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Cross-cultural adaptation and validation of the Arabic version of the Stages of Concerns (SoC) questionnaire for measuring teachers' concerns regarding the adoption of educational technologies*

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Highlights:

- Translated and culturally adapted the Stages of Concerns questionnaire into Arabic for Tunisian teachers.
- Validated the Arabic version using strong psychometric analyses and confirmatory factor analysis.
- Confirmed measurement invariance across gender and partially across teaching seniority levels.
- Offers a reliable tool for assessing teachers' concerns about adopting educational technologies in Tunisia.

Abstract

Our study aimed to translate the Stages of Concerns (SoC) questionnaire into Arabic and culturally adapt it for measuring the concerns of Tunisian in-service primary teachers about the adoption of educational technologies, and to validate this version by exploring its psychometric properties. For cross-cultural adaptation, we adopt the ITC guidelines for translating and adapting tests by the International Test Commission (2017). A total of 1.110 teachers from various public schools participated in the study. The five-dimensional alpha coefficients of the SoC indicate an excellent internal consistency, respectively, of 0.801 (Awareness), 0.909 (Informational/Personal), 0.834 (Management), 0.882 (Consequence/Collaboration), and 0.928 (Refocusing). The final Arabic version of the SoC questionnaire shows excellent CFA fit indices ($\chi 2/df=2.523$, AGFI=0.950, CFI=0.984, RMSEA=0.037, SRMR=0.0367), demonstrating the robustness and the construct validity of the survey. Multigroup confirmatory factor analysis (MGCFA) results confirmed configurational, metric, and scalar invariance based on the amount of gender and seniority. We conclude that the Arabic version of the SoC questionnaire is reliable and is equally applicable to different subgroups within the Tunisian primary teacher population.

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1. Introduction

Research in the field of educational change proposes several models for analyzing the process of change in the context of innovation adoption. The Concerns-Based Adoption Model (CBAM) is one of the most widely used in the literature over the last 30 years to analyze how teachers adopt or reject school innovations (de Vocht et al., 2017; Dunn, 2016, p. 2023; Lau & Jong, 2023; Rakes & Dunn, 2015). It is based on concern theory that emerged in the late 1960s from the pioneering research of Frances Fuller and her colleagues at the Research and Development Center for Teacher Education at the University of Texas at Austin (Hall & Hord, 1987). Gene E. Hall and his team considered that Fuller's work could be extended to any change induced by an innovation or a new approach, and to any actor involved in a change (Hall et al., 1977, 1978; Hall & Hord, 2015). Since the early 1970s, they have developed the principles, tools, and methods of the CBAM model as a theoretical and procedural framework for analyzing, understanding, and managing the change process (Byrne & Prendergast, 2020; Lau & Jong, 2023). According to CBAM, to analyze the change process, it is necessary to conduct ongoing diagnoses based on teachers' concerns. Three dimensions have been identified and verified by research to carry out this diagnosis: (1) Stages of Concerns, (2) Levels of Use and (3) Innovation Configurations. Our literature review revealed that the majority of studies adopting the CBAM framework have focused essentially on measuring teachers' concerns (Hall & Hord, 2015).

As the contexts of change and the nature of innovations have evolved, new versions of the questionnaire have been developed. The most widely utilized adaptation is that by Derek Cheung and colleagues (Cheung et al., 2001), who conducted a comparative analysis of four alternative models to the original questionnaire and constructed a new 22-item, 5-stage instrument. Since 2019, Fisher and colleagues (Fischer et al., 2019) have proposed a revised version with improved psychometric properties, retaining the same structure and number of items as Cheung's version. Therefore, the survey has been translated and adapted to several languages, including German (van den Berg, 1981) and French (Meunier, 2010). For the Arabic language, no empirical validation has been identified according to standard transcultural adaptation protocols. Researchers have often been content to bypass the cross-cultural adaptation process (Alshammari, 2000; Baytar et al., 2023). Without an empirically validated version, it is challenging to conduct reliable analyses that can help decision-makers implement change more effectively.

The aim of this study was (1) to carry out a cross-cultural adaptation of the English version of the Stages of Concerns questionnaire (SoC) into Arabic, and (2) to evaluate its psychometric properties for applications among Tunisian primary teachers. The underlying hypotheses are: (1) The English version of SoC-22 can be culturally adapted into Arabic, and (2) the Arabic version of SoC-22 presents good psychometric properties among Tunisian primary teachers.

2. Literature Review

2.1. Conceptualization of the Stages of Concern

Concern theory stems from Frances Fuller's work in the 1960s. She suggested that an individual's feelings about an innovation should be considered as concerns (Fuller, 1969). Hall and Hord (1987) developed the CBAM model based on the concern concept. Concerns are considered, *"as the feelings, perceptions, preoccupations, considerations, motivations, satisfactions, and frustrations that collectively describe an individual's stage in the affective response to the adoption of a new innovation."* (Rakes & Dunn, 2015, p. 3). Teachers' concerns about an object or a change situation evolve as they progress through the change process over seven stages of concern (Hall & Hord, 2015).

Firstly, the teacher is not concerned with the innovation. This is not automatically because the person does not want to learn about innovation, but sometimes other concerns take priority and are more important at this point. This stage indicates the extent to which change is at the core of the individual's thinking. It does not reflect if the teacher implements the change or not, but only the importance he or she attaches to it (Y.-H. Chen & Jang, 2014; Hall & Hord, 2015; Hatley, 2011). This

stage is referred to as the Awareness stage. Next, the teacher wants to know the general information, not the details. People with high scores in this stage do not necessarily lack knowledge of the innovation, but want to learn more. They want to determine what the change will entail and what is required to implement it (Hatley, 2011). This is the Informational stage. The Personal stage follows, the teacher asks questions that are self-oriented and generally not about the innovation; for example, "What is it?" and "How will it affect me?" (Hall & Hord, 2015). He starts to feel worried or anxious about how the change will affect him and begins to analyze his role, make decisions, and become involved. Teachers want to know about the benefits of implementing the change, including the value, praise, and gratification. The focus on the "self" absorbs the thought processes at this stage. After answering these highly personal questions, the questions become more task-oriented; for example, "How do I do it?" (Hall & Hord, 2015; Kim & Paik, 2016; Lau & Jong, 2023). Concerns at this stage are related to feelings of anxiety, doubt about the knowledge required, or the uncertainty of the situation he or she is about to face (Rismiati, 2012). The teacher begins to experiment with innovation and implement changes. They deal with task organization and time management to implement the innovation. Teachers at this stage are concerned with the workflow, resources, and overall management of the innovation. They are concerned with being efficient and doing their best with the innovation (Chen & Jang, 2014; Hall & Hord, 2015; Hatley, 2011). This is the Management stage. Once the problems of the task have been solved, the teacher can now focus on the impact of the change, asking questions such as "Do my students like this innovation?" and "Is there anything that could work better?" (Hall & Hord, 1987). At this stage, the teacher considers how the change is benefiting learners, examines the advantages, and makes modifications to the innovation to improve its performance. Concerns evolve on their own and begin to focus on learners, how change can impact learners' learning, and how they can ensure their practices improve (Hatley, 2011). This is the Consequence stage. Once the teacher is confident about the relevance of the innovation, they can then consider possible ways to refine it to ensure a greater impact on learners. Furthermore, some teachers may attempt to observe how others are utilizing the innovation and seek to collaborate with colleagues to maximize its potential (Chen & Jang, 2014). This is the collaboration stage. Ultimately, the teacher begins to ask new questions, such as "Are they learning what they need to know?" and "Is there anything that would work even better?" (Hall & Hord, 2015). Indeed, at this stage, people are confident and well informed enough to make significant changes to the innovation that they see as improvements. These people sometimes feel that something is wrong with the innovation and want to change it, or they may consider that something else is better (Fan & Zhao, 2023). This is the Refocusing stage.

2.2. The Stages of Concerns Questionnaire (SoCQ)

To measure these concerns, Hall and colleagues have developed a Stages of Concerns (SoC) questionnaire with seven 5-item dimensions (Hall et al., 1977). Each dimension assessed the concerns of each stage. The first version had a total of 35 items. Since its publication in 1977, the SoC has been utilized in hundreds of studies across various fields of education and research. The items have been continually modified in line with the characteristics of the application fields and the nature of the innovations and reforms being investigated.

The Stages of Concerns Questionnaire (SoCQ) has undergone several adaptations and refinements over time on three main levels: (1) Contextual Adaptations: The SoCQ has been adapted to various educational contexts, encompassing primary and secondary education, higher education, and even healthcare settings (Armer et al., 2004; Christou et al., 2004; Yan & Deng, 2019), (2) Cultural Adaptations: It has been modified to fit different cultural contexts. Research based on SoCQ has been carried out in North and South America (Armer et al., 2004; Cardoza & Tunks, 2014; Fischer et al., 2019; Lochner et al., 2015; Longyhore, 2020; Meunier, 2010; Murza & Ehren, 2015), Europe (de Vocht et al., 2017; Dörrenbächer-Ulrich et al., 2020; Goktalay & Cangur, 2008; Wiedemann et al., 2017), Africa (Baytar et al., 2023; Dele-Ajayi et al., 2021; Makwinya et al., 2022; Sackstein et al., 2022; Trabelsi & Naceur, 2025), the Middle East (Al-Furaih & Al-Awidi, 2020; Alshammari, 2000), Asia (W.-R. Chen, 2023; Y.-H. Chen & Jang, 2014; Fan & Zhao, 2023; Yan & Deng, 2019) and Australia (Forlin et al., 2008; Thompson et al.,

2020), and (3) Innovation Adaptations: The SoCQ has been used to evaluate concerns about a range of innovation adoptions, including different educational technologies (i.e. mobile-assisted language learning, e-learning platforms, serious games, robotics and the employment of AI in the classroom), curriculum and pedagogical changes (Alshammari, 2000; Byrne & Prendergast, 2020; Christou et al., 2004; Darr, 1985; Gokcek & Baki, 2013; Makwinya et al., 2022).

The latest versions of SoCQ are based on five stages rather than seven. In fact, the researchers have demonstrated that merging the "Information/Personal" and "Consequence/Collaboration" stages, and reducing the number of items, yields better psychometric properties. Initially designed with 35 items, new versions of the SoC contain only 22. Since the work of Cheung et al. (2001), most adaptations use 22 items spread over 5 stages, respectively "Awareness" (4 items), "Informational/Personal" (5 items), "Management" (4 items), "Consequence/Collaboration" (4 items) and "Refocusing" (5 items). All items are scored on a 0 -7 Likert-type scale. A comparison of the psychometric qualities of the different versions led us to choose Fisher's version (2019). Table 1 illustrates the statistical properties of the confirmatory factor analyses (CFA) of the six most frequently used versions of the SoC questionnaire.

Table 1. Fit of alternative models

Model	Items	χ^2	*df*	χ^2/df	RMSEA	TLI	CFI
7 subscales (Hall et al., 1978)	35	4798	539	8.9	.082	.76	.79
5 subscales (Bailey & Palsha, 1992)	15	1033	80	12.9	.092	.77	.83
5 subscales (Shotsberger & Crawford, 1996)	27	3523	314	11.21	.092	.74	.77
5 subscales (Cheung et al., 2001)	22	1428	132	10.81	.087	.85	.87
5 subscales (Meunier, 2010)	22	799	366	2.18	.08	.86	.83
5 subscales (Fischer et al., 2019)	22	290	131	2.12	.056	.911	.95

3. Method

3.1. Research Design

For the purposes of the cross-cultural adaptation, we adopted the recommendations of the International Test Commission (2017) and the APA standards (American Educational Research Association et al., 2014) which were adapted to the context of our study (Gana et al., 2021). The process of cross-cultural adaptation is presented in Figure 1.

Firstly, to obtain the necessary permission from the holder of the intellectual property rights relating to the Stages of concerns questionnaire, we sent an electronic request to The American Institutes for Research (AIR) on 27 February 2023. We received authorization on 28 February 2023.

Secondly, a translation from English to Arabic was performed by two translators who are both native speakers of Arabic and fluent in English. They are also experts in educational technologies. It was requested of both translators to translate conceptually rather than literally. Then, the back translation was carried out by an English teacher who had not participated in the first step and not informed of the study purpose. Next, to obtain a pre-final Arabic version, the original and back-translated versions were thoroughly reviewed and compared for semantic, experiential, and conceptual equivalence. Finally, a sample of 67 primary school teachers tested the Arabic pre-final version to ensure that instructions and item content were understandable and easy to answer. The used questionnaire employs a for-point Likert-type response scale from "Not at all clear" to "Absolutely clear". The results showed that the instructions and the 22 items were well understood by teachers. No changes were necessary after this pretest (See Appendix I).

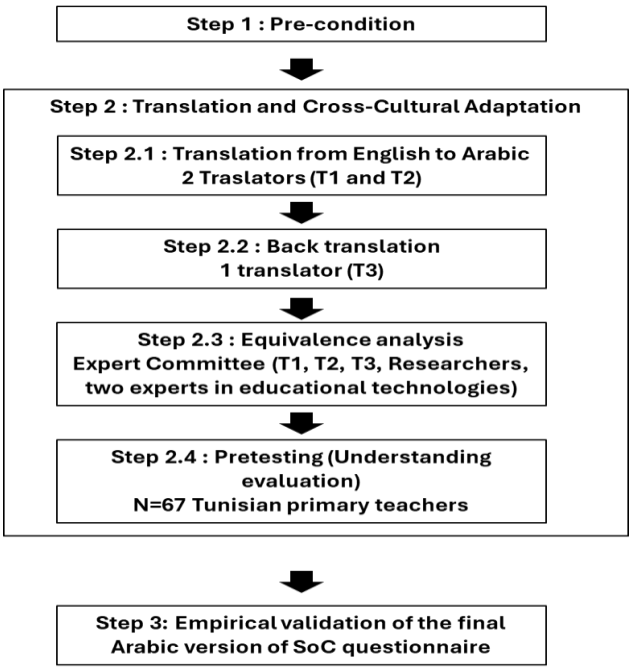

Figure 1. The cross-cultural adaptation process of the SoCQ to Arabic

3.2. Sample

In total, 1110 in-service Tunisian primary school teachers belonging to 24 states participated in this study (269 male and 841 female). All were volunteers who took part anonymously and confidentially. They teach several disciplines (Science, Arabic, French, English, Biology, Technology).

3.3. Data Analysis

The ITC Guidelines for Translating and Adapting Tests (ITC, 2017) suggest providing statistical evidence to establish the construct equivalence of the new adapted version. We conducted three majors' analysis.

To examine the reliability of the scale, Cronbach's α, McDonald's ω, and Gutmann's λ6 were used to evaluate the internal consistency of the sub-scales and the overall score of the instrument.

To investigate the factor structure of the scale, a confirmatory factor analysis (CFA) of the first order with maximum likelihood estimation was conducted. We used various indices to evaluate the model's fit, based on the literature's recommendations (Gana et al., 2021; Kline, 2023): chi-square, chi-square/degrees of freedom, goodness-of-fit index (GFI), goodness-of-fit index (AGFI), comparative fit index (CFI), Tucker–Lewis index (TLI), Root mean square error of approximation (RMSEA) and Root mean square residuals (RMSR). In order to perform the CFA, we carried out some preliminary analysis: (1) checking the rate of missing values, which must not exceed 5% to avoid biasing the results (Tabachnick & Fidell, 2007),(2) examine the outliers, (3) check the variables' normality using the Skewness and Kurtosis indices, (4) check the variables' multinormality using the Mardia test, (5) check the ratio between the extremes of the variances. Therefore, we analyzed the convergent and discriminant validity of the scale by evaluating the Standardized Factor Loading, the Composite Reliability (CR), the Average Variance Extracted (AVE), and the Maximum Shared Variance (MSV) (Fornell & Larcker, 1981).

In line with Kline's (2023) recommendations, model refinement was conducted to improve overall fit by reducing the chi-square statistic. Modification Indices (MIs) were examined, and additional error covariances were specified only when theoretically justified—specifically, when items belonged to the same latent construct and exhibited high semantic or structural similarity.

Finally, we performed a multi-group confirmatory factor analysis (MGCFA) to assess measurement invariance across genders and seniority, which is examined from three angles: configurational, metric and scalar invariance (Campbell et al., 2008; Fornell & Larcker, 1981; Xu & Tracey, 2017)(Campbell et al.,

2008; Fornell & Larcker, 1981; Xu & Tracey, 2017). To perform all these analyses, we used the software programs JASP (0.18.3) and AMOS (version 25, IBM, Armonk, NY, USA).

4. Results

4.1. Sample characteristics

The study sample was composed mostly of female participants (75.76%). The proportion of teachers with a bachelor's degree or higher is 75%. Teachers working in an urban area account for 60% of the population. Thirty-two percent of respondents declared a career span of less than 5 years. As regards seniority in teaching, we proposed three choices: less than 6 years, between 6 and 15 years, and more than 16 years. The respective answers were 32.79%, 35.85% and 31.35%. See Table 2 for the distribution of the sample by gender and seniority.

Table 2. Distribution of the study population by gender and seniority

Gender	Seniority			Total
	<6	[6..15]	>15	
Male	67	66	136	269
	24.907%	24.535%	50.558%	
Female	297	332	212	841
	35.315%	39.477%	25.208%	
Total	364	398	348	1110
	32.793%	35.856%	31.351%	

4.2. Internal Reliability

To examine the reliability of the scale, Cronbach's α, McDonald's ω, and Gutmann's λ6 were used to evaluate the internal consistency of the overall score of the instrument as well as the five sub-scales. Cronbach's coefficient α for the entire Arabic version of SoCQ (ASoCQ) is acceptable at 0.804. Furthermore, the value of the McDonald's ω and the Gutmann's λ6 coefficients of the scale are good (McDonald's ω=0.754, Gutmann's λ6=0.905). The findings reported in Table 3 show that all five sub-scales have good internal consistency coefficients.

Table 3. Score Ranges and Internal Reliability Coefficients for the ASoCQ subscales

Subscales	McDonald's ω	Cronbach's α	Guttman's λ6	Mean	SD	Score range
Awareness	0.803	0.802	0.760	8.071	5.133	4 to 28
Informational/Personal	0.908	0.910	0.908	29.329	6.980	5 to 35
Management	0.843	0.839	0.808	17.428	6.912	4 to 28
Consequence/Collaboration	0.882	0.884	0.854	21.959	6.402	4 to 28
Refocusing	0.928	0.929	0.917	26.556	9.027	5 to 35

4.3. Construct validity: Confirmatory factor analysis

The CFA was adopted on the assumption that the structure of the short version of the 22-item Stages of Concern questionnaire was empirically validated by several studies (Bailey & Palsha, 1992; Cheung et al., 2001; Fischer et al., 2019; Hall et al., 1978; Meunier, 2010; Shotsberger & Crawford, 1996) (Bailey & Palsha, 1992; Cheung et al., 2001; Fischer et al., 2019; Hall et al., 1978; Meunier, 2010; Shotsberger & Crawford, 1996). Before proceeding with the CFA, assumption tests were carried out to ensure the data were suitable for analysis (Kline, 2023).

The rate of missing values in our data does not exceed 1%. The use of the Maximum Likelihood method to carry out the CFA requires the absence of missing data. We have therefore adopted the data imputation method to overcome this problem (Kline, 2023). To verify the presence of outliers, we used the Mahalanobis distance, which revealed no major violations in the multivariate extreme outliers. Skewness index analysis reveals an acceptable asymmetry, ranging from -1.730 to +1.729 (considered

acceptable between -3 and +3). Likewise for Kurtosis scores, they vary between -1.339 and +2.248 (acceptable between -10 and +10) (Kline, 2023; Mhiri, 2019). The Mardia test is used to evaluate the multivariate normality of the data. It is a multivariate generalization of the Kurtosis test. According to Kline (2023), a multivariate Kurtosis score greater than 5 is an indicator of multinormality. In our case, this score is 8.636, well above 5. We can therefore confirm multivariate normality, just as we did for univariate normality. Kline (2023) suggested that the ratio of maximum to minimum variance should be less than 10. In our case, the highest variance is 4.669 and the lowest is 2.306. The ratio is 2.024, which is less than 10. These analyses validated the assumptions to conduct CFA. Table 4 shows these findings.

Table 4. Assessment of normality

Fisher's version items	Mean	Variance	Skewness	Kurtosis
Q1	2.213	2.768	1.105	0.066
Q6	1.949	2.518	1.631	1.641
Q11	1.940	2.340	1.658	1.936
Q17	1.970	2.895	1.729	1.865
Q14	5.713	2.984	-1.350	0.876
Q16	5.821	2.789	-1.502	1.358
Q20	5.823	2.765	-1.528	1.490
Q21	5.982	2.306	-1.690	2.247
Q22	5.991	2.462	-1.734	2.247
Q2	4.369	4.190	-0.326	-1.110
Q3	4.054	4.515	-0.136	-1.301
Q7	4.112	4.602	-0.124	-1.339
Q13	4.893	4.395	-0.608	-0.979
Q8	5.007	3.944	-0.626	-0.877
Q15	5.614	3.242	-1.198	0.294
Q9	5.580	3.441	-1.228	0.327
Q15	5.758	3.239	-1.420	0.861
Q10	4.911	4.669	-0.706	-0.935
Q19	5.329	4.039	-1.083	-0.146
Q4	5.508	3.862	-1.251	0.252
Q12	5.432	4.121	-1.182	0.033
Q18	5.376	4.330	-1.112	-0.170
Multivariate				8.636

To assess the model, we first analyze the chi-square value. This value was statistically significant $x2(192) = 484.471$, $p<0.001$). The chi-square test is very sensitive to the number of observations (Kline, 2023). That is why this result was expected, given the large sample size. The significant p-value does not necessarily indicate that the data do not match the model well. So, the model fit was assessed with the following indices: the chi-square/degree of freedom ($\chi2/df$) = 2.523, the goodness of fit index (GFI = 0.962), the goodness of fit index (AGFI = 0.950), the Tucker–Lewis index (TLI = 0.978), the comparative fit index (CFI = 0.982), the root mean square error of approximation (RMSEA = 0.037) and the standardized root mean square residual (SRMR = 0.0367). The 22 items of the ASoC demonstrated strong factorial loadings overall. Item 13 yielded an acceptable score (0.56 > 0.55), while Item 1 stood out with a notably high value (0.64 > 0.63). The remaining 20 items exhibited excellent loadings, all exceeding 0.71, underscoring the robustness of the scale. Table 5 presents the model's fit indices alongside their critical thresholds. These results confirm that the Arabic version of the SoC-22 aligns well with Fisher's model and adheres to the theoretical framework (see Figure 2).

Table 5. Model fits of ASocQ

Indices	χ^2	df	χ^2/df	GFI	AGFI	TLI	CFI	RMSEA	SRMR
ASoC	484.471	192	2.523	0.962	0.950	0.978	0.982	0.037	0.0367
Excellent			<3	>0.95	>0.90	>0.95	>0.95	<0.05	<0.05
Acceptable			<5	>0.90	>0.85	>0.90	>0.90	<0.08	<0.08

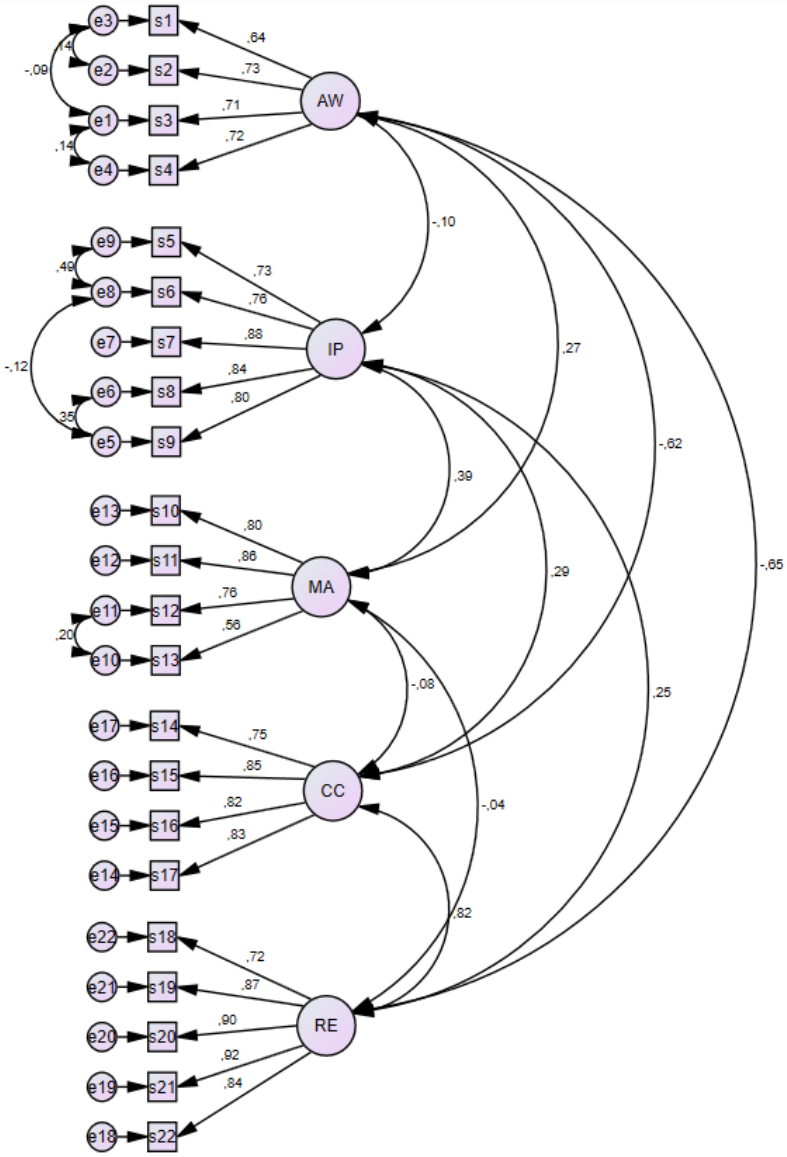

Figure 2. Final confirmatory factor analysis (CFA) model of the Arabic version of SoC-22 for Tunisian primary school teaching (N=1110)

4.4. Convergent and Discriminant Validity

Table 6 displays Model Validity Measures. Composite reliability (CR) for all items is above 0.70, indicating good reliability. The AVE (Average Variance Extracted) is also greater than 0.50 for the four dimensions Informational/Personal, Management, Consequence/Collaboration, and Refocusing, indicating excellent convergent validity (Hair et al., 2023; Hu & Bentler, 1999). For the Awareness dimension, the AVE is equal to 0.476, which is below the threshold of 0.5.

To establish discriminant validity, we employed the criteria proposed by Fornell & Larcker (1981) and Hu and Bentler (1999). The results show acceptable validity. We only identified two weaknesses: (1) The AVE for Awareness sub-scale is less than the MSV, and (2) the square root of the AVE for Consequence/Collaboration is less than its correlation with Refocusing. Malhotra and Dash (2011) argue

that AVE is often too strict (Malhotra & Dash, 2011) and that reliability can be established through CR alone. In this way, we can confirm that the reliability of the Arabic version of SoC-22 among Tunisian primary school teachers is satisfactory.

Table 6. Model Validity Measures

	CR	AVE	MSV	MaxR(H)	AW	IP	M	CC	RE
D1	0.781	0.472	0.552	0.784	0.687				
D2	0.893	0.626	0.236	0.901	-0.043	0.791			
D3	0.858	0.603	0.236	0.872	0.250**	0.486***	0.777		
D4	0.856	0.597	0.668	0.858	-0.743***	0.236**	-0109	0.773	
D5	0.912	0.677	0.668	0.929	-0.651***	0.201**	-0.004	0.817***	0.823

4.5. Measurement Invariance: Multigroup Confirmatory Factor Analysis

In our study, measurement invariance is examined under three headings: configurational, metric, and scalar invariance (Ansong et al., 2016; Campbell et al., 2008; Xu & Tracey, 2017). We investigated the generalizability of the final five-factor model across genders and seniority. First, we assessed the adequacy of the final model for the three categories of teachers, according to their seniority (0..5; 6..15 and 16+ years) individually, as well as for men and women. All five models obtained a good fit with the data. Table 7 shows all MGCFA results.

Table 7. Fit indices of the five MGCFA models

Indices	χ^2/df	AGFI	TLI	CFI	RMSEA	SRMR
Male-only sample	1.799	0.865	0.949	0.957	0.055	0.0506
Female-only sample	2.149	0.944	0.979	0.982	0.037	0.0389
Seniority1-only sample	1.600	0.909	0.968	0.973	0.041	0.0449
Seniority2-only sample	1.967	0.893	0.959	0.966	0.049	0.0470
Seniority3-only sample	1.767	0.895	0.970	0.974	0.047	0.0447
Excellent	<3	>0.90	>0.95	>0.95	<0.05	<0.05
Acceptable	<5	>0.85	>0.90	>0.90	<0.08	<0.08

Seniority1 :[0..5] ; Seniority2 : [6..15] ; Seniority3 : >15

Next, we evaluated configurational invariance by assessing measurement models for the two variables gender and seniority. The gender and seniority-based models showed adequate fit: (1) (χ 2 = 772.454; df=401; χ2/df=1.926; GFI=0.941; AGFI=0.925; CFI=0.977; RMSEA=0.029; SRMR=0.0510) and (2) (χ2= 1240.042; df=654; χ2/df=1.896; GFI=0.908; AGFI=0.893; CFI=0.962; RMSEA=0.028; SRMR=0.0737). This indicates that each group is represented by the same number of factors, which are defined by the same variables. Next, we evaluated the Metric Invariance by constraining the factor loadings of all manifest variables. The fit of the metric invariance was adequate for gender (χ 2 = 802.098; df=416; χ2/df=1.928; GFI=0.939; AGFI=0.926; CFI=0.976; RMSEA=0.029; SRMR=0.0629) and for seniority (χ2 = 1272.438; df=669; χ2/df=1.902; GFI=0.905; AGFI=0.893; CFI=0.961; RMSEA=0.029; SRMR=0.0656). Next, we compared the metric invariance models with gender and seniority configural invariance models: for gender variable (Δχ2=29.644; Δdf=15; p=,0.107; ΔCFI<0.01; ΔRMSEA<0.01) and for seniority (Δ χ2=32.396; Δdf=15; p=,0.016>0.01; ΔCFI<0.01; ΔRMSEA=0.01). These comparisons yielded statistically nonsignificant results suggesting gender and seniority metric invariance.

Finally, we tested scalar invariance to determine whether item intercepts were similar between gender and seniority groups. For both gender and seniority, the scalar invariance's overall model fit proved suitable (For gender : χ2=954.193; df=445; χ2/df=2.144; GFI=0.921; AGFI=0.911; CFI=0.968; RMSEA=0.032; SRMR=0.0642 and for seniority : χ2=1396.114; df=698; χ2/df=2.000; GFI=0.897; AGFI=0.888; CFI=0.955; RMSEA=0.030; SRMR=0.0665). Finally, we compared the scalar invariance models with gender and seniority metric invariance models. These comparisons yielded statistically nonsignificant results suggesting gender invariance (For gender: Δχ2=152.095; Δdf=29; p=0.013>0.01; ΔCFI<0.01; ΔRMSEA<0.01). However, the seniority comparison yielded statistically significant results (Δχ2=32.396; Δdf=15; p=,006; ΔCFI<0.01; ΔRMSEA<0.01), suggesting seniority scalar non-invariance. Multigroup confirmatory factor analysis (MGCFA) results are sufficiently robust to support

configurational, metric, and scalar invariance based on the amount of gender. For seniority, only scalar invariance has not been established.

5. Discussions

The primary objective of this study was to translate and culturally adapt the Stages of Concerns (SoC) questionnaire into Arabic and validate its psychometric properties among Tunisian primary school teachers. The results of our study provide strong evidence supporting the reliability and validity of the Arabic version of the SoC questionnaire in the Tunisian context. Our findings indicate that the ASoCQ demonstrates excellent internal consistency across all five subscales, with Cronbach's alpha coefficients ranging from 0.802 to 0.929. By comparing the scores of our adaptation with those of Cheung (2001) and Fisher (2019), the ASoCQ exhibits the highest internal consistency among the three versions, followed by the Fisher version (Cronbach's alpha values ranging from 0.75 to 0.84), and then the Cheung version (Cronbach's alpha values ranging from 0.67 to 0.77).

The confirmatory factor analysis (CFA) results also show a good fit for the five-factor model, with indices such as CFI (0.982), TLI (0.978), and RMSEA (0.037) indicating robust construct validity. A comparison of the ASoCQ scores with those in Table 1 illustrates that it has displays excellent model fit indices, comparable to the Fischer et al. (2019) version, and significantly better than the other versions. The Fisher version has the best fit with a χ^2/df (Chi-square/degrees of freedom) of 2.12 followed by Meunier's adaptation (2010) with a χ^2/df=2.18. The other models have much higher χ^2/df values, indicating poorer fit. The ASoCQ questionnaire has an RMSEA (Root Mean Square Error of Approximation) of 0.037, which is excellent (less than 0.05 is considered excellent). Fischer et al. (2019) also have a good RMSEA of 0.056. The other models have RMSEA values above 0.08, indicating a poorer fit. For the TLI (Tucker-Lewis Index) and CFI indices, the findings are similar.

In terms of convergent and divergent validity, our research is the first to explore these indicators thoroughly. Other studies have limited their focus to analyzing the factor loadings of the items and eliminating those with scores below 0.4. While the analysis of convergent validity showed good results, the analysis of divergent validity using the AVE revealed two weaknesses. Malhotra and Dash (2011) argued that AVE is a very strict analysis. We believe that this is why previous studies are limited to analyzing factor loading scores (Cheung et al., 2001; Fischer et al., 2019; Meunier, 2010; van den Berg, 1981).

The Multi-Group Confirmatory Factor Analysis (MGCFA) was conducted to assess the measurement invariance of the ASoCQ across different groups, specifically gender and seniority. None of the SoC adaptations reported in the published works have featured MGCFA analyses. The confirmation of configurational, metric, and scalar invariance across gender and seniority groups validates the ASoCQ as a reliable and robust tool for assessing teachers' concerns regarding the adoption of educational technologies, suggesting that the questionnaire is equally applicable to different subgroups within the Tunisian primary teacher population. This means that researchers can use this tool in future studies involving diverse teacher populations in Tunisia. However, due to the lack of invariance in seniority, the uncritical use of the ASoCQ in other contexts is hazardous.

The rigorous process of cross-cultural adaptation, following the ITC guidelines, ensured that the Arabic version of the SoC questionnaire is not only linguistically accurate but also culturally relevant. The results of the ASoCQ have far-reaching implications for educators, administrators, policymakers, researchers, and technology developers.

In the Tunisian context, the Arabic version of the SoC questionnaire serves as a culturally relevant instrument for identifying teachers' specific concerns regarding the adoption of educational technologies. This localized insight enables a more precise response to the challenges educators face. Consequently, professional development programs can be tailored to address these concerns directly, enhancing their effectiveness and supporting the integration of new technologies into classroom practice.

Moreover, the findings can inform policy development, guiding decision-makers in crafting strategies that align with teachers' needs at each stage of concern. School administrators can also leverage the results to allocate resources more strategically—whether in training, technical support, or infrastructure—based on where teachers experience the most difficulty (Dele-Ajayi et al., 2021; de Vocht et al., 2017; Jesmin et al., 2024; Lin et al., 2025)

Beyond Tunisia, the successful adaptation and validation of this tool demonstrate its potential for broader application across Arabic-speaking regions. Such efforts could foster a deeper understanding of teacher concerns throughout the Arab world and support regional initiatives aimed at improving educational technology adoption. For instance, collaborative training programs, digital resources, and support networks could be developed to address the shared challenges identified through this instrument.

6. Limitations

This study has limitations that require discussion. The first study drawback is that we were unable to use a probabilistic sampling technique due to both administrative and logistical reasons. We attempted to match the characteristics of the population of primary school teachers in Tunisia according to the gender and school zone variables. We employed a volunteer sampling technique, recruiting participants until they matched the original population in terms of gender and school zone.

Secondly, we were unable to perform the test-retest reliability analysis of the Arabic version of the SoC questionnaire (ASoCQ), as recommended by the International Test Commission (ITC) guidelines for cross-cultural adaptation and validation, and Ganna (2021). In fact, without test-retest reliability, it's unclear whether the ASoCQ can consistently measure teachers' concerns over time, especially since perceptions and attitudes toward technology adoption may fluctuate.

Thirdly, while the ASoCQ is validated in the Tunisian context, its applicability to other Arabic-speaking regions or different educational contexts may require further validation and adaptation. In addition, scalar invariance across seniority groups was not fully established, which could affect the comparison of concerns across teachers with varying levels of experience.

Finally, although the translation and cultural adaptation followed rigorous guidelines, some cultural or contextual nuances might not have been fully captured, potentially impacting the interpretation of specific questionnaire items.

7. Conclusion

This study successfully translated and culturally adapted the Stages of Concerns (SoC) questionnaire into Arabic, validating its psychometric properties among Tunisian primary school teachers. The Arabic version of the SoC questionnaire (ASoCQ) demonstrated excellent internal consistency across all five subscales and proved to be both linguistically accurate and culturally appropriate. The confirmatory factor analysis (CFA) results showed a good fit for the five-factor model, indicating strong construct validity. The Multi-Group Confirmatory Factor Analysis (MGCFA) confirmed the configurational, metric, and scalar invariance of the ASoCQ across genders, as well as configural and metric invariance for seniority groups. This validation suggests that the ASoCQ is equally applicable to different subgroups within the Tunisian primary teacher population, making it a reliable tool for future studies involving diverse teacher populations in Tunisia. The rigorous cross-cultural adaptation process, following the ITC guidelines, ensured that the Arabic version of the SoC questionnaire is both linguistically accurate and culturally relevant. The results have significant implications for educators, administrators, policymakers, and researchers in Tunisia and other Arabic-speaking regions. In Tunisia, the ASoCQ offers a culturally relevant tool to help teachers understand their specific concerns regarding the adoption of educational technologies. This understanding can help address the unique challenges faced by teachers in Tunisia. For other Arabic-speaking regions, the successful adaptation and validation of the ASoCQ in Tunisia demonstrate the feasibility of adapting similar tools for these contexts. This can lead to a broader understanding of teacher concerns across the Arab world and support regional efforts

to improve educational technology adoption. Regional initiatives, such as training programs, online resources, and support networks, can be developed to address the concerns identified by the ASoCQ. Overall, this study contributes to the field of educational change by providing a validated tool for assessing teachers' concerns in the context of technology adoption.

Statement of Researchers

Researchers' contribution rate statement:
Zied Trabelsi: Conceptualization, methodology, software, investigation, validation, writing- original draft preparation, writing - review & editing, data curation. **Abdelmajid Naceur:** Supervision, Project administration, Methodology, Data curation, validation, Writing – review & editing, formal analysis.
Conflict statement:
The authors declare that they have no conflict of interest.
Data Availability Statement:
The dataset of our study is available on the Mendeley database. https://data.mendeley.com/datasets/k64vmwz5k3/2
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Presentation(s) or Awards at a meeting:
This research extends a doctoral dissertation study of the first author under the supervision of the second author.
Ethical Considerations:
All participants in our study were volunteers, participating anonymously and confidentially. Before conducting the questionnaire, we obtained permission from the authors of the original questionnaire and from the Tunisia Education Department. The study protocol was in-depth reviewed and received full approval from the ethical committee of the ECOTIDI research unit, Tunis, Tunisia.
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9. Appendix I

Fisher's version items	ASoCQ items
Stage 1: Awareness	
Q1: I do not even know what is different about the AP redesign	أنا لا أعلم شيئا عن استخدام التكنولوجيا في التعليم.
Q6: I am not concerned about the AP redesign	أنا غير مهتمّ/ة باستخدام التكنولوجيا في عملي حاليّا.
Q11: I am preoccupied with things other than the AP redesign	أنا منشغل/ة باهتمامات أخرى لا علاقة لها باستخدام التكنولوجيا في التعليم.
Q17: I am not interested in learning about the AP redesign	في الوقت الحاضر، أنا غير مهتمّ بتعلّم استخدام التكنولوجيا في التعليم.
Stage 2: Informational/Personal	
Q14: I would like to know what the AP redesign will require in the immediate future	أريد معرفة ما سيتطلّبه منّي استخدام التكنولوجيا في عملي على المدى القريب (الوقت، المهارات، الأجهزة الرقميّة، الخ).
Q16: I would like to have more information on the time and energy commitments the AP redesign will require	أريد الحصول على معلومات أكثر حول الالتزامات التي يتطلّبها منّي استخدام التكنولوجيا في عملي على مستوى الوقت والمجهود.
Q20: I would like to know how my role will change with the AP redesign	أودّ أن أتبيّن كيف سيتغيّر دوري عند استخدام التكنولوجيا في عملي.
Q21: I would like to know how the AP redesign is better than the current course/exam	أريد معرفة أفضليّة استخدام التكنولوجيا في التعليم عمّا يتوفّر لدينا حاليّا من طرائق تعليميّة.
Q22: I would like to know how the redesigned AP is different than the current AP	أرغب بمعرفة كيف يمكن لاستخدام التكنولوجيا أن يُغيّر من طريقتي في التدريس.
Stage 3: Management	
Q2: I am concerned about not having enough time to organize myself each day	أشعر بالانشغال إزاء عدم توفّر الوقت الكافي لتنظيم التعلّمات في حالة استخدام التكنولوجيا في عملي
Q3: I would like to know how to effectively meet the obligations of the revised AP	أنا قلق/ة إزاء التّضارب بين اهتماماتي باستخدام التكنولوجيا في التعليم من جهة ومسؤوليّاتي من جهة أخرى.
Q7: I am concerned about my inability to manage all that the AP redesign requires	أنا قلق/ة من عدم قدرتي على إدارة كل ما يتطلّبه استخدام التكنولوجيا في التعليم (الوقت، المهارات التكنولوجيّة، الخ.).
Q13: I am concerned about time spent on non-academic problems related to the AP redesign	أنا قلق/ة إزاء الوقت الذي أقضيّه في التّعامل مع المشاكل التقنيّة (عطب في جهاز الحاسوب أو العرض، الخ) أو اللوجستية (توفير الأجهزة في المدرسة، توفّر الربط بالانترنات، الخ) حين استخدم التكنولوجيا في عملي على حساب الوقت المخصّص للتعلّمات.
Stage 4: Consequence/Collaboration	
Q8: I would like to familiarize others with the progress of the AP redesign	أرغب في أن أُطلع أطرافا آخرين (في مجال التربية) على آخر المستجدّات في مجال استخدام التكنولوجيا في التعليم وتأثيرها الإيجابي على المتعلّمين.
Q15: I would like to coordinate my teaching with others to maximize the AP redesign's effects	أرغب في تنسيق جهودي مع الآخرين للاستفادة أكثر من استخدام التكنولوجيا في التعليم.
Q9: I am concerned about evaluating my impact on students	أنا مهتمّ/ة بتقييم مدى تأثير استخدامي للتكنولوجيا على المتعلّمين.
Q15: I would like to develop working relationships with other teachers implementing the AP redesign	أرغب في تطوير علاقات عمل مع المدرّسين الذين يستخدمون التكنولوجيا في التعليم من داخل أو من خارج مؤسّستي.
Stage 5: Refocusing	
Q10: I would like to revise the AP redesign's approach	أرغب في مراجعة وإعادة النظر في استخدام التكنولوجيا في عملي.
Q19: I would like to use feedback from students to change the AP redesign	أرغب في استغلال ملاحظات المتعلّمين لتغيير وتطوير استخدام التكنولوجيا في عملي.
Q4: I am concerned about revising my implementation of the AP course	أرغب في مراجعة المقاربة البيداغوجيّة لاستخدام التكنولوجيا لتحسينها وتعزيز فاعليّتها.
Q12: I would like to modify our implementation of the AP redesign based on the experiences of our students	أريد أن أعدّل طريقة استخدامي للتكنولوجيا بناء على تجارب المتعلّمين معها لتتناسب أكثر مع معارفهم وانتظاراتهم.
Q18: I would like to determine how to supplement, enhance, or replace the AP redesign	أريد أن أحدّد كيفيّة تطوير وتحسين أو استبدال التكنولوجيا بطرق حديثة أخرى أكثر نجاعة.