

Differential Item Functioning (DIF) of the Arabic Version of the SONTUS

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Abstract

The objective of this study was to examine the function of the items on the Arabic version of the Social Networking Time Use Scale (SONTUS) using Differential Item Functioning (DIF) across groups of university students in SA (i.e., males and females at UQU). The findings of this study indicated that some of the items in the Arabic version of the SONTUS functioned differently across male and female students in SA. University faculty and administrators in Saudi Arabia as well as in the Arabic world can benefit from understanding students use of SNS.

Keywords:

Social Network, Psychometric Properties, IRT, DIF, Measurement.

1. The purpose of the Study:

The purpose of this study was to examine the items of the Arabic version of the SONTUS in order to detect Differential Item Functioning (DIF) across groups of university students in term of the amount of time they spend using SNSs. These groups included male and female students at UQU. The goal of using DIF was to test the hypothesis that there is no difference in item functioning between male and female Saudi students on time of using SNSs. DIF occurs when there are different probabilities of choosing an item between two or more groups with the same latent ability level (Boone, Staver, & Yale, 2013). In this study, Rasch Analysis method was used to conduct DIF with the items on the Arabic version of the SONTUS.

The main research question included: (RQ) How do the items on the Arabic version of the Social Media and Academic Performance of Students scale differ by university student group (i.e., gender)? Data in this study were collected through responses to the items on the Arabic version of the SONTUS from Umm Al-Qura University (UQU) students in SA. Students were asked to indicate the amount of the time they spend using SNSs. Results of this study may provide useful information to

help university officials understand patterns of SNS use that may or may not impact academic life specific to male and female students in SA.

2. Theoretical Framework:

The world is becoming an increasingly connected place. According to a report by the global social media analytics firm, We Are Social, 46% of the world's population uses the Internet (Kemp, 2019). Of these individuals, 2 billion actively use social media. Facebook is the most popular social media site, with more than 1.3 billion users. The sheer scope of social media use is dwarfed only by the rapidity of its growth. Pew Research Center, in its social media use report, states that in the past decade, there has been a nearly tenfold jump in social networking site (SNS) use in the United States (US; Perrin & Anderson, 2019). That is, in the US alone, social media use in adults has increased from 7% to a staggering 69% since 2010.

On the other side of the world in SA, heightened interest in technology (relative to other neighboring countries) helped the country to be one of the first Arab nations in the Middle East to embrace social media. Social media gained a foothold in SA in 2007 when an unknown number of Saudis began using social media. This small group of Saudi social media "pioneers" primarily used Facebook to communicate with each other and receive news about friends and family members in different regions of the country (Cummins, 2015). Since then, SNS use among Saudis, especially young adults, has increased dramatically, despite the Saudi government's restricted public access to the Internet for cultural and religious reasons.

In Saudi society, Islam plays a significant role in all individuals' lives, which renders complex communication and socialization differences between males and females. Based on Islamic rules, SA applies gender segregation in areas such as education, employment, and occupation. Saudi men and women who are not related usually do not communicate with each other in public places; however,

not all manifestations of gender separation in the Saudi context are related to Islamic rules, but are related to traditions instead. Some gender separation simply reflects cultural values that are forced on one gender by the dominant group in society (Stanger, Alnaghaimshi, & Pearson, 2017). The use of social media in SA, therefore, has been influenced by Islamic values and practice. This influence can clearly be seen in the number of Saudi social media users, where males are the majority (Barr, 2019; Nugal, 2019). Both males and females in SA, however, have the same opportunity to use social media sites and communicate with each other on these sites without restriction (Alkahtani, 2012). A review of the literature on differences between Saudi males and females in their use of social media indicates that the topic has received little attention from researchers.

3. Methods:

3.1. Participants. The sample of this study consisted of 508 undergraduate students from UQU in SA. Of the sample, 273 (53.7%) were males and 235 (46.3%) were females. The age range for both male and female students was between 18 and 26 years old, though most of the students were between the ages of 21 and 23 ($N = 257$; 50.6%). These students were from eight different colleges in five different campuses for UQU.

Table 1: Demographic Characteristics of the study Sample (N = 296)

Variable	<i>n</i>	%
Gender		
Male	165	55.7
Female	131	44.3
Age		
18-20	90	30.4
21-23	155	52.4
24 +	51	17.2
Marital Status		
Never Married	212	71.6
Married	84	28.4
Region of Residence		

Variable	<i>n</i>	%
South	173	58.4
West	114	38.5
Middle	8	2.7
East	1	.3
Campus		
Al-Qunfudah (Makkah)	174	58.8
Al-Lith	65	22.0
Adham	36	12.7
Al-Jumum	13	4.4
Al-Jumum	8	2.7
College		
Shari'ah and Administration	22	7.4
Science and Engineering	9	3.0
Medicine		
Humanities and Educational Sciences	11	3.7
Sciences	23	7.8
University College in Al-Jumum	8	2.7
Al-Leith University Colleges	36	12.2
Adham University Colleg	13	4.4
Al-Qunfudah University Colleges		
	174	58.8

3.2.Procedure:

A link to the scale on Qualtrics was sent to undergraduate students at UQU. The online survey was sent to undergraduate students during the 2019 academic year spring and summer semesters. The link included text that explained the purpose of the study and the voluntary, anonymous nature of the responses, the Arabic version of the SONTUS, and demographic questions. Data from 508 Saudi undergraduate students at UQU were collected through an administration of the Arabic version of the SONTUS.

3.3. Data Analysis.

In this study, Rasch Analysis was used to conduct DIF with the items on the Arabic version of the SONTUS across male and female students. Differential Item Functioning (DIF) is a statistical method used to detect item bias (Linacre, 2012). DIF shows how an item functions across two (or more) comparable groups (e.g., male and female) and typically is used to examine whether the item difficulty is significantly different for the groups when their abilities are equal (de Ayala, 2009).

When conducting DIF analysis, at least two groups, a focal group (i.e., minority group) and a reference group (i.e., majority group), are needed (Boone, Staver, & Yale, 2013). In this study, Rasch Analysis was used to conduct DIF with the items on the Arabic version of the SONTUS. Specific to DIF analysis in Rasch, it compares the item difficulty estimates between two or more distinct groups (e.g., male and female). An item will display DIF when the difference in the difficulty estimates between the groups is significant (Bond & Fox, 2015). Two tests are used to determine if an item has significant DIF: the Mantel-Haenszel test (Mantel & Haenszel, 1959) and the Rasch-Welch test (Satterthwaite, 1946; Welch, 1947). The present study examined DIF between male and female students of their time on the use of SNSs.

3.4. Data Sources/Evidence:

The Arabic version of the Social Networking Time Use Scale (SONTUS) was translated into Arabic by Alhaythami (2020) and it was originally developed by Olufadi in 2015 in English to measure time spent on SNSs by users in Nigeria. The Arabic version of the SONTUS in its final format contained 17 items represented by three factors (i.e., “Use in Academic and Public Places” [N= 7]; “ Use in Stress Relief” [N= 5]; and “ Use in Free Time” [N= 5]) to measure time spent on the use of SNSs by students. The item response format was a 5-point Likert

scale ranging from 1 (Never) to 5 (Always). Higher scores indicated more time spent using SNSs. The results of Alhaythami (2020) showed that the Arabic version of the SONTUS had a good sound of psychometric properties.

4.Results:

4.1.Rasch Analysis: The data of the Arabic version of the SONTUS data were Likert scale responses; therefore, a polytomous Rasch model was run (i.e., the Rating Scale Model [RSM]; Andrich, 1978). A Rasch analysis was conducted on 508 cases and items on each factor separately using Winsteps software (i.e., Three different Rasch analyses were run). Summary statistics for persons, and items for each factor are represented in multiple tables below (See Tables 1 to 4) . No items were removed in the Rasch analysis as all the items contribute well on the scale.

Table 2: Person Summary Statistics for the “Use in Academic and Public Places” Subscale

Statistic	Total Score	Measure	Model Error	Infit		Outfit	
				MNSQ	ZSTD	MNSQ	ZSTD
M	19.90	-.18	.41	1.02	-.20	1.02	-.20
SD	5.30	.86	.06	.72	1.50	.71	1.50
Max	33.00	2.41	1.00	3.83	3.70	3.83	3.70
Min	8.00	-	.37	.02	-4.40	.02	-4.30
		3.11					

Note. Measure = Person Ability Estimate; MNSQ = Mean Square; ZSTD = Standardized Fit; RMSE = Root Mean Square Error. REAL: (1) RMSE = .47, (2) True SD = .71, (3) Person Separation = 1.51, (4) Person Reliability = .69. MODEL: (1) RMSE = .42, (2) True SD = .75, (3) Person Separation = 1.80, (4) Person Reliability = .76. Standard Error (SE) of Person Mean = .04.

Table 3: Item Summary Statistics for the “Use in Academic and Public Places” Subscale (n = 7)

Statistic	al Score	:asure	Model Error	Infit		Outfit	
				MN SQ	ZST D	MN SQ	ZSTD
M	1447.3	.00	.05	1.00	.1	1.02	.3
SD	74.7	.17	.00	.07	1.2	.08	1.4
Max	1565.0	.23	.05	1.11	1.8	1.12	1.9
Min	1345.0		.05	.09	-	.89	-1.9
		-26			1.5		

Note. Measure = Item Calibration Estimated; MNSQ = Mean Square; ZSTD = Standardized Fit; RMSE = Root

Mean Square Error. REAL: (1) RMSE = .05, (2) True SD = 1.5, (3) Item Separation = 3.08, (4) Item Reliability = .90. MODEL: (1) RMSE = .05, (2) True SD = .05, (3) Item Separation = 3.13, (4) Item Reliability = .91. Standard Error (SE) of Item Mean = .06.

Table 4: Person Summary Statistics for the “Use in Free Time” Subscale

Statistic	Total Score	Measure	Model Error	Infit		Outfit	
				MNSQ	ZSTD	MNSQ	ZSTD
M	16.7	.39	.50	1.00	-.10	1.00	-.10
SD	3.40	.84	.08	.76	1.40	.75	1.40
Max	24.00	2.76	.97	3.69	3.00	3.68	3.20
Min	6.00	-2.76	.47	.05	-3.30	.05	-3.30

Note. Measure = Person Ability Estimate; MNSQ = Mean Square; ZSTD = Standardized Fit; SD = Standard Deviation; RMSE = Root Mean Square Error. REAL: (1) RMSE = .57, (2) True SD = .61, (3) Person Separation = 1.06, (4) Person Reliability = .53. MODEL: (1) RMSE = .50, (2) True SD = .67, (3) Person Separation = 1.32, (4) Person Reliability = .64. Standard Error (SE) of Person Mean = .04

Table 5: Item Summary Statistics for the “Use in Free Time” Subscale (n = 5)

Statistic	Total Score	Measure	Model Error	Infit		Outfit	
				MNSQ	ZSTD	MNSQ	ZSTD
M	1717	.00	.05	1.00	.00	1.00	.00
SD	117.90	.28	.00	.05	.90	.06	1.0
Max	1844.0	.35	.05	1.09	1.5	1.10	1.6
Min	1572.0	-.31	.05	.95	-.8	.94	-1.0

Note. Measure = Item Calibration Estimated; MNSQ = Mean Square; ZSTD = Standardized Fit; SD = Standard Deviation; RMSE = Root Mean Square Error. REAL: (1) RMSE = .05, (2) True SD = .25, (3) Item Separation = 5.02, (4) Item Reliability = .96. MODEL: (1) RMSE = .05, (2) True SD = .25, (3) Item Separation = 5.06, (4) Item Reliability = .96. Standard Error (SE) of Item Mean = .13.

4.2. Research (RQ). The DIF analysis was conducted to examine how items in each subscale (i.e., Factor)

functioned across two different groups (i.e., Male and female students). Among the three subscales, items on only two subscales showed DIF (i.e., Use in Academic and Public Places and Use in free time). No DIF found on items in the Use in Stress Relief.

Use in Academic and Public Places” Subscale. The DIF analysis was conducted to examine how the seven items in this subscale functioned across male and female students. In comparing male and female students, the Mantel-Haenszel (1959) Chi-Square statistics indicated that three items (i.e., Items S10, S12 and S16) showed significant DIF (p < .05 for all; see Table 6; Figure 1).

Table 6: Differential Item Functioning (DIF) Comparing Male (n = 273) and Female (n = 235) Students on the “Use in Academic and Public Places” Subscale Items (n = 7)

Item	DIF Measure Male	DIF Measure Female	DIF Contrast	t	df	Mantel-Haenszel χ^2
S1	.14	-.13	.27	2.85*	439	10.07**
S12	.02	.28	-.26	-2.7**	492	5.19*
S15	.09	-.01	-.08	-.84	493	.99
S16	.13	.35	-.23	-2.34*	491	4.82*
S21	-.20	-.34	.14	1.50	493	1.13
S23	-.06	-.22	.14	1.69	493	3.42
S26	.07	.07	.00	.00	493	.15

Note. SE = Standard Error; df = degrees of freedom. *p < .05. **p < .01.

For male students, the DIF measure (i.e., the difficulty in endorsing an item for a group) was lower (i.e., easier) for choosing a response to Items S12 (i.e., “When you are in the class receiving a lecture.”) and S16 (i.e., “When you are in a meeting.”). Item S10 was difficult for male students to endorse. Compared to male, female students found it more difficult to endorse a response for Items S12 and S16 (i.e., reported less frequency of SNS use in this context). Item S10 was the easiest for female

students to endorse (i.e., reported more frequency of SNS use in this context).

“Use in Free Time” Subscale. The DIF analysis was conducted to examine how the five items in this subscale functioned across male and female students. In comparing male and female students, the Rasch-Welch *t*-test and the Mantel-Haenszel χ^2 test indicated that only two items (i.e., Items S10, S12 and S16) showed significant DIF ($p < .05$ for all; see Table 7; Figure 2). Item S3 (i.e., “When you are at a place to repair your car, house appliances, etc.”) was easier for male students to select higher levels of SNS use compared to female students. Conversely, Item S9 (i.e., “When you are in bed about to sleep.”) was easier for female students to select higher frequencies of SNS use compared to males.

Table 6: Differential Item Functioning (DIF) Comparing Male (n = 273) and Female (n = 235) Students on the “Use in Free Time” Subscale Item (n = 5)

Item	DIF Measure Male	DIF Measure Female	DIF Contrast	Rasch-Welch <i>t</i>	<i>df</i>	Mantel-Haenszel χ^2
S1	.28	.11	.17	1.78*	486	2.36
S3	.15	.57	-.42	-4.28***	486	14.80***
S5	.01	.01	.00	.00	486	.05
S7	-.28	-.24	-.04	-.44	486	.12
S9	-.15	-.48	.33	3.25**	485	10.35**

Note. SE = Standard Error; *df* = degrees of freedom. * $p < .05$. ** $p < .01$. *** $p < .001$.

5. Discussion

The purposes of this study were to examine differences in item responses by gender in each subscale in the Arabic version of the SONTUS. The finding of this study indicated that items on only two subscales showed DIF based on the values of both the Rasch-Welch *t*-test and the Mantel-Haenszel χ^2 test. The results suggests that male students are more likely to endorse using SNSs in an academic setting (e.g., in a class or meeting) or while they are in a public place (e.g., outside repairing something) compared to female students who are more likely to use SNSs for academic purposes (e.g., reading for a class) or in their free time (e.g., before sleeping). Previous research that examined the differences between male and female students’ SNS use supports some of the results in the

current study where female students use SNSs more than male students for academic purposes (Alhaythami et al., 2017; Mazman & Usluel, 2011; Levenson, Shensa, Sidani, Colditz, & Primack, 2017).

The difference between male and female students’ use of SNSs stems from the theoretical, natural differences between the two genders. Males and females differ in many aspects related to the use of SNSs, including purposes, motivations, addictions, and attitudes. Researchers have evidenced that differences exist between males and females regardless of country and/or culture (e.g., Alhaythami et al., 2017; Lenhart, 2015; Samuel, Edward, & Edward, 2017; Thompson & Loughheed, 2012). No studies, however, have examined gender differences among males and females in SA for newly developed Arabic-language social media measures. The results of this study may provide helpful information for educational official in the higher education in SA and some Arabic countries that share the same educational system as SA regarding the place and the purposes that SNSs use by both male and female students.

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