficiency and reliability-in-use of daylio mobile app," *International Journal of Advanced Science and Technology*, vol. 29, no. 8, pp. 180–187, 2020.

[37] Krisnawati, M. Hayaty, B. Setiaji, and A. Setyanto, "First time user experience assessment on web based online examination," in *Proceedings of the 2019 International Conference on Information and Communications Technology*, pp. 829–834, Guangzhou, China, August 2019.

[38] V. M. Sue and L. A. Ritter, *Conducting Online Surveys*, L. C. Shaw and B. A. Bernstein, Eds., SAGE Publications, Thousand Oaks, CA, USA, 2007.

[39] J. Hair, G. T. Hult, C. Ringle, and M. Sarstedt, *A Primer on Partial Least Squares Structural Equation Modeling*, SAGE Publications, Thousand Oaks, CA, USA, 2nd edition, 2017.

[40] G. Ursachi, I. A. Horodnic, and A. Zait, "How reliable are measurement scales? External factors with indirect influence on reliability estimators," *Procedia Economics and Finance*, vol. 20, no. 15, pp. 679–686, 2015.

[41] H. G. Osburn, "Coefficient alpha and related internal consistency reliability coefficients," *Psychological Methods*, vol. 5, no. 3, p. 343, 2000.

[42] L. A. van der Ark, D. W. van der Palm, and K. Sijtsma, "A latent class approach to estimating test-score reliability," *Applied Psychological Measurement*, vol. 35, no. 5, pp. 380–392, 2011.