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Psychometric Properties of the Arabic Version of the Unified Theory of Acceptance and Use of Technology (UTAUT-2012) Among Nursing Students

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Abstract

The integration of artificial intelligence (AI) into nursing education is essential for equipping future nurses with the skills required to navigate an increasingly technology-driven healthcare environment. This study aimed to validate the Arabic version of the Unified Theory of Acceptance and Use of Technology (UTAUT-2012) model in assessing factors influencing nursing students' acceptance and use of AI in healthcare education. A cross-sectional pilot study was conducted with 200 nursing students to evaluate the psychometric properties of the Arabic-translated UTAUT (2012) instrument. Confirmatory factor analysis was performed using covariance-based structural equation modeling (CB-SEM) in SmartPLS (Version 4.1.0). Confirmatory factor analysis supported the construct validity of the nine UTAUT 2012 constructs: performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, price value, habit, behavioral intention, and use behavior. All items showed acceptable factor loadings ($> .5$), composite and construct reliability (> 0.7), and average variance extracted (> 0.5). Discriminant validity was confirmed using the Fornell-Larcker criterion and the heterotrait-monotrait ratio. The findings offer valuable insights into the factors influencing Arabic-speaking nursing students' acceptance and use of AI in healthcare education, supporting the model's validity in this cultural context.

Keywords: psychometric properties, UTAUT 2012 model, artificial intelligence, structural equation modeling, nursing education, nursing students

Introduction

Incorporating artificial intelligence (AI) into nursing education is becoming increasingly important for preparing nurses to meet the evolving demands of modern healthcare. As AI continues to reshape clinical practice, its integration into nursing curricula is essential to ensure that future nurses are well-equipped to navigate these technological changes (O'Connor et al., 2023). Successful implementation of AI in nursing education requires a nuanced understanding of the factors that influence nursing students' intentions and readiness to engage with AI applications (Alenezi, 2023). As emphasized by Alenezi (2023) and O'Connor et al. (2023), identifying these factors is critical for supporting the effective integration of AI within educational environments.

To investigate these factors, researchers must employ robust, psychometrically sound instruments. Accurate measurement of students' acceptance and use of AI depends on tools that demonstrate strong reliability and validity, particularly when adapted for different languages and cultural contexts. However, there remains a notable gap in the literature regarding validated Arabic-translated instruments, especially within the field of nursing education (Taskiran, 2023). Existing technology acceptance models have largely been developed and tested in Western contexts, raising concerns about their generalizability to non-Western populations (McCoy et al., 2007). Although these models have demonstrated high explanatory power in Western settings, their applicability in non-Western cultures has been questioned (Bandyopadhyay & Fraccastoro, 2007).

Recent studies have emphasized the importance of incorporating cultural nuances into technology acceptance research, particularly within educational systems in non-Western countries (Drissi et al., 2022; Gabriel, 2023; Rouibah, 2008). For Arabic-speaking populations, cultural factors significantly influence how technology is perceived and adopted in educational contexts (Drissi et al., 2022; Gabriel, 2023). Consequently, validating these models in Arabic-speaking environments is essential for accurate and meaningful application.

This study adopts the Unified Theory of Acceptance and Use of Technology (UTAUT) 2012 model, which provides a comprehensive framework for analyzing the determinants of technology adoption. The updated UTAUT 2012 model, an evolution of the original framework, has gained substantial recognition as a theoretical advancement due to its continued refinement through empirical research (Venkatesh et al., 2012). It has been extensively applied in educational settings to assess technology acceptance across various populations, particularly in non-Arabic-speaking contexts (Abu-Al-Aish & Love, 2013; Barchielli et al., 2021; Williams et al., 2015; Zhou et al., 2019). Its flexibility and robustness make it particularly valuable for cross-cultural studies, offering insights into students' and nurses' readiness to adopt emerging technologies such as AI in education (Kwak et al., 2022).

The UTAUT 2012 model evaluates user acceptance and technology usage behavior through seven core constructs: performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, price value, and habit, which in turn influence behavioral intention and use behavior (Venkatesh et al., 2003, 2012). These constructs are defined as follows: performance expectancy (PE) refers to the perceived usefulness of a system in enhancing job performance; effort expectancy (EE) relates to the ease of use; social influence (SI) concerns the perceived expectations of important others; facilitating conditions (FC) address the perceived support available for system use; hedonic motivation (HM) reflects the enjoyment derived from system use; price value (PV) pertains to the trade-off between benefits and cost; and habit (HT) captures the extent of automatic use behavior (Venkatesh et al., 2003,

2012).

In Arabic-speaking contexts, the UTAUT model has shown promising results. For instance, a study examining Internet banking behaviors across Jordan, Saudi Arabia, and Egypt with 677 participants validated the Arabic version of the model through confirmatory factor analysis (CFA), affirming its applicability in non-Western settings (Al-Qeisi et al., 2015). Additionally, in Saudi Arabia, the UTAUT 2012 model was employed to explore factors affecting the use of virtual classrooms among faculty in various disciplines at the University of Ha'il. This study, which involved 235 teaching staff, validated the measurement model via CFA after modifying select items to improve model fit (SI3, SI4, M4, M5, FC4). The results supported the model's reliability and validity, with satisfactory values for average variance extracted (AVE) and composite reliability (CR; Alshammari, 2021).

Despite these findings, the psychometric properties of the UTAUT 2012 model have not yet been evaluated in the context of nursing education in Saudi Arabia. Given the increasing relevance of AI in healthcare, assessing the model's reliability and validity in this field is essential, particularly for Arabic-speaking nursing students. To date, no studies have directly examined the psychometric validation of the Arabic-translated UTAUT 2012 model within nursing education.

Validating the Arabic version of the UTAUT 2012 model for nursing students holds meaningful implications for both educational practice and policy. Educators can design more targeted learning experiences that promote engagement and readiness for technology-driven healthcare environments by understanding the factors that influence students' acceptance of AI. Institutions may also use the validated tool to identify barriers to AI adoption and provide the necessary support or training. Ultimately, this research contributes not only to measurement science but also to improving digital transformation in nursing education across Arabic-speaking regions.

Evaluating the psychometric properties of research instruments is crucial to ensuring the accuracy, credibility, and generalizability of study findings. Valid and reliable tools are necessary to support the integrity of research outcomes across diverse contexts. Several studies have highlighted the significance of psychometric evaluation in research involving questionnaires, emphasizing its role in strengthening the overall quality of measurement (Dikkema et al., 2021; Speyer et al., 2014; Terwee et al., 2007).

In cross-cultural research, applying models without appropriate linguistic and contextual adaptation can result in measurement error and limit the interpretability of outcomes. Within Arabic-speaking contexts, the lack of validated instruments presents a methodological gap that constrains efforts to assess students' acceptance of educational technologies with precision. This study addresses this limitation by adapting and validating the UTAUT-2012 model for Arabic-speaking nursing students, thereby contributing a culturally and linguistically appropriate measurement tool that can support evidence-based decision-making in educational planning and policy development (Venkatesh et al., 2012).

Materials and Methods

Research Design and Participants

The study used a cross-sectional design. To meet the assumptions of confirmatory factor analysis, the sample size was 200 participants (Kline, 2016). The questionnaire form was available on Google Forms from early September to late October 2023. This study included males and females from the first year

to year four who enrolled in the nursing bachelor's program. The study excluded students with academic issues, such as academic suspension.

Ethical Considerations

The researchers had institutional review board (IRB) approval from the university in the study (KSU-HE; 23-838), and the approval date was 5 September 2023. The researchers used an electronic questionnaire to ensure that no one's identity could possibly be exposed. The electronic questionnaire maintained participant confidentiality to ensure no identifying information was obtained. Each participant was free to discontinue the study at any point, with no impact or consequences, at their will. Each participant signed an electronic consent form contract. Each respondent was asked to indicate their agreement to the terms of an electronic consent form that was part of the survey. The privacy statement was presented before the participant clicked "Yes," indicating they would answer the survey questions. The participant was routed to the disagree page if the respondent clicked "No."

Research Instrument

UTAUT 2012 Model Questionnaire

The first section of the questionnaire asked the participants about their demographic characteristics (age, gender, and year of study). The study variables were measured using the question items developed by Venkatesh et al. (2012). That is, the questionnaire was a 30-item self-report measure of performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, price value, habit, behavioral intention, and use behavior. Official approval for its use was obtained from the author. For this study, it was adapted to the context of AI usage.

The questionnaire consisted of nine constructs: performance expectancy (4 items), effort expectancy (4 items), social influence (3 items), facilitating conditions (4 items), hedonic motivation (3 items), price value (3 items), habit (3 items), behavioral intention (3 items), and use behavior (3 items). All the items were rated on a 5-point Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree).

Translation of the Study Questionnaire Into Arabic

After obtaining permission from the questionnaire's original author, the researcher sent the questionnaire to five experts in nursing education to evaluate in order to adapt and translate the instrument. We used a comprehension and cultural relevance index for the questionnaire items, asking each expert to evaluate the items on that basis. The index ranged from 1 (not at all) to 10 (very much). Based on the expert's reviews, we made slight modifications to items.

All items were translated from English into Arabic and back-translated by the official translator with the assistance of a linguistic expert to ensure that the content and meaning of the items were the same as the original. Sidani et al. (2010) emphasized the importance of investigating conceptual equivalence while adjusting and translating instruments. Some concepts in one culture may not always have the same meaning in another, depending on how they are perceived, understood, and operationalized (also known as conceptualization and operationalization; Sidani et al., 2010). Moreover, the researcher tested content validity by having experts review the Arabic translation of the questionnaire. Content validity is the degree to which items accurately reflect the content of the characteristic or quality the researcher wants to measure (Polit & Beck, 2016).

Data Analysis

Overview of Statistical Approach

Data analysis was conducted using SmartPLS (Version 4.1.0). CFA was performed to assess the measurement model and ensure the reliability and validity of the Arabic-translated UTAUT-2012 instrument. Factor loadings were analyzed to determine how well each item reflected its intended construct. Internal consistency and reliability were examined using Cronbach's alpha and rho_C coefficients, which measure how closely related the items within each construct are. Construct validity was evaluated through the average variance extracted (AVE), indicating how much of the item variance is captured by the underlying factor. Discriminant validity, or the degree to which constructs are distinct from one another, was assessed using the Fornell-Larcker criterion and the heterotrait-monotrait ratio (HTMT). In addition, model fit was examined using several indices: chi-square divided by degrees of freedom (CMIN/DF); goodness of fit index (GFI); comparative fit index (CFI); Tucker-Lewis index (TLI); standardized root-mean-square residual (SRMR); and root-mean-square error of approximation (RMSEA) to determine how well the model fit the observed data. These analyses provided the basis for evaluating the psychometric properties of the Arabic version of the UTAUT-2012 model.

Confirmatory Factor Analysis

The type and strength of the interactions between constructs are now the focus instead of the relationships between latent constructs and measured variables. Confirmatory factor analysis (CFA) emphasizes the relationships between measured variables and latent constructs (Kline, 2016). The CFA value was used to evaluate the validity and unidimensionality of the entire assessment model.

This approach does not require distinguishing between dependent and independent variables. Therefore, the oval forms represent latent variables. One-headed connections show a causal relationship between a construct and an indicator, whereas two-headed arrows show covariance between constructs. The factor loadings were assessed for each item representing each construct.

Results

Participant Characteristics

The total number of participants in the study was 200. All were nursing students. The majority were female, 98% ($n = 196$), while males made up 2 % of the sample ($n = 4$). Regarding age, the 18–20-year-old age group represented the majority (72.5%). For the study year, the second year had the highest number of students at 38.5%, followed by the first and third Years at 21% each, and the fourth year at 19.5%, as shown in Table 1.

Table 1

Demographic Characteristics of Participants (N = 200)

Characteristic	<i>n</i>	%
Gender		
Female	196	98.0
Male	4	2.0

Characteristic	<i>n</i>	%
Age (years)		
18–20	145	72.5
21–23	55	27.5
Study year		
First	42	21.0
Second	77	38.5
Third	42	21.0
Fourth	39	19.5

Confirmatory Factor Analysis

The factor loadings were assessed for each item representing each construct. None of the items was deleted because all factor loadings were more significant than .50, as shown in Figure 1 and Table 2. This indicates that each survey item effectively measured the concept it was intended to assess. The model fit measures used to assess the overall goodness of fit were: CMIN/DF, GFI, adjusted goodness-of-fit index (AGFI), parsimony goodness-of-fit index (PGFI), RMSEA, and SRMR. All the model fit values were within acceptable limits except the RMSEA, which had a value of 0.084, and the GFI and AGFI, which approximated the recommended value, as shown in Table 2. In general, these values suggest that the overall structure of the questionnaire was a good match for the way participants responded. Thus, the model was assumed to fit.

Table 2

Fit Indices for the Arabic Version of the UTAUT-2012 Model

Measure	Recommended value	Reference	Estimated model
χ^2			891.341
Model parameters, <i>n</i>			96
Observations, <i>n</i>			200
<i>df</i>			369
<i>p</i> -value			0
CMIN/DF	< 5	Consiglio et al. (2016)	2.416
RMSEA	< 0.08	Hu & Bentler (1998)	0.084
RMSEA low (90% CI)			0.077
RMSEA high (90% CI)			0.091
GFI	≥ 0.8	Hair et al. (2012)	0.792
AGFI	≥ 0.8	Tanaka & Huba (1985)	0.785
PGFI	≥ 0.5	Mulaik et al. (1989)	0.627
SRMR	< 0.08	Hu & Bentler (1998)	0.066

Note. UTAUT = Unified Theory of Acceptance and Use of Technology; CMIN/DF = chi-square divided by degrees of freedom; RMSEA = root-mean-square error of approximation; CI = confidence interval; GFI = goodness-of-fit index; AGFI = adjusted goodness-of-fit index; PGFI = parsimony goodness-of-fit index; SRMR = standardized root-mean-square residual.

Factor Loadings, Construct Reliability, and Convergent Validity

The consistency of the indicator was assessed and confirmed by all the indicators exhibiting loadings of .6 and above. The construct reliability was assessed using Cronbach's alpha and composite reliability, which is standardized reliability for each construct. Cronbach's alpha for all the constructs was observed to be greater than the required excellent limit of 0.708. The construct validity was measured with average variance extracted (AVE); all the AVE were above the threshold of 0.5. This means that each group of items worked together consistently and accurately reflected the concept they were intended to measure. Therefore, the convergent validity of all the constructs was achieved as shown in Table 3. These results confirm that the Arabic version of the questionnaire is a reliable and valid tool for measuring students' acceptance of AI in nursing education.

Table 3

Results of Factor Analysis for the Relationships Among UTAUT-2012 Questionnaire Constructs

Relationship	Outer loading	α	rho_C	AVE
Performance expectancy		0.881	0.882	0.653
PE1	.726			
PE2	.846			
PE3	.829			
PE4	.826			
Effort expectancy		0.879	0.882	0.66
EE1	.703			
EE2	.776			
EE3	.915			
EE4	.839			
Social influence		0.844	0.842	0.642
SI1	.763			
SI2	.807			
SI3	.833			
Facilitating condition		0.84	0.839	0.57
FC1	.697			
FC2	.738			
FC3	.814			
FC4	.768			
Hedonic motivation		0.888	0.888	0.727
HM1	.874			
HM2	.861			
HM3	.822			
Price value		0.816	0.812	0.596
PV1	.732			
PV2	.799			

Relationship	Outer loading	α	rho_C	AVE
PV3	.782			
Habit		0.846	0.874	0.680
HT1	.882			
HT2	.911			
HT3	.658			
Behavioral intention		0.865	0.859	0.69
BI1	.701			
BI2	.892			
BI3	.886			
Use behavior		0.963	0.964	0.899
UB1	.927			
UB2	.939			
UB3	.978			

Note. UTAUT = Unified Theory of Acceptance and Use of Technology; AVE = average variance extracted; PE = performance expectancy; EE = effort expectancy; SI = social influence; FC = facilitating condition; HM = hedonic motivation; PV = price value; HT = habit; BI = behavioral intention; UB = use behavior.

Discriminant Validity

To further affirm the indicators of the measurement model for each construct, discriminant validity was assessed using the heterotrait-monotrait (HTMT) ratio and the Fornell-Larcker criterion. All the values of the HTMT ratio were less than 0.90 as recommended (Ab Hamid et al., 2017) and as shown in Table 4; therefore, all indicators achieved discriminant validity. This indicates that the constructs are distinct from one another, meaning each set of questions measures a different concept. However, the Fornell-Larcker criterion revealed similarities in using behavior and behavioral intention constructs (Ab Hamid et al., 2017). Every construct must have a square root of the AVE that exceeds the correlation value for another construct. [Click or tap here to enter text.](#) In comparing other constructs in this study, effort expectancy had a higher association with itself than other constructs, and other constructs showed the same trend except for use of behavior under behavioral intention. This slight overlap suggests a potential connection between students' intentions and their actual technology use, which is common in behavioral research. Table 5 shows the achievement of discriminant validity for other constructs considered in the study using the Fornell-Larcker criterion.

Table 4

Heterotrait-Monotrait (HTMT) Ratio

Construct	1	2	3	4	5	6	7	8	9
1. Behavioral intention									
2. Effort expectancy	.764								
3. Facilitating condition	.764	.82							
4. Habit	.793	.618	.643						
5. Motivation	.71	.799	.84	.531					
6. Performance expectancy	.735	.824	.802	.626	.77				
7. Price value	.707	.591	.637	.771	.473	.587			

Construct	1	2	3	4	5	6	7	8	9
8. Social influence	.737	.763	.767	.736	.677	.732	.633		
9. Use behavior	.854	.625	.684	.698	.677	.676	.614	.617	

Table 5

Fornell-Larcker Criterion

Construct	1	2	3	4	5	6	7	8	9
1. Behavioral intention	.831								
2. Effort expectancy	.717	.812							
3. Facilitating condition	.757	.795	.755						
4. Habit	.67	.54	.557	.824					
5. Motivation	.684	.779	.847	.427	.853				
6. Performance expectancy	.75	.781	.785	.559	.767	.808			
7. Price value	.707	.565	.646	.723	.477	.595	.772		
8. Social influence	.712	.751	.766	.697	.677	.727	.648	.801	
9. Use behavior	.855	.575	.675	.599	.664	.678	.618	.612	.948

Discussion

The study assessed the psychometric properties of the Arabic version of Venkatesh et al.'s (2012) UTAUT 2012 model for nursing students. This was done to ascertain the reliability and validity of the adapted Arabic-translated version of the instrument. The latent constructs of performance expectation, effort expectation, social influence, facilitating conditions, hedonic motivation, price value, and habit, with behavioral intention and use behavior, optimally loaded, and the factor loadings were more than .5 as recommended (Hair et al., 2012). Furthermore, a good fit was shown using the CFA of the model's nine factors. However, the results showed that the use of behavior and behavioral intention cannot be discriminately validated. This can be attributed to cultural differences.

The study's findings support the significance of the latent constructs in the instrument and align with previous research using the UTAUT 2012 model (Alhamazani, 2020; Alshammari, 2021; Venkatesh et al., 2003, 2012). However, the UTAUT 2012 model's constructs have received significant support from various studies, indicating that they are dynamic and context-dependent rather than static. For example, a Taiwanese study revealed that performance expectancy significantly influenced behavioral intention among nursing students (Lee et al., 2024). Similarly, a study on using the PeduliLindungi app during the COVID-19 pandemic in Indonesia highlighted the favorable impact of social influence, effort expectation, and performance expectation on behavioral intention and usage behavior while facilitating circumstances had no appreciable effect (Akbar et al., 2023). In contrast, facilitating circumstances emerged as a unique predictor of behavioral intention, according to a meta-analytic structural equation modeling analysis aggregating empirical studies using UTAUT in educational contexts. Concurrently, effort expectations and social influence were new predictors of usage behavior (Or, 2023). Research has indicated that several factors, including price value, habit, hedonic motivation, social influence,

performance expectancy, effort expectancy, and facilitating settings, significantly influence students' behavioral intention to use blended learning. Likewise, a study on the adoption of telemedicine by healthcare professionals found that hedonic motivation, habit, and performance expectancy influenced behavioral intention to adopt and use telemedicine systems (Thabet et al., 2023). Finally, a study conducted by Jordanian university faculty members on using digital learning tools discovered a substantial positive association between social effects, performance expectations, effort expectations, and the receptivity level of these tools (Ahmad et al., 2023).

Moreover, the results of this study show that both behavioral intention and use behavior constructs are more correlated with each other than other constructs. Various studies support this result, including an analysis of mobile learning (m-learning; Gonzalez & dos Santos, 2017) and the report of errors in clinical care by nurses in educational and medical organizations (Abry et al., 2022). Lastly, the study of nurses' intention to use blended e-learning systems underscores the need for supportive educational environments to enhance behavioral intentions (Chang et al., 2015).

Conclusion

This investigation highlights the significance and usefulness of the UTAUT 2012 instrument. The results generally support using the Arabic-translated UTAUT model for the proposed study, which investigates the factors affecting the acceptance of new technologies, views of novel systems, and innovations in healthcare settings. Applying CFA to the Arabic-translated UTAUT 2012 yielded confirmation of a valid and reliable instrument with well-represented latent constructs. This finding supports integrating AI into nursing education, which is crucial for preparing nurses to adapt to the evolving healthcare landscape driven by technology. These findings can help educators and decision-makers in distance learning settings better understand students' readiness for adopting new technologies.

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