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The Mediating Role of Self-Determination in the Relationship Between Assistive Technology and Employment Outcomes for People with Disabilities in Saudi Arabia

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ABSTRACT

The current research study conducts an investigation of the dynamic relationship between three key variables: assistive technology (AT) provision, self-determination (SD), and employment outcomes (EOs) as they pertain to persons with disabilities (PwDs) in Saudi Arabia (KSA). The main objective of the study is to investigate the function of AT in improving EOs for PwDs and contextualize the mediating effect of SD on the observed relationship. The study features a quantitative study design which utilizes survey data obtained from a sample size of 120 PwDs. The study participants are employed in either private or public sector organizations situated in Riyadh and Al-Jouf regions of KSA. The conducted survey provides measurements, using a Likert scale, for AT provision, various aspects of SD (decision-making autonomy, self-belief, self-advocacy, goal setting, and persistence and resilience), and EOs (job placement, satisfaction, retention, income level, and career advancement). For data analysis, the study utilizes the partial least square-structural equation modeling. The study findings demonstrate significant direct and indirect effects of AT provision on EOs for PwDs—with SD playing a key mediating role. Specifically, positive effects of AT can be observed in job placement, satisfaction, income level, retention, and career advancements—SD is observed as a key facilitator of AT adoption and effectiveness (EFF) within workplace settings. The findings emphasize the key role of AT investment (accessibility and EFF) in the enhancement of the SD skills of PwDs, and the resulting effect of more inclusive workplace environments for PwDs in KSA.

KEYWORDS

assistive technology, self-determination, employment outcome, people with disabilities, Saudi Arabia

INTRODUCTION

For most societal frameworks, the promotion of inclusivity and equal opportunities acknowledges the crucial aspect of integrating persons with disabilities (PwDs) into economic programs. However, for increased effectiveness (EFF), the integration process often takes into account the myriad of challenges encountered by PwDs with respect to issues of access and maintenance of employment in the face of unique barriers such as physical limitations, societal prejudices, and communication difficulties. PwDs face several significant disparities in employment outcomes (EOs). For instance, comparatively, working-age PwDs have a lower employment rate compared to their counterparts without disabilities, and when employed, they often earn significantly less per year—a consequence that has made working-age PwDs twice as likely to live in poverty or social isolation, compared to persons without disabilities, due to lower levels of employment and earnings (Kruse et al., 2024). Other compounding factors consist of the work-related experiences of PwDs, which include negative attitudes from supervisors and co-workers, lower job security with higher risks of layoff, lower rates of training and involvement in decision-making processes, and higher rates of precarious contingent work (Abed et al., 2024).

In terms of statistics, as illustrated by the Eurostat dataset, "Disability employment gap by level of activity limitation and sex," across 27 European Union member states and covering the period between 2014 and 2021, indicated that approximately 16.1% of working-age PwDs outside the labor force were inactive due to the limitations of their disability, with 11.4% of persons without disabilities being inactive as a

result of taking care of either adult or young PwDs (Marinaci et al., 2023). Marinaci et al. (2023) place the percentage of working-age PwDs who are at risk of poverty or social exclusion at 30.6%, for those with severe levels of activity limitation, and 19.8% for PwDs without any limitations to activity. Assistive technology (AT) offers an inclusive workplace approach that takes into account the activity limitations of PwDs, as informed by the International Classification of Functioning, Disability, and Health (Marinaci et al., 2023). Recent research, albeit with limited systematic and representative evidence, explores the EFF of AT with respect to the improvement of EOs for PwDs, with research indicating the positive impact of AT on different EOs such as job placement, earnings, retention, and career advancement (Kruse et al., 2024).

However, most importantly, the underlying mechanisms informing the positive effects of AT on EOs largely remain unclear. There exists a general lack of studies pertaining to the affective and socio-cultural dimensions surrounding the use of AT in the workplace (Marinaci et al., 2023). Additionally, findings from current research emphasize the importance of providing adequate support to aid in the development of self-determination (SD) in working-age PwDs—with SD being representative of characteristics such as self-belief, self-advocacy, decision-making autonomy, goal setting, and persistence and resilience (Di Maggio et al., 2019). Therefore, it is crucial for modern research to investigate the intersectionality between provision of AT, SD, and EOs relative to the development and promotion of targeted interventions and policies guiding the employment of PwDs—with studies indicating that improvements in SD can significantly improve career readiness among working-age PwDs (Binghashayan et al., 2022). In the context of Saudi Arabia (KSA), there is a need to examine these dynamics from the perspective of the prevailing cultural, societal, and economic factors that may influence the workplace experiences of PwDs. The current research study aims to address this gap by conducting an in-depth investigation of the existing relationship between AT provision, SD, and EOs for PwDs in KSA. Specifically, the research features a targeted study of the various aspects of AT provision [accessibility (ACC), compatibility (COM), EFF, and the level of training and support (TAS)], and their effect on EOs for PwDs with primary emphasis on the mediating effect of SD on the relationship between AT provision and EOs, and an additional examination of the direct impact of SDs on EOs. This research seeks to provide insights that will inform relevant policies and practices, within the unique socio-cultural context of KSA, pertaining to the development of more inclusive and supportive working environments for PwDs.

LITERATURE REVIEW

In recent years, the role of AT in promoting the inclusion and employment of PwDs within workplace settings has significantly increased. AT consists of a wide range of tools, inclusive of software and devices, specifically designed to assist PwDs in the performance of tasks and obligations that may otherwise prove to be difficult or impossible (Kruse et al., 2024). From the perspective of the Human Activity Assistive Technology model, the development of sustainable solutions with technology usage among PwDs has significantly revolutionized traditional AT systems with remarkable transformations in the mechanisms of inclusion with the spheres of general health, workplace, and social equality (Marinaci et al., 2023). The empowerment of PwDs within workplace settings, and the mitigation of barriers to effective performance, can be attributed to AT such as mobility aid (e.g. wheelchairs and prosthetic limbs) and communication devices and software (Kruse et al., 2024).

AT and employment outcome

Several studies have indicated the positive effects of AT on different dimensions of EOs in relation to PwDs. For instance, research demonstrates that AT has the capability of improving job placement rates by creating an enabling environment from which PwDs can perform essential job tasks with increased EFF (Marinaci et al., 2023). Additionally, career advancement and higher levels of job satisfaction among PwDs have been attributed to AT, as an enabling tool that allows PwDs to achieve professional excellence by overcoming their various limitations (Heyn et al., 2021). However, various factors influence the EFF of AT in improving the EOs for PwDs—and these factors primarily include ACC, types of AT employed, EFF, level of TAS provided, and COM with an individual's needs (Morris et al., 2022). Most importantly, whereas certain forms of type of assistive technology (TAT), such as voice recognition software and screen readers, may be highly effective for some segment of PwDs, their suitability or ACC may not be guaranteed for other segments of PwDs. For instance, Wang et al. (2017) argue that there is a necessity to investigate the interactions between impairment-related and work-related factors associated with recommendations for any specific AT (Wang et al., 2017). Research also suggests that inadequate training support in the usage or employment of AT devices can significantly reduce their EFF, in addition to acting as a hindrance to workplace integration (Damianidou et al., 2019).

AT and SD

The use of AT has been found to impact the SD of individuals with disabilities in various ways. AT enables individuals to execute activities of daily living and increases their perceived independence, making them feel enabled, secure, and less needy. It also increases their choice and control, provides them with time alone, and enhances their participation (Sinclair et al., 2023; van Dam et al., 2023). For individuals with severe or profound intellectual disabilities (IDs), interventions aimed at supporting SD have shown positive effects. These interventions focus on components such as choice-making, independence, and problem-solving and include elements such as technology, training packages, and changes in policies and living arrangements (Kuld et al., 2023). Additionally, contextual variables such as living

environment and specialized supports play a significant role in the development of SD in individuals with IDs (Canlas et al., 2023; Vicente et al., 2023). Overall, the use of AT and the implementation of interventions can contribute to enhancing the SD of individuals with disabilities.

SD and EO

SD plays a crucial role in the EOs of individuals with disabilities. It empowers individuals to make choices, set goals, and solve problems, which are essential skills for successful adulthood and employment (Avellone et al., 2023; Sinclair et al., 2023). Self-determined behaviors benefit individuals with disabilities in navigating work and life, and they provide clear examples of these behaviors that contribute to their employment experiences (Avellone et al., 2023). Factors that facilitate self-EOs for individuals with disabilities include demographics, social networks, financial standing, personal motivation, interagency collaboration, and services provided (Randall et al., 2023). Postsecondary education programs for individuals with disabilities also offer opportunities for teaching SD skills, leading to improved life outcomes (Skarsaune, 2023). Overall, SD skills are critical for individuals with disabilities to achieve successful EOs.

SD has a mediating effect between AT and EO

Another key area of interest, as observed in extant literature, in the investigation of the relationship between AT and EOs for PwDs pertains to the mediating role of SD. Typically, SD is used in reference to one's ability to take part in decision-making processes such as goal setting, self-advocacy, and persistence when faced with challenges (Field et al., 1998). Higher levels of SD in PwDs have been linked with increased usage of AT devices to ease the workload within workplace settings (Damianidou et al., 2019). Improved EOs for PwDs can be attributed to SD due to its positive effects in enhancing one's goal setting, self-advocacy, and problem-solving (Pacheco et al., 2019). Numerous research studies have investigated the nature of the existing relationship between AT provision, SD, and EOs for PwDs from a wide array of socio-cultural contexts. For instance, within learning contexts, studies have illustrated a correlation between SD skills and the ability to achieve academic excellence—these are accompanied by positive transition outcomes such as improvements in employment and independent living (Field et al., 1998). Lund and Cmar (2019) demonstrate a positive relationship between the usage of AT and factors such as SD and job satisfaction among persons with visual impairments.

Overall assessment of the intersectionality of AT provision, SD, and EOs for PwDs

Marinaci et al. (2023) demonstrate the EFF of AT training programs that emphasize the development of SD skills with respect to improvements in economic outcomes for PwDs. Moreover, the TAS are essential sub-variables in successfully implementing and using AT. Individuals with disabilities require appropriate TAS to effectively utilize AT devices (Skouge, 2014). However, a review of existing literature indicates gaps and limitations in relation to the observed relationship between AT, SD, and EOs for PwDs. The generalizability of findings has been significantly limited by the overwhelming preference by existing research to focus on specific types of disabilities or AT devices. In addition, limited studies have conducted an examination of the observed intersectionality from the unique socio-cultural perspective of KSA—and how the country's economic, social, and cultural factors may impact the work-related experiences of PwDs.

Research framework

The research framework incorporates all constructs according to the stated objectives of the study that are consistent with the structuring theory elaboration approach (Fisher and Aguinis, 2017). The motivation of the present study has been based on the fact that extant studies reported a significant relationship between AT and EOs of people with disabilities, most especially in the world's developed countries. There are scanty studies on the effect of AT and EOs of people with disabilities in developing countries like KSA. However, very few studies have incorporated AT (such as technology assistive types, training, and support, among others) in KSA. As such, the study has become necessary in KSA. Therefore, the study is among the pioneers that examine the mediating role of SD on the relationship between AT and EOs of people with disabilities in KSA, as indicated in Figure 1.

The present study investigates the influence of AT on EOs for PwDs in KSA via the following main hypotheses:

H1: AT provision influences EOs for PwDs in KSA.
H1a: TAT influences EOs for PwDs in KSA.
H1b: ACC influences EOs for PwDs in KSA.
H1c: EFF influences EOs for PwDs in KSA.
H1d: COM influences EOs for PwDs in KSA.
H1e: TAS influences EOs for PwDs in KSA.

The present study investigates the influence of AT on SDs for PwDs in KSA via the following main hypotheses:

H2: AT provision influences SDs for PwDs in KSA.

The present study investigates the influence of SD on EOs for PwDs in KSA via the following main hypotheses:

H3: SD influences EOs for PwDs in KSA.

The present study investigates the mediating role of SD on the relationship between AT and EOs for PwDs in KSA via the following main hypothesis:

H4: SD mediates the relationship between AT and EOs for PwDs in KSA.

H4a: SD mediates the relationship between TAT and EOs for PwDs in KSA.

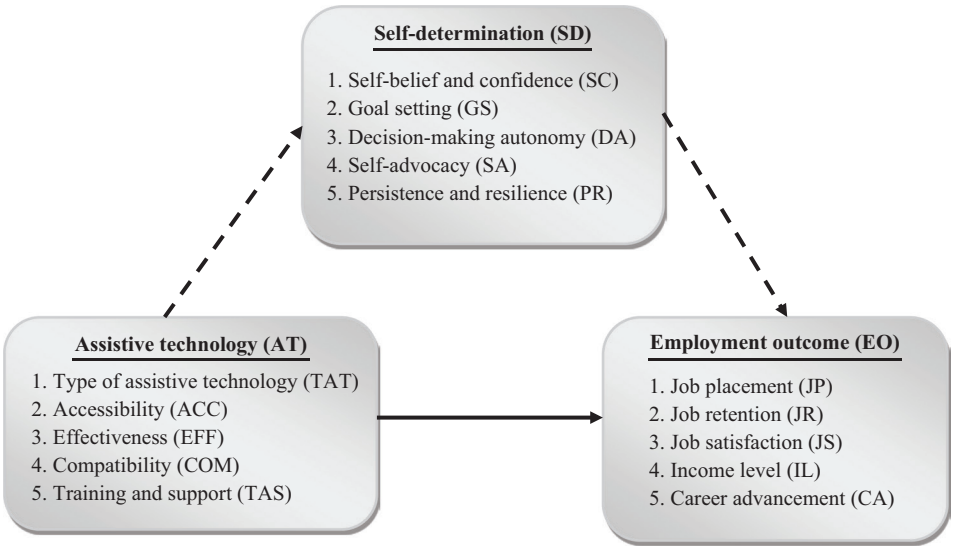

Figure 1: Research framework. The direct pathway of assistive technology (AT) effects on employment outcomes (EOs) is indicated with a solid arrow. The indirect pathway wherein self-determination (SD) mediates AT effects on EOs is shown with dashed arrows.

H4b: SD mediates the relationship between ACC and EOs of PwDs in KSA.
H4c: SD mediates the relationship between EFF and EOs of PwDs in KSA.
H4d: SD mediates the relationship between COM and EOs of PwDs in KSA.
H4e: SD mediates the relationship between TAS and EOs of PwDs in KSA.

MATERIALS AND METHODS

Subjects

The questionnaire survey sample consisted of 120 respondents with disabilities. All survey participants were employees in both the public and private sectors in the Riyadh and Al-Jouf regions. The characteristics of the sample of survey respondents are summarized in Table 1.

Survey

A questionnaire written in Arabic was distributed electronically by centers and associations of people with disabilities in the Al-Jouf region and the Riyadh region. All questionnaires were completed online in the period between June and December of 2023. Survey answers were separated from participants' identities, and participants were notified of this separation to encourage honesty in their answers. A total of 120 questionnaires were collected from respondents. The characteristics of the survey respondent sample are summarized in Table 1.

The questionnaire included a demographic information section, the answers from which were used to describe the PwDs' sample characteristics (Table 1), as well as a second (main) section consisting of a series of items assessing the PwDs' views on AT, EOs, and SD. Appendix 1 provides an English translation of the questionnaire. We used 10 items from Kinney et al. (2016), Pousada García et al. (2021), Marinaci et al. (2023), and Morris et al. (2022) to measure

Table 1: Likert-type questionnaire respondent sample characteristics (N = 120).

Variables	Category	Frequency	Percentage (%)
Sex	Male	81	67.5
	Female	39	32.5
Age (years)	≤30	30	25
	>30 to ≤40	34	28.3
	>40 to ≤50	42	35
	>50	14	11.7
Education level	Less than bachelor	34	28.3
	Bachelor	62	51.7
	Masters and above	24	20
Duration of disability (years)	Short-term disability: ≤5	15	13.4
	Intermediate-term disability: >5 to ≤10	24	20
	Mid-range disability: from >10 to ≤15	32	26.6
	Long-term disability: >15	49	40

the AT construct's sub-constructs of TAT, ACC, EFF, COM, and TAS. Furthermore, the EO is focused on job placement, retention, satisfaction, career advancement, and income level. Ten items, adapted from Hedrick et al. (2006), Schur et al. (2017), Romeo et al. (2020), Khayatzadeh-Mahani et al. (2020), Wang et al. (2017), and Heyn et al. (2021), measure the EO. Finally, the study also considered the mediating effect of the SD variable with five sub-dimensions: self-belief and confidence (SC), goal setting, decision-making autonomy, self-advocacy, and persistence and resilience, adapted from Mumpuni et al. (2023), Muslihin et al. (2022), Shogren and Ward (2018), van Dam et al. (2023), and Sinclair et al. (2023).

This study detailed sample respondents' demographics. Table 1 lists gender, age, education, and disability duration as demographic characteristics examined in this study. Most of the sample (81, 67.5%) was male with disabilities, while 39 (32.5%) were female. Respondent gender distribution has been similar in previous studies. Forty-two (35%) participants were 41-50 years old. The next group, 30 respondents under 30, made up 25% of the sample. The smallest age group was 51 and older, with 14 (11.7%) respondents. Table 2 also shows that 62 (51.7%) respondents had bachelor's degrees. Next were 34 (28.3%) respondents with a first degree and below, and 24 (20%) with master's degrees. Finally, 15 (13.4%) participants had a short-term disability of <5 years, and 24 (20%) had an intermediate-term disability of 5-10 years. Table 1 shows that 32 (26.6%) of respondents have mid-range disabilities from 11-15 years and 49 (40%) have long-term disabilities over 15 years.

The distributions of PwDs' Likert-type responses to the questionnaire items are reported in Figure 2.

Data analysis

The study used partial least square-structural equation modeling (PLS-SEM) for the significant analysis. The analysis models are categorized into measurement models and structural models. The measurement model tests the validity (convergent and discriminant), and reliability [items and composite reliability (CR)] of the construct was examined through exploratory factor analysis. Finally, the structural model was adopted to test direct and indirect effects hypotheses.

RESULTS

This study analyzed the relationship between AT and EOs of people with disabilities in the KSA, with the mediating effect of SD. The study analyzed the data collected from the respondents and commenced with codifying the collected data into statistical packages of social sciences (SPSS 25 version; IBM Corp., Armonk, NY, USA). Furthermore, the analysis used is classified into descriptive statistics and inferential statistics. The descriptive statistics included the demographical information and normality test of the data collected (via SPSS), whereas the inferential statistics included the measurement model and structural model (via PLS-SEM), as explained in the following sub-section.

Descriptive statistics for the variables

This was used to establish the normality of the questionnaires, mean and standard deviation of the respondents, mean gaps AT, SD, and EO where mean and standard deviation are regarded as descriptive statistics for ratio and interval scale. According to Muhammad et al. (2010), scores of 2.33 and below are low-level response rates, 2.34 and 3.66 are moderate-level response rates, and 3.67 and above are high-level response rates. Table 3 indicates that SD has the highest average mean value with (M = 3.95, SD = 0.676), whereas the AT is regarded as having the lowest average mean value with (M = 3.91, SD = 0.790) as shown in Table 2.

Based on the normality test, the essential tools for the statistical normality test are skewness and kurtosis, where the value for both should be close to 0 to be considered normally distributed. As Tabachnick and Fidell (2013) suggested, the rule of thumb for skewness and kurtosis should range within ±2.58 for the large sample size, but Hair et al. (2018) indicate the value as ±1. The result from Table 3 revealed that the data are usually distributed because the results of skewness and kurtosis are within the range.

Correlation analysis

The correlation analysis determines the relationship between or among the variables regarding strength and direction. According to Pallant (2011), the correlation of 0 indicates no relationship, whereas the correlation of 1 (±1) shows a significant relationship (positive or negative relationship). However, the relationship of >0.9 indicates the multicollinearity issue. Therefore, Table 3 shows that the correlation analysis for the variables was statistically significant at the 0.05 level ($P = 0.000$) without multicollinearity issues.

Measurement model

The measurement model's validity and reliability should be tested early to ensure the testing of the hypotheses. According

Table 2: Descriptive statistics and normality test (mean and SD).

Constructs	Min	Max	Mean	SD	Skewness	Kurtosis
Assistive technology	1	5	3.9458	0.67586	−1.384	1.643
Employment outcome	1	5	3.9812	0.75008	−1.396	1.340
Self-determination	1	5	4.0124	0.63903	−1.373	2.389

Abbreviation: SD, standard deviation.

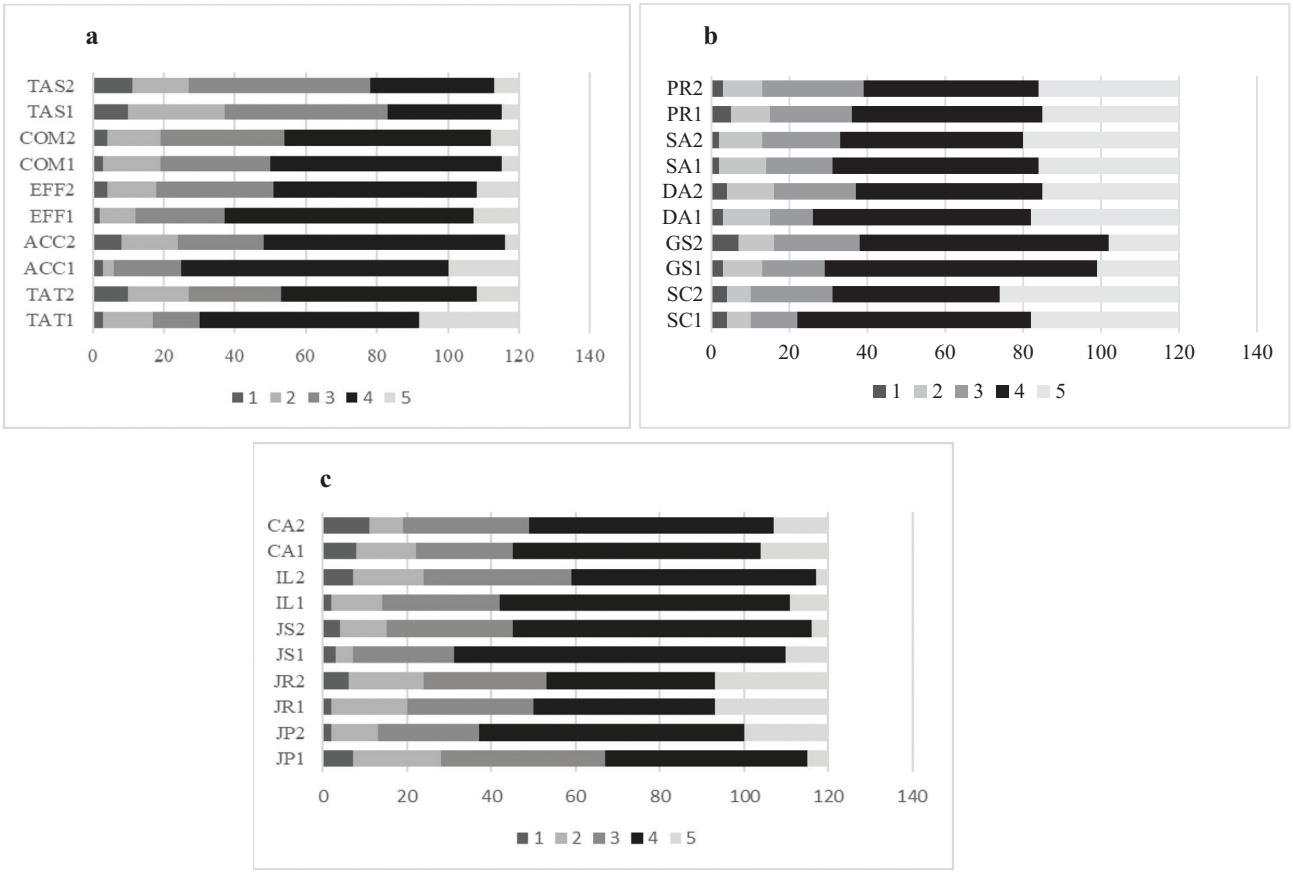

Figure 2: Distributions of questionnaire responses. The precise numbers of Likert 1, 2, 3, 4, and 5 responses for each item are indicated, respectively, within curly brackets herein. (a, b) Assistive technology (AT) variables: items in a: type of assistive technology (TAT): {TAT1: 3, 14, 13, 62, 28} {TAT2: 10, 17, 26, 55, 12}; accessibility (ACC): {ACC1: 3, 3, 19, 75, 20} {ACC2: 8, 16, 24, 68, 4}; effectiveness (EFF): {EFF1: 2, 10, 25, 70, 13} {EFF2: 4, 14, 33, 57, 12}; compatibility (COM): {COM1: 3, 16, 31, 65, 5} {COM2: 4, 15, 35, 58, 8}; training and support (TAS): {TAS1: 10, 27, 46, 32, 5} {TAS2: 11, 16, 51, 35, 7}. Employment outcome (EO) items in b: job placement (JP): {JP1: 7, 21, 39, 48, 5} {JP2: 2, 11, 24, 63, 20}; job retention (JR): {JR1: 2, 18, 30, 43, 27} {JR2: 6, 18, 29, 40, 27}; job satisfaction (JS): {JS1: 3, 4, 24, 79, 10} {JS2: 4, 11, 30, 71, 4}; income level (IL): {IL1: 2, 12, 28, 69, 9} {IL2: 7, 17, 35, 58, 3}; career advancement (CA): {CA1: 8, 14, 23, 59, 16} {CA2: 11, 8, 30, 58, 13}. Self-determination (SD) items in c: self-belief and confidence (SC): {SC1: 4, 6, 12, 60, 38} {SC2: 4, 6, 21, 43, 46}; goal setting (GS): {GS1: 3, 10, 16, 70, 21} {GS2: 7, 9, 22, 64, 18}; decision-making autonomy (DA): {DA1: 3, 12, 11, 56, 38} {DA2: 4, 12, 21, 48, 35}; self-advocacy (SA): {SA1: 2, 12, 17, 53, 36} {SA2: 2, 11, 20, 47, 40}; persistence and resilience (PR): {PR1: 5, 10, 21, 49, 35} {PR2: 3, 10, 26, 45, 36}.

Table 3: Correlation analysis.

Constructs	AT	EO	SD
Assistive technology (AT)	1		
Employment outcome (EO)	0.665**	1	
Self-determination (SD)	0.459**	0.470**	1

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

to Hair et al. (2018), reliability is the internal conformity scaled by the CR coefficient. In contrast, the validity comprises convergent validity and discriminant validity. As stated by Hair et al. (2018), the value of the CR coefficient of the latent constructs should be above 0.70, the lowest critical value, which means every conception has relevant good interior conformity. Furthermore, the entire factor loading of the measurement index must be higher than the lowest critical value of 0.60. At the same time, average variance extracted (AVE) must be >0.5. This implied that the constructs have relevant good convergent validity. According to Chin (1998), to ensure discriminant validity, it is explained whether there is a significant difference among variables; hence, the square root of each AVE of the constructs in the model should be greater than the relevant coefficient of this variable. Therefore, the validity and reliability of various constructs can all be employed for further hypothesis tests. Figure 2 and Table 4 indicate the summary of the measurement model of this study.

Table 4 presents a detailed summary of the measurement model, focusing on the reliability and convergence validity of various constructs associated with AT and its implications on EOs, among other aspects. Figure 3 provides a visual representation of these relationships, further illustrating the interconnections between the constructs. The constructs, including AT, ACC, EFF, COM, TAS, and several dimensions of SD and EOs, are evaluated through item loadings, Cronbach alpha, CR, and AVE.

The item loadings across constructs are generally high, indicating strong relationships between items and their respective constructs. Notably, TAS and certain sub-constructs of

Table 4: Summary of measurement model (reliability and convergence validity).

Constructs	Sub-constructs	Items	Loadings	Cronbach alpha	CR	AVE
Assistive technology (AT)	Type of assistive technology (TAT)	TAT1	0.908	0.774	0.775	0.816
		TAT2	0.898			
	Accessibility (ACC)	ACC1	0.850	0.729	0.770	0.783
		ACC2	0.919			
	Effectiveness (EFF)	EFF1	0.875	0.774	0.811	0.813
		EFF2	0.928			
	Compatibility (COM)	COM1	0.920	0.723	0.772	0.780
		COM2	0.845			
	Training and support (TAS)	TAS1	0.922	0.847	0.855	0.867
		TAS2	0.939			
Self-determination (SD)	Self-belief and confidence (SC)	SC1	0.773	0.948	0.953	0.686
		SC2	0.659			
	Goal setting (GS)	GS1	0.738			
		GS2	0.780			
	Decision-making autonomy (DA)	DA1	0.874			
		DA2	0.891			
	Self-advocacy (SA)	SA1	0.849			
		SA2	0.905			
	Persistence and resilience (PR)	PR1	0.876			
		PR2	0.899			
Employment outcomes (EO)	Job placement (JP)	JP1	0.723	0.940	0.945	0.653
		JP2	0.705			
	Job retention (JR)	JR1	0.729			
		JR2	0.841			
	Job satisfaction (JS)	JS1	0.802			
		JS2	0.897			
	Income level (IL)	IL1	0.853			
		IL2	0.796			
	Career advancement (CA)	CA1	0.858			
		CA2	0.851			

Items designations are as in the Figure 2 legend.
Abbreviations: AVE, average variance extracted; CR, composite reliability.

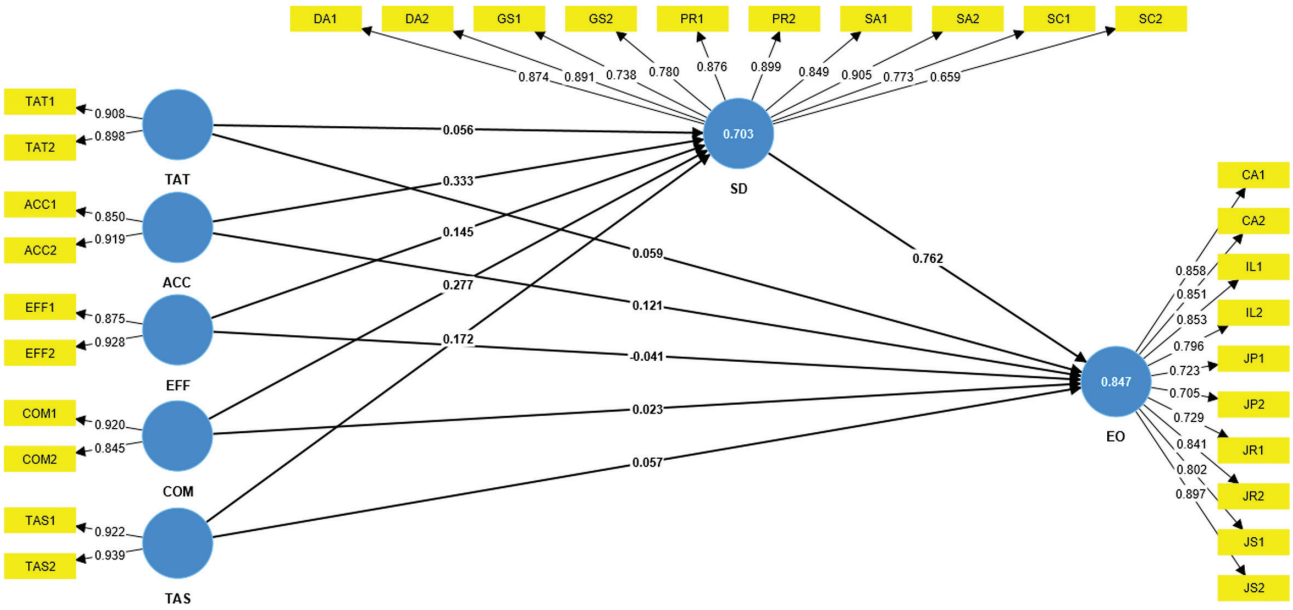

Figure 3: Measurement model. Abbreviations: ACC, accessibility; AT, assistive technology; CA, career advancement; COM, compatibility; DA, decision-making autonomy; EFF, effectiveness; EO, employment outcome; GS, goal setting; IL, income level; JP, job placement; JR, job retention; JS, job satisfaction; PR, persistence and resilience; SA, self-advocacy; SC, self-belief and confidence; SD, self-determination; TAS, training and support; TAT, type of assistive technology.

SD exhibit exceptionally high-reliability scores, signifying consistent and dependable measurement. However, the SC sub-construct within SD, despite high-reliability scores, shows a lower AVE, suggesting some items may not converge well on the intended construct, indicating a potential area for refinement.

Most constructs demonstrate strong convergence validity, with AVEs surpassing the commonly accepted threshold of 0.5. This suggests that a significant portion of the variance in items is accounted for by their constructs, affirming the constructs' ability to capture their intended concepts effectively. Nevertheless, specific areas, especially within the SD construct, highlight lower AVEs, pointing to the need for closer examination to ensure all model aspects adhere to the desired standards of measurement validity.

Discriminant validity

This shows the extent to which constructs differ, as Ab Hamid et al. (2017) reported. Thus, the Heterotrait–Monotrait ratio (HTMT) and Fornell–Larcker criterion were used to calculate the discriminant validity because of their high sensitivity in detecting correlation issues (Voorhees et al., 2016). The rule of thumb value for HTMT is 0.9. If the HTMT value is below 0.9, it shows no correlation problem. Thus, the HTMT value in this study (0.564-0.686) is acceptable, as Henseler et al. (2009) recommended as seen in Table 5.

Table 5 presents the results of a discriminant validity test for various constructs within a study, utilizing both the Fornell–Larcker criterion and the HTMT to assess the validity. According to the Fornell–Larcker criterion, discriminant validity is confirmed when the square root of the AVE for each construct, highlighted by bold diagonal values, is greater than the correlations between it and other constructs. For instance, the ACC has a diagonal value of 0.885, indicating its AVE square root, which needs to be higher than its correlations with constructs such as COM, EFF, and others, to confirm discriminant validity. The HTMT criterion further validates discriminant validity, with a threshold that HTMT ratios must be <0.85. The provided data imply that all constructs meet these criteria, with ACC, COM, EFF, EO, SD, TAS, and TAT all showing strong diagonal values indicative of significant discriminant validity. The HTMT values are below the 0.85 threshold, further reinforcing the discriminant validity across constructs.

Structural model (testing of hypotheses)

This study analyzed the overall structural model and hypotheses testing, in which the R2 of the EO is 0.847 and for SD is 0.703. Therefore, we have fully explained the constructs and the constructed model exhibits substantial explanatory power. The path coefficient of the model structure adopted the significant hypotheses test of bootstrapping of 5000 with the standardized path coefficient, t value, and the hypothesis test. Thus, Figures 4 and 5 and Table 6 show the results of the structural model of the study.

Table 6 presents the results of the structural model used to analyze the direct and indirect effects of AT on EO, with SD as a mediating variable. The results are presented in terms of standardized beta coefficients (Std beta), t values, *P* values, and confidence intervals, along with decisions to accept or reject the hypotheses.

Analyzing the direct effects:

- H1a: AT → EO: The direct effect of AT on EO is significant (Std beta = 0.172, $P = 0.028$), suggesting that AT has a positive impact on EOs.
- H1b: TAT → EO: The effect of the TAT on EO is not significant ($P = 0.296$), indicating that the kind of AT used does not directly influence EOs in a statistically significant way.
- H1c: ACC → EO: ACC's impact on EO is significant (Std beta = 0.121, $P = 0.041$), meaning that the ACC of AT is important for improving EOs.
- H1d: COM → EO and H1e: TAS → EO: The effects of COM and TAS on EO are not significant, with *P* values of 0.770 and 0.346, respectively, suggesting these factors do not have a direct, significant impact on EOs.

When looking at the role of SD:

H2: AT → SD: There is a very strong and significant relationship between AT and SD (Std beta = 0.832, $P < 0.001$), indicating that AT greatly enhances SD.

Table 5: Discriminant validity test.

	Discriminant validity (Fornell–Larcker criterion result)							Discriminant validity [Heterotrait–Monotrait ratio (HTMT) result]						
	ACC	COM	EFF	EO	SD	TAS	TAT	ACC	COM	EFF	EO	SD	TAS	TAT
ACC	**0.885**													
COM	0.706	**0.883**						0.758						
EFF	0.626	0.712	**0.802**					0.618	0.671					
EO	0.753	0.721	0.661	**0.808**				0.787	0.756	0.762				
SD	0.750	0.758	0.710	0.712	**0.828**			0.690	0.797	0.713	0.761			
TAS	0.537	0.530	0.569	0.601	0.607	**0.931**		0.670	0.671	0.698	0.678	0.679		
TAT	0.688	0.664	0.597	0.646	0.638	0.480	**0.903**	0.917	0.696	0.769	0.757	0.746	0.592	

Abbreviations: ACC, accessibility; COM, compatibility; EFF, effectiveness; EO, employment outcome; SD, self-determination; TAS, training and support; TAT, type of assistive technology.
*Following the Fornell–Larcker criterion, the bold value is accepted when it exceeds its row and column values.
*A HTMT ratio <0.85 is considered valid.

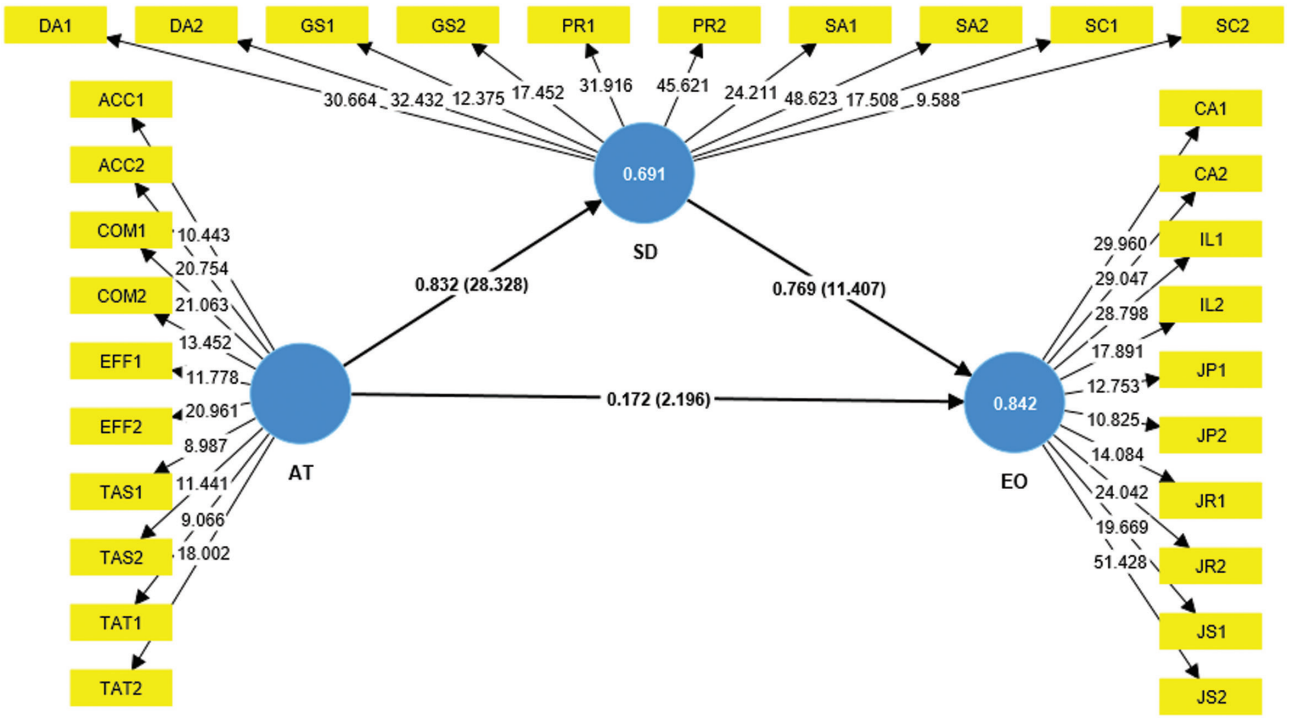

Figure 4: The structural model to test the main hypotheses (bootstrapping at 5000). Abbreviations: ACC, accessibility; AT, assistive technology; CA, career advancement; COM, compatibility; DA, decision-making autonomy; EFF, effectiveness; EO, employment outcome; GS, goal setting; IL, income level; JP, job placement; JR, job retention; JS, job satisfaction; PR, persistence and resilience; SA, self-advocacy; SC, self-belief and confidence; SD, self-determination; TAS, training and support; TAT, type of assistive technology.

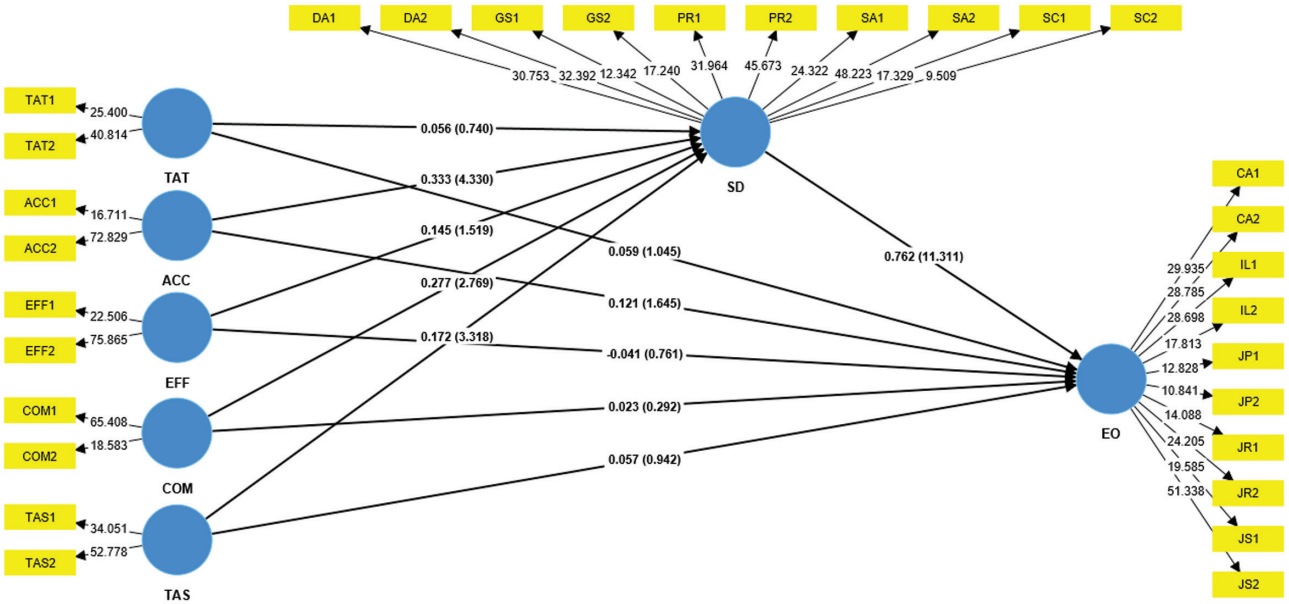

Figure 5: The structural model to test the sub-hypotheses (bootstrapping at 5000). Abbreviations: ACC, accessibility; AT, assistive technology; CA, career advancement; COM, compatibility; DA, decision-making autonomy; EFF, effectiveness; EO, employment outcome; GS, goal setting; IL, income level; JP, job placement; JR, job retention; JS, job satisfaction; PR, persistence and resilience; SA, self-advocacy; SC, self-belief and confidence; SD, self-determination; TAS, training and support; TAT, type of assistive technology.

Table 6: The result of the structural model.

Relationships	Std beta	t value	*P* values	CI (2.5-97.5%)	Decision
Direct effects					
H1: AT → EO	0.172	2.196	0.028	0.013-0.320	Accept*
H1a: TAT → EO	0.059	1.045	0.296	−0.053-0.170	Reject*
H1b: ACC → EO	0.121	1.645	0.041	0.039-0.249	Accept*
H1c: EFF → EO	−0.041	0.761	0.446	−0.080-0.300	Reject*
H1d: COM → EO	0.023	0.292	0.770	−0.143-0.073	Reject*
H1e: TAS → EO	0.057	0.942	0.346	−0.056-0.181	Reject*
H2: AT → SD	0.832	28.328	0.000	0.771-0.886	Accept**
H3: SD → EO	0.769	11.407	0.000	0.644-0.908	Accept**
Bootstrapping results for testing SD as a mediator					
H4: AT → SD → EO	0.640	10.454	0.000	0.533-0.772	Accept**
H4a: TAT → SD → EO	0.043	0.728	0.467	−0.067-0.165	Reject*
H4b: ACC → SD → EO	0.253	3.974	0.000	0.136-0.388	Accept**
H4c: EFF → SD → EO	0.110	1.488	0.137	−0.062-0.238	Reject*
H4d: COM → SD → EO	0.211	2.686	0.007	0.067-0.375	Accept**
H4e: TAS → SD → EO	0.131	3.128	0.002	0.050-0.216	Accept**

Abbreviations: ACC, accessibility; AT, assistive technology; CI, confidence interval; COM, compatibility; EFF, effectiveness; EO, employment outcome; SD, self-determination; Std beta, standardized beta coefficients; TAS, training and support; TAT, type of assistive technology.
*$P < 0.05$, **$P < 0.01$.

H3: SD → EO: Similarly, there is a significant effect of SD on EO (Std beta = 0.769, $P < 0.001$), which supports the idea that SD is crucial for positive EOs.

The bootstrap results for testing SD as a mediator are also provided:

- H4a: AT → SD → EO: The indirect effect of AT on EO through SD is significant (Std beta = 0.640, $P < 0.001$), confirming the mediating role of SD.
- H4b: ACC → SD → EO: Similarly, the ACC of AT significantly affects EO through SD (Std beta = 0.253, $P < 0.001$).
- However, the effects of EFF (H4c) and COM (H4e) through SD on EO are not significant, with *P* values of 0.137 and 0.102, respectively.
- H4d: TAS → SD → EO: The pathway from TAS through SD to EO is significant (Std beta = 0.131, $P = 0.002$), highlighting the importance of TAS in leveraging SD to improve EOs.

In conclusion, the analysis suggests that while certain aspects of AT do not directly influence EOs, they can have a significant impact when they contribute to enhancing an individual's SD. The strong mediating role of SD highlights the importance of considering both the technological and psychological aspects when seeking to improve EOs for people with disabilities.

DISCUSSION

The study conducts an in-depth examination of the dynamic relationship that exists between AT provision, SD, and EOs, specifically, with respect to PwDs in KSA. Based on the findings of the study, there exist significant associations between AT provision, SD, and EOs—an outcome that emphasizes the crucial role of these factors as determinants of EFF in the development and promotion of inclusion and employment of working-age PwDs within work environments. The study findings indicate the key role of AT provision with respect to the improvement of EOs for PwDs in KSA. Specifically, the study found the direct effect of AT on EOs to be significant, indicative of the positive effects of AT usage on job placement, satisfaction, career advancement, income level, and retention for PwDs. These research findings are consistent with the findings of Marinaci et al. (2023) that indicate that the deployment of AT works on multiple levels to shape the workplace experiences of PwDs. Additionally, research also indicates that usage of AT, in work environments for PwDs, accrues benefits such as reduced absenteeism, increased productivity and engagement, and increased collaboration and communication (Bonaccio et al., 2020).

Furthermore, the study also demonstrated a strong relationship between AT provision and SD, which indicates that AT significantly improves the characteristics of self-belief, decision-making autonomy, self-advocacy, goal setting, and persistence and resilience within PwDs. This finding is consistent with Pacheco et al.'s (2019) investigation of ICT-enabled SD skills that are developed through the usage and adaptation of collaborative and interactive online tools and mobile devices. Similar to Pacheco et al.'s (2019) study which explores the implications of new technologies for the personal development and enhancement of SD for PwDs, the current study underscores the importance of taking into consideration the role of SD as a key facilitator of the adoption and EFF of AT devices within workplace environments. These findings demonstrate the mediating role of SD in the relationship between AT provision and EOs—with SD functioning as a mechanism by which EOs are influenced by AT for PwDs. In terms of ACC of AT, the current study findings indicate a significant influence of this factor on EOs through SD—a finding that highlights the

crucial role of targeted, tailored, and accessible AT tools in the maximization of their impact on EOs (Boot et al., 2018).

Based on an assessment of the implications of the current study findings, the supportive framework of employment of PwDs in KSA needs to improve significantly—particularly, as it pertains to the domains of employers, policymakers, and practitioners. The findings emphasize the importance of AT investment and the need to improve the ACC, EFF, and COM of AT tools with the specific or unique and varied needs of PwDs, a finding also indicated by Boot et al. (2018), Heyn et al. (2021), Kruse et al. (2024), Marinaci et al. (2023), Morris et al. (2022), and Wang et al. (2017). Essentially, consistent with the findings of the current study, findings from numerous studies, as indicated, demonstrate the positive effects of creating an enabling working environment for PwDs that allows for the provision of necessary tools and resources required to overcome the barriers of their limitations and guarantee professional excellence. Additionally, the current study demonstrates the key role of SD with respect to the enhancement of AT adoption and EFF within workplace environments—as acknowledged by previous findings by Di Maggio et al. (2019) and Field et al. (1998). Consequently, AT provision strategies are complemented by interventions targeted at improving the SD skills of PwDs (self-advocacy training, goal-setting workshops, and resilience-building projects), which cumulatively have a positive effect on EOs.

However, based on the research methodology and the quantitative analysis undertaken within the current study, the reliance on self-reported data from a relatively small sample of PwDs in specific regions of KSA poses significant limitations with respect to the generalizability of the study findings. Martinez-Mesa et al. (2014) argue that small sample sizes or inadequate sample sizes are quite limited with respect to the demonstration of desired differences, or the estimation of the frequency of the event of interest, or degree of association, with acceptable precision. In addition, research has indicated the crucial role of demonstrating a temporal relationship between events of potential cause and effect in the generation of a causal relationship (Muthu et al., 2023). However, for the current cross-sectional research study, cause does not follow effect; hence, the study precludes causal inferences—therefore, a longitudinal research study on the same parameters is required to ascertain the existing temporal relationships between AT, SD, and EOs.

CONCLUSION

In conclusion, the above study adds positively to the understanding of the complex and dynamic relationship between AT provision, SD, and EOs for PwDs within the unique socio-cultural context of KSA. The findings of the study indicate the significant effect of AT provision in the improvement of EOs for PwDs, in addition to the mediating effect of SD in the context of this relationship. In a breakdown of various specific effects, the study demonstrates that AT has a positive effect on job placement, satisfaction, earnings, retention, and career advancement for PwDs in KSA—with an additional indication of the crucial role of SD in the facilitation of AT adoption and EFF within workplace environments. Heading into the future, there is a need for employers, policymakers, and practitioners to take into account the importance of AT investment as a method of improving the ACC and EFF of these devices, and their accompanying interventions targeted at enhancing SD skills among PwDs.

In order to create empowering work environments for PwDs, inclusive and supportive spaces, AT investment is acknowledged as an essential strategy for overcoming the challenges that limit professional excellence by PwDs—with a resulting effect of greater equality and participation in KSA workforce. To achieve evidence-based interventions and policies, there is a need for continued research with respect to the dynamic relationship of AT, SD, and EOs for PwDs within KSA—this research could prove quite effective in the advancement and structuring of rights and opportunities for PwDs within KSA, and abroad.

Limitations and suggestions for further studies

Even though the current study provides insightful findings of the relationships between AT provision, SD, and EOs for PwDs in KSA, as discussed in the Discussion section earlier, the two key issues of inadequate sample size and the cross-sectional nature of the study create significant limitations in terms of the generalizability of the study findings and the confirmation of the cause–effect sequence of variables (temporal relationships), respectively. In terms of recommendations, future research needs to address the identified limitations by opting for larger and diverse samples of PwDs from various different regions of KSA. Future examination of the mediating role of SD, in terms of the effects of AT on EOs, should be covered in longitudinal studies to investigate the long-term effects of these relationships. In addition to structured self-reported surveys, future research may also employ additional qualitative research methods such as focus groups and interviews to acquire a rich and in-depth analysis of the lived experiences of PwDs and the various factors affecting their employment trends. There is also a need to undertake comparative studies examining the EFF of different AT devices and interventions across various cultural backgrounds—these studies would be quite effective in informing the best-practice approaches.

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APPENDIX 1

QUESTIONNAIRE

Research Title: The Mediating Role of Self-Determination in The Relationship Between Assistive Technology and Employment Outcomes for People with Disabilities in Saudi Arabia

Section I: Personal data

1- Type: Male () Female ()
2- Age: <30 years () 30 to <40 years () 40+ ()
3- A Education level: Less than bachelor () Bachelor () Masters and above ()
4- Duration of Disability, y
Short-Term Disability: ≤5 ()
Intermediate-Term Disability: >5 to ≤10 ()
Mid-Range Disability: From >10 to ≤15 ()
Long-Term Disability: >15 ()

Section II: Survey

Assistive Technology	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. Type of Assistive Technology (TAT)					
The range of sustainable assistive technology options available meets my specific needs.					
The choice of sustainable assistive technology options is diverse and inclusive.					
2. Accessibility (ACC)					
The sustainable assistive technology I use is easy to access and easy to use.					
It is easy to customize assistive technology to suit my specific needs.					
3. Effectiveness (EFF)					
The sustainable assistive technology I use is affordable, given my financial circumstances.					
It is easy to access and buy the assistive technology I need.					
4/Compatibility (COM)					
The assistive technology I use seamlessly integrates with my job tasks and tools.					
b. I face compatibility issues when using assistive technology with specific work applications.					
5/Training and support (TAS)					
I have received comprehensive training in the effective use of assistive technology.					
Ongoing technical support is available to address any assistive technology challenges.					

Self-Determination (SD)	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. Self-belief and Confidence (SC)					
I believe in my ability to perform my job tasks successfully.					
I have confidence in my skills and capabilities despite my Disability.					
2. Goal Setting (GS)					
I actively set goals related to my job performance and career advancement.					
Setting realistic and achievable goals in my employment is challenging.					
3. Decision-making Autonomy (DA)					
I can make decisions regarding my job tasks and responsibilities.					
I feel limited in my decision-making authority due to my Disability.					

4. Self-advocacy (SA)	
I am confident in advocating for my needs and accommodations in the workplace.	
I face difficulties in asserting my needs and accommodations in the workplace.	
5. Persistence and Resilience (PR)	
I remain determined and resilient in overcoming challenges at my workplace.	
I find it difficult to bounce back from setbacks or obstacles in my work.	

Employment Outcome (EO)	**Strongly agree**	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**
1. Job Placement (JP)					
I have successfully secured employment.					
I have received job offers related to my field of interest.					
2. Job Retention (JR)					
I have maintained my current job for a significant period.					
I have faced difficulties in retaining employment due to my Disability.					
3. Job Satisfaction (JS)					
I am satisfied with my overall job responsibilities and tasks.					
I feel valued and recognized for my contributions to the workplace.					
4. Income Level (IL)					
I earn a fair and competitive income based on my qualifications.					
I face income disparities compared to colleagues without disabilities.					
5. Career Advancement (CA)					
I have opportunities for growth and advancement in my current job.					
I have been promoted or given increased responsibilities in my career.					