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The Factorial Structure and Psychometric Properties of the Abbreviated Technology Anxiety Scale (ATAS) Within the Palestinian Context

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Abstract: This study aimed to examine the factor structure and psychometric properties of the abbreviated Technology Anxiety Scale (ATAS) in the Arabic language, specifically within the Palestinian context. **Methods:** The sample consisted of 792 Palestinian adults recruited through online email campaigns, advertisements, and social media. **Findings:** The ATAS demonstrated strong validity and reliability in measuring technology-related anxiety among Palestinians. Confirmatory Factor Analysis (CFA) confirmed a stable, unidimensional structure for the ATAS. **Conclusion:** The study suggests that future research should further validate the ATAS across different Palestinian groups. Identifying specific sources of anxiety related to digital tools can help health professionals design targeted interventions to reduce technology anxiety, ultimately promoting better mental health, resilience, and well-being in an increasingly digital world.

Keywords: Techno Anxiety, Mental Health, Test Validation, Palestine.

Introduction

Technology anxiety, a complex construct characterized by fear and discomfort in using digital tools, has gained increasing relevance in educational and professional settings due to rapid digitalization (Heinssen et al., 1987; Popoola & Adedokun, 2021). Early assessments, such as the Computer Anxiety Rating Scale (CARS), provided foundational insights by focusing on computer-specific anxieties, showing that individuals with high levels of technology anxiety often exhibit avoidance behaviors and reduced digital engagement (Heinssen et al., 1987; Rahimi & Yadollahi, 2014). However, as digital technologies have evolved beyond computers to encompass mobile devices, online platforms, and e-learning systems, scholars recognized the need for more comprehensive and adaptable measures (Onah et al., 2023; Pfaffinger et al., 2021).

The Abbreviated Technology Anxiety Scale (ATAS) was developed as a concise tool to assess technology-related anxiety across a range of digital platforms. Its relevance is particularly pronounced in academic settings, where technology anxiety can hinder students' engagement, learning outcomes, and overall digital literacy (Abdous, 2019; Razavi et al., 2024). By providing a measure applicable to various technology contexts, ATAS addresses the limitations of previous tools, enabling more effective identification and intervention for technology anxiety among students from diverse cultural and educational backgrounds (Alibak et al., 2019).

Technology anxiety encompasses both psychological and behavioral responses, often arising from a perceived inability to manage or adapt to rapidly evolving technologies. Heinssen et al. (1987) highlighted the discomfort associated specifically with computers, identifying avoidance behaviors as central symptoms of technology anxiety. This concept's evolution parallels studies on subject-specific anxieties, such as math and science anxiety, which similarly impact academic engagement and performance (Carey et al., 2017; Zeidner, 2014).

As digital tools became more integral to daily life, the need arose for broader measures like ATAS, which can account for anxiety related to both competency and adaptability in using diverse technologies (Pfaffinger et al., 2021; Razavi et al., 2024). Studies reveal that technology anxiety now includes a wide range of fears, including concerns about digital incompetence and apprehension toward new tools, which may inhibit users from developing essential digital skills (Popoola & Adedokun, 2021). The conceptualization of technology anxiety has thus shifted to consider how discomfort with technology affects academic and professional success, particularly in environments where digital tools are crucial to daily operations (Hodges et al., 2020; Lowenthal et al., 2015).

The development of ATAS involved refining an initial set of 21 items down to 11, focusing on items that consistently measured technology anxiety across contexts. The validation process for ATAS was rigorous, involving exploratory factor analysis (EFA) and confirmatory factor

analysis (CFA) to confirm a two-factor structure. These two factors—technology change anxiety and technology incompetence anxiety—mirror broader dimensions found in previous anxiety measures, such as the Modified Abbreviated Math Anxiety Scale (m-AMAS) and CARS, which also addressed specific areas of apprehension and competency (Carey et al., 2017; Crocker & Algina, 1986).

The Persian adaptation of ATAS, validated by Razavi et al. (2024), demonstrated high internal consistency (Cronbach's $\alpha = 0.96$) among Iranian students, confirming its applicability across linguistic and cultural boundaries. This cross-cultural validation highlights the flexibility of ATAS, as it aligns with cultural factors that shape technology anxiety differently across global contexts (Popoola & Adedokun, 2021; Rahimi & Yadollahi, 2014). By establishing concurrent validity with established measures like the CAS, the Persian ATAS supports the tool's robustness in capturing technology anxiety, as it aligns with similar constructs in digital stress and apprehension scales (Nunnally, 1978; Taber, 2018).

One of the strengths of ATAS is its adaptability across different cultural contexts. The validation of a Persian version by Razavi et al. (2024) highlights that technology anxiety is not solely dependent on individual factors but is also shaped by cultural and societal influences. This flexibility enables ATAS to capture technology anxiety across diverse educational and technological environments, underscoring its relevance in regions where access to technology may be limited or unevenly distributed (Abdous, 2019; Rahimi & Yadollahi, 2014).

Previous studies (Balogtra & Chakraborty; 2024; Popoola & Adedokun, 2021) further highlight ATAS's utility by confirming its applicability in non-Western settings. These studies reveal that technology anxiety is a global phenomenon, with students and professionals across varying cultural backgrounds experiencing similar anxieties related to digital skills and adaptation. The cross-cultural application of ATAS is particularly valuable for educators and policymakers who aim to improve digital literacy and technology engagement in diverse regions (Hohlfeld et al., 2010; Taber, 2018).

The ATAS validation process followed a structured approach, ensuring that the scale is reliable and applicable across different educational and technological contexts. Wilson et al. (2023) established content validity by consulting with digital education experts to select items that are universally relevant across digital tools. Construct validity was assessed through both EFA and CFA, with fit indices (e.g., RMSEA and CFI) meeting established thresholds, reinforcing the two-factor structure of ATAS as a stable measure (Razavi et al., 2024).

For concurrent validity, ATAS was compared with other well-established anxiety scales, such as the Computer Anxiety Scale (CAS) and the Computer Self-Efficacy Scale. Studies confirmed moderate positive correlations with these scales, indicating that ATAS effectively captures technology anxiety in alignment with broader anxiety constructs (Heinssen

et al., 1987; Pfaffinger et al., 2021). Using Classical Test Theory (CTT) principles, reliability was further confirmed through Cronbach's alpha, ensuring that ATAS provides consistent results across samples (Crocker & Algina, 1986; Rahimi & Yadollahi, 2014). This extensive validation process solidifies ATAS as a reliable measure of technology anxiety, adaptable to various digital environments (Taber, 2018).

As a validated tool, ATAS holds potential for further research into the impact of technology anxiety on digital engagement. The cross-cultural applications of ATAS, as seen in studies by Popoola & Adedokun (2021) & Razavi et al. (2024), underscore its global relevance, providing a foundation for interventions aimed at reducing digital anxiety in educational and professional contexts. Longitudinal research could track the impact of technology anxiety over time, assessing how educational interventions and evolving digital literacy levels influence anxiety (Liu et al., 2023; Lowenthal et al., 2015).

Expanding ATAS to assess responses to specific technologies, such as artificial intelligence or virtual reality, could further enhance its applicability in diverse digital environments. This research would provide insights into how individuals adapt to new technologies and highlight areas where digital support systems may be necessary (Hodges et al., 2020). Furthermore, the broad applicability of ATAS makes it a valuable tool for policymakers and educators striving to create inclusive digital environments that alleviate anxiety and foster technological competency among users (Pfaffinger et al., 2021).

The need to validate the ATAS scale in the Palestinian context is pressing. Beyond serving as an assessment tool for technology anxiety, it could aid health providers in developing intervention protocols to alleviate technology anxiety among Palestinians. Accordingly, the current study aimed to evaluate the psychometric properties of the ATAS scale within the Palestinian context, focusing on its validity, internal consistency, and factorial structure.

Method

Participants and procedures

The current study was conducted in September 2024 and targeted Palestinian adults living in the West Bank of Palestine. The study sample was recruited using online tools. Participants were provided with all information about the study, and signed an informed consent. Participants totaled 792 Palestinian adults: 320 men and 472 women. 59.7 % of participants were located in cities in the West Bank, and the remaining 40.3% were from surrounding villages. 58.5 % of participants had a bachelor's degree, 28.3% had a master's degree, and the remaining 13.2 had a high school diploma degree. To be included the study, participants were required to be 1) Palestinians, 2) free from having mental health disorders, and 3) Native Arabic speakers. The study was approved by An-Najah Institutional Review Board(IRB) before data collection was administered.

Measures

Abbreviated Technology Anxiety Scale The technology anxiety measure was operationalized using the Abbreviated Technology Anxiety Scale (ATAS), an 11-item scale designed to assess an individual's level of technology anxiety. The ATAS asks respondents to indicate their level of agreement with negatively stated sentences about technology (e.g., "I feel technology complicates simple tasks") using a standard five-point Likert scale of agreement: 5. Strongly agree, 4. Agree, 3. Neither Agree nor Disagree, 2. Disagree, and 1. Strongly disagree. The ATAS has been previously evaluated in prior research and was deemed appropriate for research and low-stakes evaluation purposes based on multiple pieces of validity evidence (Madley et al., 2015). The ATAS demonstrated a high level of internal consistency for these data with a Cronbach's $\alpha = .91$. We projected that online learning anxiety would positively relate to technology anxiety as measured by the ATAS

Generalized Anxiety Disorder—7. The GAD-7 is a 7-item questionnaire developed to identify probable cases of GAD and measure the severity of GAD symptoms. The GAD-7 assesses the most prominent diagnostic features (diagnostic criteria A, B, and C from the Diagnostic and Statistical Manual of Mental Disorders, fourth edition [DSM-IV]) for GAD. The GAD-7 items include: 1) nervousness; 2) inability to stop worrying; 3) excessive worry; 4) restlessness; 5) difficulty in relaxing; 6) easy irritation; and 7) fear of something awful happening. The GAD-7 asks participants to rate how often they have been bothered by each of these 7 core symptoms over the past 2 weeks. Response categories are "not at all," "several days," "more than half the days," and "nearly every day," scored as 0, 1, 2, and 3, respectively. The total score of the GAD-7 ranges from 0 to 21.

Depression, Anxiety and Stress Scale (DASS21): The DASS 21 is a 21 item self-report questionnaire designed to measure the severity of a range of symptoms common to both Depression and Anxiety. In completing the DASS, the individual is required to indicate the presence of a symptom over the previous week. Each item is scored from 0 (did not apply to me at all over the last week) to 3 (applied to me very much or most of the time over the past week). The essential function of the DASS is to assess the severity of the core symptoms of Depression, Anxiety and Stress. Accordingly, the DASS allows not only a way to measure the severity of a patient's symptoms but a means by which a patient's response to treatment can also be measured. Only the Anxiety subscale (DASS-A) was included in the present analysis.

Data Analysis

This study used the Pearson's Correlation Coefficient to test the correlation between the ATAS, GAD-7, and DASS-A. Moreover, test-retest, Chronbach's Alpha, and Guttman Split-Half were used to test the reliability indicators of the scale. The CFA model was calculated using AMOS25 software. In this model GFI, NFI, IFI, and RMSEA were

calculated based on Hu & Bentler's (1999), who indicated that the NIF, IFI, and GFI values should be more than .90, while RMSEA values should be less than .07.

Results

Exploratory Factor Analysis (EFA)

Results of EFA test (see figure1) showed a one- factor solution of ATAS within the Palestinian context. The one-factor construct explained 48.29% of the cumulative variance, with 5.31 of eigenvalue.

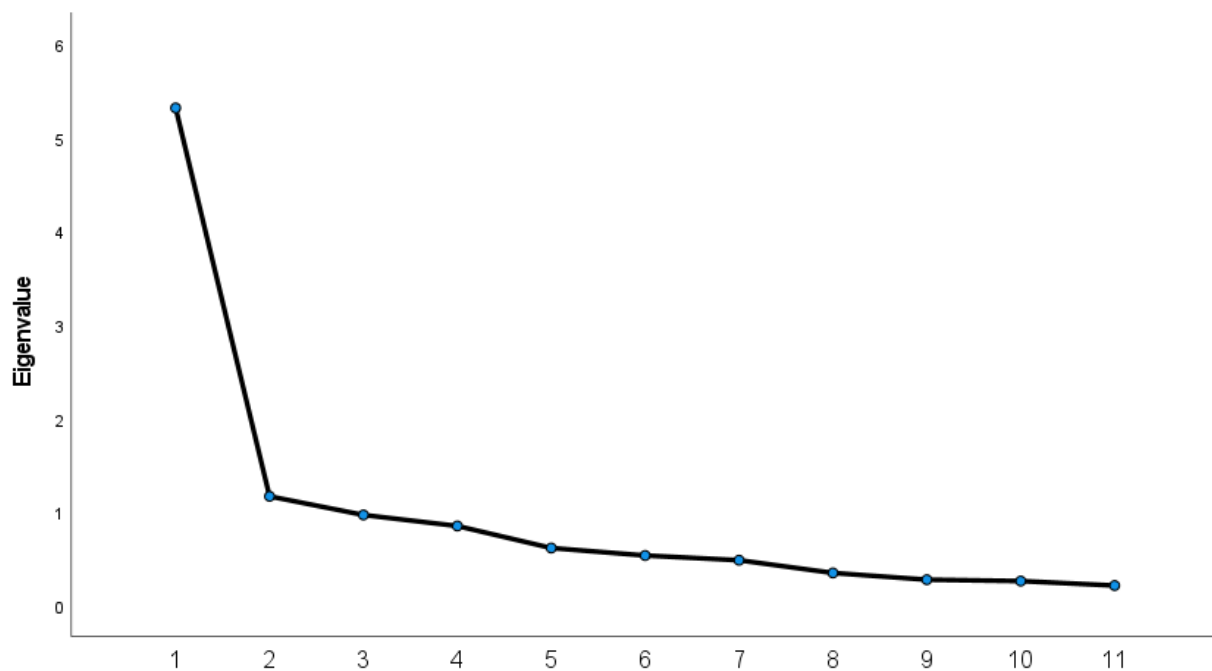


Fig1. Number of factors based on eigenvalue for ATAS

Confirmatory Factor Analysis (CFA)

Before conducting the CFA, an item-total correlation was calculated using all sample data ($N = 792$), to ensure that all items of ATAS had a strong correlation to their total scores. The correlation ranged (.65-.84). The initial model assumed that ATAS is unidimensional and consisting of a one-factor structure for each. Results of CFA (see figure 2) demonstrated a good fit of AMS's model in assessing technology anxiety in the Palestinian context (GFI = .97, CFI = .99, NFI = .98, RFI = .96, RMSEA = .03, and IFI = .97).

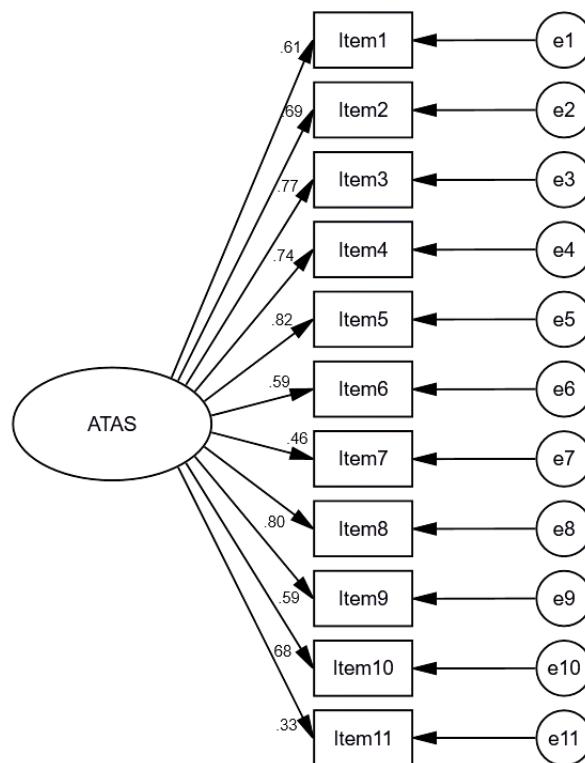


Fig2. CFA for ATAS within the Palestinian context

Concurrent Validity

In order to evaluate the concurrent validity of the ATAS, a Pearson Correlation Coefficient was calculated between the ATAS, GAD-7, and DASS-A scales. Results of concurrent validity are presented in Table 1.

Table 1. Pearson Correlation between ATAS, GAD-7, and DASS-A (n= 792)

Scale	1	2	3
1. ATAS	1	.76**	.86**
2. GAD-7		1	.77**
3. DASS-A			1

****Correlation is significant at the 0.01 level (2-tailed).**

The findings of correlational analysis showed that the ATAS correlated positively and significantly with GAD-7 scale ($r = .76; p < .01$). In addition, a significant association was showed between ATAS and DASS-A scale ($r = .86; p < .01$). While a positive correlation was found between the GAD-7 and DASS-A scale ($r = .77; p < .01$).

Reliability of the ATAS

To test the reliability of ATAS, test-retest, Cronbach's Alpha, and Guttman Split-Half were calculated as shown in table 2.

Table 2. Reliability analysis of ATAS (n= 792)

Item	Items	Cronbach's Alpha if Item Deleted	Corrected Item- Total Correlation	Test-retest	Guttman Split- Half	α
1	I am not a technology person	.75	.743	.81		
2	I am reluctant to learn new features of technology	.76	.754	.82		
3	I am uncomfortable using technology	.79	.698	.84		
4	Technology does not improve my quality of life	.73	.49	.81		
5	I feel out of control using technology	.65	.59	.83		
6	I feel uneasy using technology	.71	.65	.82		
7	I feel technology complicates simple tasks	.82	.59	.82		
8	Keeping up with the newest technology is impossible	.62	.54	.76		
9	I am inefficient with technology	.68	.44	.84		
10	Using technology makes me nervous	.69	.80	.83		
11	I am often annoyed when using technology	.66	.75	.82		
<i>Total score of ATAS</i>				.83	.88	.92

Results of Chronbach's Alpha for internal consistency of the ATAS showed a high level of reliability ($\alpha = .92$). In addition, results of the split-half indicated a high level of internal reliability (.88). Test re-test of the

ATAS was calculated by administering the scale to 80 participants three weeks after the first administration. The correlation between first- and second-time ATAS was 0.83, which indicates that the ATAS is a reliable measure in assessing technology anxiety in the Palestinian context.

Discussion

The current study aimed to test the psychometric properties and factorial structure of the ATAS in Arabic language within the Palestinian context. The findings of the study indicated that the ATAS is a valid measure in assessing technology anxiety in the Palestinian context. A positive correlation was found between the ATAS and other measures designed to evaluate general anxiety in the Palestinian context, such as GAD-7, and DASS-A. The CFA findings revealed a stable construct of a one-factor structure of the ATAS in assessing technology anxiety among Palestinians. The relationship between technological anxiety and anxiety in general provides an indication of the validity of the technological anxiety scale within the Palestinian context. As is well known, Palestinian society is currently suffering from numerous psychological pressures and disturbing stimuli due to the conditions of occupation and the ongoing conflict that the Palestinian community is enduring. This is reflected in the continuous incursions into Palestinian cities and villages.

Previous study conducted within the Iranian context by Razavi et al. (2024) demonstrated that ATAS has a strong content validity, with all items exceeding the required content validity ratio (CVR) and content validity index (CVI) thresholds. Their findings revealed that the ATAS, with its 11 questions, possesses high validity and reliability. Therefore, it can serve as a credible and dependable tool for assessing technology anxiety and its facets among Iranian students.

Standardizing tools specifically designed for diagnosing technological anxiety within the Palestinian context is of considerable importance. These tools could significantly contribute to enhancing and developing various interventions aimed at reducing anxiety levels. They would also assist in altering individuals' negative perceptions regarding their capabilities and their use of technology more broadly. This, in turn, would improve the performance of these individuals, particularly within a context like the Palestinian one, where people often experience extremely high levels of anxiety.

Historically, the use of technology among Palestinians has been linked to the Israeli occupation, as well as the racial discrimination Palestinians face on social media in general, and the surveillance by the occupying authorities on the other hand. This has contributed to an increased level of anxiety regarding the use of technology in general, and the use of smart electronic devices in particular (Hamamra & Gould, 2024).

Recent events have exacerbated these issues, particularly for Palestinians in the West Bank and Gaza Strip. During the Israeli war on Gaza after October 7, 2023, Palestinians faced intensified racist campaigns

on social media, including calls for displacement, violence, and dehumanization. Concurrently, social media platforms restricted Palestinian content, worsening psychological trauma and increasing feelings of inadequacy and shame. Previous studies have similarly linked online racism to techno anxiety. McMahon (2014) highlights how exposure to racist content online can lead to feelings of alienation, anxiety, and vulnerability among targeted individuals. The study also suggests that such experiences lead to disengagement from technology and social media as a coping mechanism. Selbst's study (2019) showed that facial recognition software disproportionately misidentifies individuals from minority racial groups, particularly Black and Asian faces. The study underscores the anxiety these biased systems can create, as people may feel surveilled, misrepresented, or even discriminated against. Davis et al. (2021) suggested that racial minorities face unique forms of technological anxiety due to fears of discrimination, bias, and surveillance, particularly when using emerging technologies like AI, big data, and social media.

Limitations of the study

The current study has several limitations, particularly in terms of validating the new instruments, as this is an ongoing process. Therefore, future research should focus on expanding the validation of the ATAS across various contexts. First, this study relied on a convenience sample of Palestinians who were recruited through online self-reports. It is important to validate the ATAS with different groups, especially those who may be at a higher risk of experiencing online racism, as the factorial structure of the measure could vary across populations. Second, the study was conducted in the West Bank during a period of significant conflict and political violence between Palestinians and Israelis, which may have influenced the levels of technology anxiety among Palestinians, potentially affecting the factorial structure of the ATAS. Future research should validate the ATAS over different time periods to account for this factor. Third, the sample used in the study was not fully representative of the various groups within Palestinian society, particularly those who heavily use social media and are likely to experience lower levels of mental well-being. This highlights the need to validate the ATAS with a broader range of individuals from different social groups.

Conclusion

The ATAS is an internationally recognized tool designed to assess technology anxiety levels among adults. However, it had not been validated in the Palestinian context before this study. This research demonstrated that the ATAS is both valid and reliable for assessing technology anxiety among Palestinian adults. The Confirmatory Factor Analysis (CFA) revealed a strong one-factor solution for the ATAS, confirming its structural stability and effectiveness in capturing technology anxiety within this population.

As a result, future studies are recommended to validate the ATAS with a variety of groups within the Palestinian context, particularly those vulnerable to online racism, social media discrimination, or experiencing high levels of stress due to ongoing political conflict. Given the unique challenges faced by Palestinians, especially in terms of restricted access to technology and digital platforms, the ATAS can play a significant role in understanding and addressing technology-related anxieties that may be compounded by these contextual factors. Furthermore, validating the ATAS with diverse populations will enhance its applicability, allowing researchers to investigate technology anxiety across different demographic groups and social conditions.

The ATAS will allow mental health professionals to develop targeted interventions for individuals struggling with technology anxiety, helping to improve their digital engagement, performance, and overall adaptability to new technologies. By identifying specific anxiety triggers related to digital tools, health providers can tailor support strategies to alleviate technology anxiety, ultimately fostering better mental health, resilience, and well-being in an increasingly digitalized world.

Ethics approval

Our study was approved by An-Najah Institutional Review Board (IRB) before data collection was initiated

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No funding was received for this study.

Relative Contributions

All authors contributed equally to this work. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

Research Promotion

N/A

References

- Abdous, M. H. (2019). Influence of satisfaction and preparedness on online students' feelings of anxiety. *The Internet and Higher Education*, 41, 34–44. <https://doi.org/10.1016/j.iheduc.2019.01.001>
- Alibak, M., Talebi, H., & Neshat-Doost, H.-T. (2019). Development and validation of a test anxiety inventory for online learning students. *Journal of Educators Online*, 16(2), 10–25. <https://doi.org/10.9743/JEO.2019.16.2.2>
- Autman, H., & Kelly, S. (2017). Reexamining the writing apprehension measure. *Business and Professional Communication Quarterly*, 80(4), 516–529. <https://doi.org/10.1177/2329490617691968>
- Baker, C. (2010). The impact of instructor immediacy and presence for online student affective learning, cognition, and motivation. *Journal of Educators Online*, 7(1), 1–30. <https://eric.ed.gov/?id=EJ904072>
- Balgotra, D., & Chakraborty, R. (2024). Validation of Abbreviated Science Anxiety Scale in the Indian context. *International Journal of Research in Science & Engineering*, 4(3), 68–77. <https://doi.org/10.55529/ijrise.43.68.77>
- Carey, E., Hill, F., Devine, A., & Szűcs, D. (2017). The Modified Abbreviated Math Anxiety Scale: A valid and reliable instrument for use with children. *Frontiers in Psychology*, 8, 1–13. <https://doi.org/10.3389/fpsyg.2017.00011>
- Crocker, L., & Algina, J. (1986). *Introduction to classical and modern test theory*. Holt, Rinehart and Winston, 6277 Sea Harbor Drive, Orlando, FL 32887.
- Davis, F. D. (1993). User acceptance of information technology: System characteristics, user perceptions, and behavioral impacts. *International Journal of Man-Machine Studies*, 38(3), 475–487. <https://doi.org/10.1006/imms.1993.1022>
- Davis, J. L., Williams, A., & Yang, M. W. (2021). Algorithmic reparation. *Big Data & Society*, 8(2), 1–12. <https://doi.org/10.1177/20539517211044808>
- Hamamra, B., & Gould, R. R. (2024). Free speech and democracy in Palestinian Universities: A call for parrhesiastic speech. *Educational Philosophy and Theory*, 1–15. Advanced online publication. <https://doi.org/10.1080/00131857.2024.2391857>
- Heinssen, R. K., Glass, C. R., & Knight, L. A. (1987). Assessing computer anxiety: Development and validation of the Computer Anxiety Rating Scale. *Computers in Human Behavior*, 3(1), 49–59. [https://doi.org/10.1016/0747-5632\(87\)90010-0](https://doi.org/10.1016/0747-5632(87)90010-0)
- Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020). The difference between emergency remote teaching and online learning. *Educause Review*, 27, 1–12. <https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning>
- Hohlfeld, T. N., Ritzhaupt, A. D., & Barron, A. E. (2010). Development and validation of the Student Tool for Technology Literacy (ST2L). *Journal of Research on Technology in Education*, 42(4), 361–389. <https://doi.org/10.1080/15391523.2010.10782556>
- Liu, X.-Q., Guo, Y.-X., & Xu, Y. (2023). Risk factors and digital interventions for anxiety disorders in college students: Stakeholder perspectives. *World Journal of Clinical Cases*, 11(7), 1442–1457. <https://doi.org/10.12998/wjcc.v11.i7.1442>
- Lowenthal, P., Bauer, C., & Chen, K. Z. (2015). Student perceptions of online learning: An analysis of online course evaluations. *American Journal of Distance Education*, 29(2), 85–97. <https://doi.org/10.1080/08923647.2015.1023621>

- Nunnally, J. (1978). *Psychometric theory*. McGraw-Hill.
- Onah, B. I., Ede, M. O., Eze, B. N., Uzoegwu, C. R., Mgboji, C., & Agbo, G. C. (2023). Effectiveness of rational emotive behavior education (REBE) on computer anxiety. *Medicine*, 102(30), e34303. <https://doi.org/10.1097/MD.00000000000034303>
- Pekrun, R. (2020). *Emotions and learning*. Routledge Handbook of Learning.
- Pfaffinger, K. F., et al. (2021). Digitalisation anxiety: Development and validation of a new scale. *Discover Mental Health*, 1(1), 1-14. <https://doi.org/10.1007/s44192-021-00003-w>
- Popoola, S. O., & Adedokun, O. O. (2023). Computer self-efficacy, computer anxiety, cognitive skills, and use of electronic library resources by social science undergraduates in a tertiary university in Nigeria. *Journal of Librarianship and Information Science*, 55(1), 111-122. <https://doi.org/10.1177/09610006211063938>
- Powers, W. G., Cummings, H. W., & Talbott, R. (1973, April). *The effects of prior computer exposure on man-machine computer anxiety*. Paper presented at the International Communication Association Convention (Montreal, Canada, April 25-28, 1973). <https://eric.ed.gov/?id=ED089763>
- Rahimi, M., & Yadollahi, S. (2014). Validation of Persian Version of Computer Anxiety Rating Scale. *Information and Communication Technology in Educational Sciences*, 4(4 (16)), 117-141. <https://sanad.iau.ir/journal/ictedu/Article/641356?jid=641356&lang=en>
- Razavi, S. M., Haji Alizadeh, K., & Amirfakhraei, A. (2024). Psychometric Properties of the Persian Version of Abbreviated Technology Anxiety Scale: Insights from University Students in Iranian Context. *Interdisciplinary Journal of Virtual Learning in Medical Sciences*, 15(3), 241-255. <https://doi.org/10.30476/ijvlms.2024.102118.1297>
- Selbst, A. D., Boyd, D., Friedler, S. A., Venkatasubramanian, S., & Vertesi, J. (2019, January). Fairness and abstraction in sociotechnical systems. In *Proceedings of the conference on fairness, accountability, and transparency* (pp. 59-68). <https://doi.org/10.1145/3287560.3287598>
- Taber, K. S. (2018). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education*, 48, 1273-1296. <https://doi.org/10.1007/s11165-016-9602-2>