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Research article

Teacher well-being and use of artificial intelligence applications and tools: Moderation effects of leadership support in inclusive classroom

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Abstract: Integrating artificial intelligence (AI) into primary inclusive classrooms can significantly enhance teacher well-being by streamlining tasks, preventing burnout, fostering collaboration, and supporting diverse learning needs. However, for teachers to effectively use AI, they need to recognize its relevance, engage with its benefits, and promote its use to enhance their own well-being. The primary goal of this study is to examine the moderator effect of leadership support on the adoption of AI applications and tools and psychological well-being in primary inclusive classrooms in our hypothesized research model. To address this purpose, a quantitative methodology with structural equation modeling was utilized. Data was retrieved through an online questionnaire from 342 primary inclusive teachers, most being regular AI users. Our findings indicate that extensive use of AI tools is linked to engagement, relationships, and accomplishment but not to positive emotions or meaning. Surprisingly, school leadership negatively moderates factors outcomes, except for accomplishment, which remained effective. Leadership appeared less crucial in promoting AI adoption and enhancing teacher well-being. Leadership emerged as a less critical factor in promoting AI applications and tool adoption and teacher well-being. Professional programs for teachers should incorporate the impact of AI-based educational tools on psychological well-being, emphasizing the key role of leadership in AI adoption. Additionally, these programs should offer opportunities for sharing best practices to enhance the effective integration of AI in educational settings.

Keywords: well-being, PERMA model, AI applications and tools, inclusive teachers, school leadership support

1. Introduction

Teacher well-being has been recognized as a critical concern in today's educational landscape, especially with the challenges brought on by the digitization era [1]. In inclusive classrooms, characterized by the integration of students with diverse abilities into general education settings and guided by the philosophy that all children can learn together [2], teachers face increased responsibilities to meet individual student needs, manage differentiated instruction, collaborate with special education professionals, and ensure an equitable learning environment, making their mental and emotional well-being crucial. Well-being encompasses teachers' mental, emotional, and physical health, vital for their professional success and personal satisfaction. In the light of the current context, this study tries to offer such an approach by applying Seligman [3] PERMA model to explore inclusive teachers' well-being, with a focus on the consequences of their unique professional contexts. PERMA model stands for positive emotion, engagement, relationships, meaning, and accomplishment. Each element represents a crucial aspect of well-being: happiness, task involvement, social connections, purposeful work, and professional achievement.

The adoption of artificial intelligence (AI) in United Arab Emirates (UAE) education has gained substantial attention, with AI tools and applications offering potential solutions to many of the challenges faced by teachers [4]. AI-based educational tools have been shown to enhance teaching practices, improve educational outcomes, and facilitate decision-making processes, contributing to sustainable learning possibilities and supporting the UAE's initiatives in developing educators for innovative pedagogies and technology-enabled teaching standards [5]. AI technology holds great promise for revolutionizing inclusive education and assessing how teachers deliver tailored lessons, providing real-time feedback, reducing teachers' administrative tasks and overall workload, and enhancing student collaboration, improving their educational learning experiences that meet a variety of learning demands [6–8]. Incorporating AI in teaching requires additional time and effort to meet the diverse learning needs of typical students and those with disabilities [9]. Research suggests that educators with higher well-being, resilience, and motivation are more likely to effectively use AI applications [10]. For inclusive teachers, however, barriers such as a lack of understanding of AI tools and applications, inadequate training, socio-cultural reservations, resistance to change, insufficient policies, and limited resources can significantly impact their well-being [11]. Additionally, the challenges of updating curricula with AI disciplines, adopting inclusive teaching techniques, and developing new evaluation metrics further compound these difficulties [12]. Ethical implications, such as ensuring responsible AI use, add to the complexity, increasing educators' stress and affecting their mental health [10,13]. Moreover, research shows that teachers often experience uneasiness, doubt, and anxiety when adopting new approaches [14], leading to poor overall well-being [15] and feelings of being undervalued in their profession [16].

School leadership support is a crucial factor in the successful adoption of new technologies in schools and in fostering teacher well-being by providing necessary infrastructure, resources, and a supportive environment that encourages innovative practices, promotes collaboration, addresses students' learning needs, and shares responsibilities [17]. Transformational leadership is a style of

leadership characterized by the ability to inspire and motivate teachers to exceed expectations by fostering innovation and collaboration [18], playing a critical role in facilitating AI adoption through professional development and technology integration [18]. Research emphasizes the significance of leadership actions that enhance teacher well-being, such as feeling valued, meaningful professional development, and agency in decision-making [19]. School leadership plays a vital role in shaping teachers' positive perceptions of AI technology by encouraging the development of AI-related skills, promoting professional growth, and ensuring the ethical use of AI tools. This, in turn, enhances teaching effectiveness and contributes to the psychological well-being of educators [5,20–27]. Moreover, effective leadership strategies that emphasize crisis prevention and mental well-being are crucial for creating a positive and supportive environment in educational institutions [28].

Despite the widespread interest in AI's role in improving educational outcomes, the impact of AI adoption on inclusive teacher well-being through PERMA elements and the role of leadership support has been relatively underexplored. Even so, teacher well-being, as captured through the PERMA model, has been linked to greater life satisfaction and job satisfaction [29]. Previous studies found that practicing positive psychology interventions (PPIs) enhanced teachers' well-being multidimensionally and produced positive impacts on others [30]. In addition, leadership support in schools may play a critical role in promoting teachers' positive emotions at work by boosting their sense of value through meaning and accomplishment [31]. Given the relatively limited understanding of how AI can enhance their psychological well-being, this study aims to examine a PERMA model of teacher well-being in inclusive classrooms. Additionally, the role of leadership support in facilitating AI adoption and promoting teacher well-being has not been sufficiently examined.

The present study

Based on the theoretical propositions of PERMA well-being [32] and transformational leadership [33], we aimed to answer the following research questions:

RQ1: What is the association between psychological well-being (positive emotion, engagement, meaning, relationship, and accomplishment) and the adoption of AI applications and tools by teachers in inclusive classrooms?

RQ2: How does school leadership support the association between psychological well-being (positive emotion, engagement, meaning, relationship, and accomplishment) and the use of AI applications and tools by teachers in inclusive classrooms?

2. Literature review

2.1. Artificial intelligence in education

Artificial intelligence has emerged as a transformative force in various sectors, and the field of education is no exception. AI in education is defined as an educational technology capable of detecting patterns in existing or in vivo data and making automatic instructional decisions that are developed or implemented for pedagogical purposes to enhance the teaching and learning process [34,35]. Indeed, different motion pictures have been made to showcase the abilities of AI, such as in smart buildings to manage air quality, temperature, and/or playing music depending on the sensed mood of the occupants of the space. Within the education sector, there has been increased application of artificial intelligence,

going over and above the conventional understanding of AI as a supercomputer to include embedded computer systems [36]. Ali et al. [37] identified administration, instruction, and learning as key areas where AI has been integrated into education, forming the framework for analysis in this study. The potential of AI-assisted instruction is immense, as it holds the promise of revolutionizing how students learn, and teachers educate [38]. One of the primary benefits of integrating AI into education is its ability to facilitate adaptive learning [39]. AI-powered systems can tailor the learning experience to the individual needs and preferences of each student, adjusting the pace, content, and difficulty level accordingly. This personalized approach can lead to increased engagement, better retention of information, and ultimately, improved learning outcomes [11]. Moreover, AI can enhance the efficiency and effectiveness of the education system using predictive analytics. By analyzing student data, such as performance, attendance, and engagement, AI-based systems can identify patterns and provide valuable insights to educators, enabling them to make informed decisions and allocate resources more effectively [34].

2.2. Teacher well-being and its measures

Well-being is a multifaceted and abstract concept encompassing physical, mental, and social dimensions, which can be divided into objective (e.g., basic needs, education) and subjective (e.g., life satisfaction, emotional experiences) domains [40]. The high attrition rates and challenges faced by teachers highlight the need to address their well-being. Research indicates that teachers often encounter stress, low self-esteem, reduced job satisfaction, and increased burnout risk, negatively impacting their well-being [41]. Ensuring teacher well-being is crucial for fostering job satisfaction, positive emotions, professional growth, lower dropout rates, and improved student outcomes [42]. Prioritizing teacher well-being, a comprehensive construct involving physical, social, emotional, and psychological aspects, helps educators manage career demands and lead fulfilling lives [43]. Positive school climates reduce teacher absenteeism and foster a sense of belonging [44], while supportive environments help counteract burnout, leading to increased engagement, improved performance, and enhanced student outcomes [45].

PERMA model [positive emotion (P), engagement (E), relationship (R), meaning (M), and achievement (A)], also known as happiness PERMA [28], is used to understand and cultivate well-being. PERMA-based interventions have been shown to enhance collaboration, classroom effectiveness, and teaching activities, fostering belonging, respect, and trust, which in turn increase student engagement [46]. The PERMA model aims for individuals to feel fulfilled and live "the good life" [32]. Studies reveal significant correlations between PERMA elements and factors like life satisfaction, school engagement, physical vitality, positive work outcomes, and psychological safety [47]. Positive emotions involve hedonic feelings of happiness, contentment, and joy. Engagement refers to being deeply immersed, interested, and enthusiastic about activities or causes. Relationships include feeling socially integrated and supported by others. Meaning involves having a purpose, direction, and a sense that one’s work matters. Accomplishment entails making progress toward goals, feeling capable in daily activities, and experiencing personal satisfaction and achievement [32,48]. Based on related studies, we propose the following hypotheses (Figure 1):

H^1: Positive emotions are positively correlated with teachers' use of AI in inclusive classrooms.
H^2: Engagement is positively associated with teachers' use of AI in inclusive classrooms.
H^3***:*** Relationship is positively associated with teachers' use of AI in inclusive classrooms.

H^4: Meaning is positively associated with teachers' use of AI in inclusive classrooms.
H^5: Accomplishment is positively associated with teachers' use of AI in inclusive classrooms.

2.3. School leadership support

Leadership at school is a very new topic in psychology and well-being research. In our study, we refer to a leadership style that may have a pivotal role in influencing teachers' well-being, namely transformational leadership. A well-known model developed by Burns [33] describes the role of leaders in inspiring and motivating individuals. In this model, leaders focus on fostering a sense of value and investment in organizational goals, thereby boosting workplace motivation, self-esteem, and growth [49]. This approach does not directly define leadership behavior or specific characteristics of a leader. Instead, it offers an organizational theory that can lead to an indirect derivation of leadership behavior in schools by establishing and communicating a vision. This vision aims to develop the organization and people by approaching them individually and setting a good example; also, it fosters collaboration between teachers [50,51]. Bass [52] defined transformational leadership as including four key components: idealized influence (offering a sense of purpose and acting as a model of the change process), inspiration (informing employees about high expectations and communicating important aspects in a comprehensible manner), intellectual stimulation (fostering the employees' creativity, critical thinking, and problem-solving), and individual consideration (paying attention to each employee, coaching, and advising).

The influx of technology in schools demands a shift in traditional leadership roles to support employee well-being, influenced by socio-psychological factors like meaningful work, empowerment, trust, and role clarity [53]. Consistently, several empirical studies have shown a positive relationship between school leaders' transformational leadership behavior and technology integration and teacher well-being. For example, Venema-Steen et al. [54] argued that leadership, viewed as fostering collective capacity and enhancing well-being, is essential for school improvement. Building on positive psychology in schools, which emphasizes vitality, strengths, and human capacities for well-being such as compassion, kindness, and care, leadership can significantly enhance the well-being of teachers and others, thereby driving school improvement efforts. School leaders are in a unique position to meet challenges and bring about change [55]. Cheng and Wang [56] indicated that leadership is a significant factor in facilitating AI applications and tool incorporations in schools and that teachers' internal and external barriers considerably affect learning about AI. Schmitz et al. [57] emphasized that transformational leadership had a significant and positive impact on the digital school infrastructure, teachers' positive beliefs about digital technology, their technical skills, and their skills in teaching with digital technologies. Raman et al. [58] also highlighted the positive impact of principals' leadership on technology use in classrooms, as they serve as role models and shape teachers' behaviors through interactions. These studies commonly consider school leaders to be central figures who exhibit transformational leadership practices and influence well-being and technology integration. Based on related studies, we proposed the following hypothesis (Figure 1):

H^6: School leadership support moderates the relationship between positive emotion, engagement, relationship, meaning, and accomplishment and using AI applications and tools in an inclusive classroom.

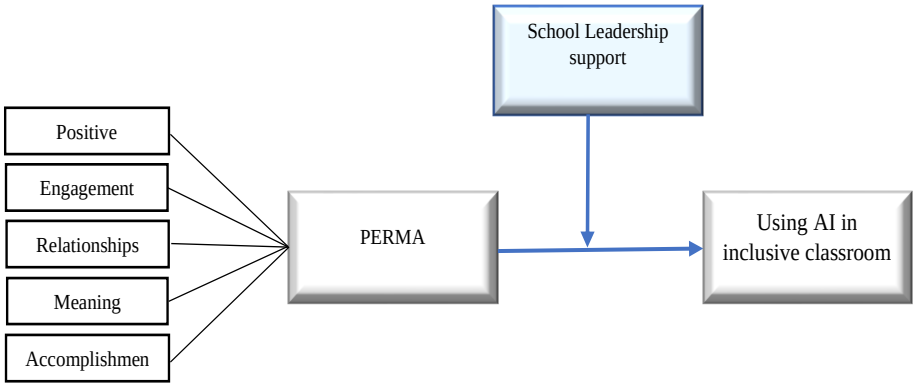

Figure 1. Theoretically assumed mechanisms based on PERMA and transformational leadership theory.

3. Methods

3.1. Participants

In research studies, the demographic profile of respondents is crucial in comprehending their background characteristics. In the present study, four demographic characteristics (gender, age, level of education, years of experience) were assessed. Participants' mean age was less than 30 years old, 56.7% were female, 52.3% had taught for 6–10 years, and the majority (71.1%) had a bachelor's degree. 73.1% of participants had 1–2 years of experience, while 26.9% had 3–5 years of experience in using AI applications and tools. All questionnaires were complete, without any missing data. Prior to conducting the survey, all participants were provided with a briefing regarding the purpose of the study and were informed of their freedom to withdraw from participation at any time. According to them, most had begun using AI applications and tools relatively recently, starting after the onset of COVID-19, particularly in inclusive classrooms for teaching purposes. Additional participant information is included in Table 1.

3.2. Procedure

The correlational design was selected to address the research questions by studying the variables in a measurable way. The original sample consisted of 342 inclusive classroom teachers in government high schools in Abu Dhabi. A random cluster sampling strategy was used to recruit participants. Specifically, participants were selected from various government high schools in Abu Dhabi that permitted inclusive teachers to participate in the survey. The recruitment process involved school administrators who sent the link to potential participants at their schools; the survey was in a Google Form format and included an informed consent statement. All participants voluntarily and individually responded to the questionnaire without receiving any form of compensation. To qualify for participation in the study, they were expected to meet the following criteria: being in a public school's high school, working as inclusive teachers, and using AI in an inclusive classroom.

Table 1. Participant frequency distribution (n = 342).

Variables	Demographic	N	% of sample
Gender	Male	148	43.3%
	Female	194	56.7%
Age	Less than 30 years old	169	49.4%
	30–40 years old	111	30.2%
	41–50 years old	49	14.3%
	More than 50 years old	13	3.8%
Educational level	Bachelor	243	71.1%
	Master	83	24.3%
	PhD	16	4.7%
Years of teaching experience	6–10 years	179	52.3%
	11–15 years	86	25.1%
	16–20 years	30	8.8%
	More than 20 years	47	13.7%
Years of experience using AI	1–2 years	250	73.1%
	3–5 years	92	26.9%

3.3. Measures

3.3.1. PERMA well-being scale

To obtain the relationship between the psychological well-being of inclusive teachers and their use of AI in inclusive classrooms, 28 items from the PERMA well-being scale [29,32,59] were adopted to measure participants' psychological well-being. Response categories were as follows: 1 = all the time, 2 = most of the time, 3 = half of the time, 4 = only a little of the time, and 5 = not at all. Some item examples are as follows: Regarding positive emotion, “I feel fatigued when I get up in the morning and remember I will face challenges in using AI in an inclusive classroom”. Regarding engagement, “When I am using AI in an inclusive classroom, I often lose track of how much time passes". Regarding relationships, “My relationships are supportive and rewarding when I need help in using AI in an inclusive classroom”. Regarding meaning, “I feel great value for what I do using AI in an inclusive classroom”. Regarding accomplishment, “When I use AI in my inclusive classroom, I feel a sense of accomplishment from what I do." Previous studies by Butler and Kern [60] have demonstrated the internal consistency and validity of the English version of the scale.

3.3.2. Use of AI in an inclusive classroom

Seven items were developed from [61]. Response categories were as follows: 1 = Always, 2 = Often, 3 = Sometimes, 4 = Rarely, and 5 = Hardly ever/ever. An example of an item is “I use the AI frequently during teaching inclusive classrooms”. Upon completing these phases, a pool of 43 items was developed. A panel of 10 experts in the field of educational psychology and leadership discussed and reviewed the items to examine the appropriateness and clarity of each item and to ensure that

each item assessed an aspect of the study. Experts were invited to rate each item formally for its relevance in measuring perception on a five-point Likert-type scale (1 = extremely irrelevant, 2 = irrelevant, 3 = slightly relevant, 4 = relevant, and 5 = strongly relevant).

3.3.3. Moderation model

Transformational leadership scale

Seven items were extracted from the school leadership support with the transformational leadership scale [14,62]. Response categories were organized as follows: 1 = To a very large extent, 2 = To a large extent, 3 = Somewhat, 4 = To a small extent, and 5 = To a very small extent. An example of an item is “The school leaders usually provide the right climate for us to think positively and motivate us to try out new technologies while using AI in inclusive classrooms in line with their interests”.

3.4. Transparency and openness

Significant steps were taken, such as an explication of our sampling plan, identification of any data exclusion, a transparent account of all manipulations employed, and a comprehensive description of all measures used throughout the study. These practices align with the TOP guidelines, contributing to the credibility and robustness of our findings. The analysis was conducted using R version 4.0.0 R Core Team, 2020 and the ggplot package, version 3.2.1. It is important to note that the study's design and analysis were not preregistered.

3.5. Statistical analysis

To investigate the impact of the PERMA model of well-being on using AI applications and tools among inclusive classroom teachers in the UAE and the moderating role of school leadership support, several statistical analyses can be conducted. Here are some potential analyses that could be employed:

Descriptive statistics: Calculate descriptive statistics (e.g., means, standard deviations) for variables such as PERMA well-being factors (e.g., positive emotions, engagement, relationships, meaning, accomplishment), AI application use, and school leadership support. This will provide an overview of the sample and variables of interest.

Correlation analysis: Conduct correlation analysis to examine the relationships between the PERMA well-being factors, AI application use, and school leadership support. This analysis will help determine the initial associations between these variables.

Multiple regression analysis: Perform multiple regression analysis to assess the impact of the PERMA well-being factors (independent variables) on AI application use (dependent variable). This analysis will help determine the extent to which the PERMA well-being factors predict AI application use.

Moderation analysis: Utilize moderation analysis (e.g., hierarchical regression with interaction terms) to examine the moderating role of school leadership support on the relationship between the PERMA well-being factors and AI applications and tools use. This analysis will help determine if school leadership support strengthens or weakens the impact of the PERMA well-being factors on AI applications and tool use.

Structural equation modeling (SEM): Employ SEM to simultaneously examine the direct and indirect effects of the PERMA well-being factors, AI application use, and school leadership support. This analysis can provide a comprehensive understanding of the relationships among these variables.

The study's replicability and generalizability are ensured through the use of a random cluster sampling strategy, detailed documentation of the methodology, and standardized measurement tools, allowing for consistent replication and potential application to similar educational settings beyond Abu Dhabi.

4. Results

4.1. Descriptive statistics

The analysis of descriptive statistics revealed that, on average, the ratings provided by teachers were predominantly positive across all aspects. However, there was a significant amount of variation that required further investigation in subsequent analyses. For a comprehensive overview of the descriptive statistics pertaining to all constructs, the normality of the sample for the PERMA well-being scale was investigated by using numerical and graphical methods. Further, skewness and kurtosis were all below 1.96 (Table 2), indicating a normal distribution of the data.

Table 2. Normality distribution skewness and kurtosis test.

Variables	N	Mean	Std. Deviation	Skewness	Kurtosis
1. PE	342	4.5103	.58533	-1.195	.900
2. EN	342	4.4693	.57338	-1.376	1.309
3. RE	342	4.5912	.53525	-1.393	1.500
4. ME	342	4.6045	.46173	-1.620	2.497
5. AC	342	4.6013	.42140	-.897	.005
6. SLS	342	4.5296	.47960	-1.558	1.267
7. USE	342	4.6104	.42947	-.757	-.457

Note: PE = positive emotion; EN = engagement; RL = relationships; MN = meaning; AC = accomplishment; SLS = school leadership support; USE = use of AI applications.

Table 2 shows the descriptive statistics for six variables: positive feelings, engagement, relationships, meaning, achievement, emotional school leadership support, and using AI applications and tools. The sample size is 342, and the mean, standard deviation, skewness, and kurtosis are reported for each variable. The mean scores for all variables are above the midpoint of the scale (which is 3), indicating that on average, participants tended to report positive experiences and perceptions related to each variable. The standard deviations for each variable are relatively small, indicating that there is not a large amount of variability in the responses. The skewness and kurtosis values for each variable indicate the degree to which the distribution of scores deviates from a normal distribution. Skewness values below 0 indicate that the distribution is negatively skewed, while values above 0 indicate positive skew. Kurtosis values above 0 indicate that the distribution has more extreme scores (i.e., is more peaked) than a normal distribution, while values below 0 indicate that the distribution has fewer extreme scores (i.e., is flatter) than a normal distribution. The skewness values for all variables are negative, indicating that the distributions are negatively skewed.

The kurtosis values for engagement, relationships, and emotional school leadership support are above 1, indicating that these distributions have more extreme scores than a normal distribution. The kurtosis value for meaning is particularly high (2.497), indicating that this distribution is highly peaked and has a very narrow range of scores. Overall, these descriptive statistics provide a useful summary of the distribution of scores for each variable and can help to inform further analyses and interpretations of the data. Both skewness and kurtosis can be analyzed through descriptive statistics. Acceptable values of skewness and kurtosis are appropriate from a range of − 3 to + 3 when utilizing SEM [59].

4.2. Correlation analysis

Table 3 shows the values of correlation. The results show that positive emotions were positively related to using AI applications in inclusive classrooms. Since the standard deviation of the present study is not far from the mean value, it indicates that respondents had similar thoughts about the questions. Measurement of correlation is important as it represents the relatedness of variables with each other. The correlation problem occurs when the value is high; however, all the values of this study are between 0.419 and 0.915, which is quite suitable for the study. The correlation among latent variables is also shown in Table 3. The correlations between using AI applications and tools and positive emotion, engagement, relationships, meaning, accomplishment, and school leadership support scores were moderate and high. Even after Bonferroni's correction, all mentioned correlations remained significant.

Table 3. Person correlations among main variables (N = 342).

Variables	1	2	3	4	5	6	7
PE							
EN	.482**						
RE	.555**	.742**					
ME	.581**	.765**	.823**				
AC	.564**	.786**	.877**	.915**			
SLS	.472**	.673**	.769**	.732**	.847**		
USE	.419**	.796**	.790**	.772**	.869**	.817**	

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

PE = positive emotion; EN = engagement; RL = relationships; MN = meaning; AC = accomplishment; SLS = school leadership support; USE = using AI applications and tools.

4.3. Structural equation modeling

To evaluate the SEM models, the following statistical analyses were employed: (1) measurement model analysis to verify and evaluate the reliability of the individual items and find the “internal consistency, reliability, convergent validity, and discriminant validity” of the instrument; (2) a confirmatory factor analysis (CFA) to examine the validity of the constructs within the proposed model; (3) a series of structural equation models as implemented in LISREL 8.3 [60] and derived from covariance matrices generated in PRELIS 2. We considered the indirect relationship between

psychological well-being (five PERMA dimensions) and using AI applications and tools as moderated by school leadership support [64].

As shown in Table 4, the results showed a good model fit, also shown from the Chi-square/df value = 2.444, which is within the recommended range of > 0.5; GFI = 0.863, CFI = 0.914, and RMSEA = 0.08. Based on the values provided, it appears that the model fits the data well. The TLI and CFI values are both above the recommended threshold of 0.90, indicating a good fit. The RMSEA value is also below the recommended threshold of 0.08, indicating a good fit. Therefore, this model appears to be a good fit for the data.

Table 4. Model fit indices.

Fit index	Recommended value	Measurement model	Structural model
Chi-square	< 5.0	2.691	2.444
GFI	> 0.9	0.828	0.863
CFI	> 0.9	0.887	0.914
RMSEA	< 0.08	0.070	0.08
IFI	> 0.9	0.888	0.915
TLI	> 0.9	0.875	0.903

Based on the values provided in Table 4, the fit indices for both the measurement model and the structural model generally meet the recommended criteria for a good fit. However, it is important to note that the interpretation of fit indices should also consider the specific context, sample size, and complexity of the model. It is recommended to consult additional literature or expert guidance to ensure a comprehensive evaluation of the model fit. In sum, the adequacy of the measurement model indicated that all items were reliable indicators of the hypothesized constructs they were purported to measure.

4.4. Test of direct effects

Table 5 examines the direct correlations of different variables. Specifically, the table shows the beta coefficients, standard errors, critical ratios (C.R.), and p-values for each of the predictor variables. The predictor variables in this analysis include five different dimensions: positive emotion, engagement, relationships, meaning, and accomplishment. The outcome variable is the use of AI applications and tools.

Table 5. Hypothesis testing results.

	Direct effect	Beta	S.E.	C.R.	P	
H1	PE → USE	.157	.068	2.181	.001	Supported
H2	EN → USE	.143	.058	1.979	.043	Supported
H3	RL → USE	.133	.056	1.890	.049	Supported
H4	MN → USE	.298	.075	3.584	.000	Supported
H5	AC → USE	.972	.079	9.986	.000	Supported

Note: PE = positive emotion; EN = engagement; RL = relationships; MN = meaning; AC = accomplishment; USE = using AI applications and tools.

As shown in Table 5, positive emotions had a positive correlation with the use of AI applications and tools (b = 0.157, C.R = 0.068, p = 0.001). Similarly, meaning had a positive correlation with using AI applications and tools (b = 0.298, C.R. = 3.584, p < 0.001), hence supporting H1 and H2. Engagement had a positive correlation with the use of AI applications and tools (b = 0.143, C.R. = 1.979, p < 0.05). Similarly, relationships had a positive correlation with the use of AI applications and tools (b = 0.133, C.R. = 1.890, p < 0.05). In addition, accomplishment had a large positive correlation with using AI applications and tools (b = 0.972, C.R. = 9.986, p < 0.001). All five hypotheses were supported by the results, hence supporting H1, H2, H3, H4, and H5. These results suggest that teachers who feel a sense of accomplishment in their work are more likely to use AI applications and tools.

4.5. Testing indirect (moderation) effect

To examine the moderating effect of school leadership support on the relationships between psychological well-being and using AI applications and tools, a path analysis was conducted. A saturated model was constructed, which incorporated the psychological well-being variables (positive emotion, engagement, relationships, meaning, and accomplishment) as a predictor, school leadership support as a moderator, and use of AI applications and tools as an outcome variable (Table 6).

Table 6. Hypothesis testing results

	Indirect effect	Beta	S.E.	C.R.	P	
H6	PE → SLS → USE	-.018	.006	-2.996	.003	Supported
H7	EN → SLS → USE	.064	.006	1.060	.289	Not Supported
H8	RE → SLS → USE	.005	.007	.091	.927	Not Supported
H9	ME → SLS → USE	-.055	.006	-.937	.349	Not Supported
H10	AC → SLS → USE	.281	.006	4.341	.000	Supported

Note: PE = positive emotion; EN = engagement; RL = relationships; MN = meaning; AC = accomplishment; SLS = school leadership support; USE = use of AI applications and tools.

Table 6 shows the indirect effects of five PERMA dimensions on using AI applications and tools through the moderating variable of school leadership support, with beta coefficients, standard errors, critical ratios (C.R.), and p-values for each of the predictor variables. The results show that positive emotions had a significant negative indirect correlation with using AI applications and tools through school leadership support (b = -0.018, C.R. = -2.996, p = 0.003). Engagement (b = 0.064, C.R. = 1.060, p > 0.05) and relationships (b = 0.005, C.R. = 0.091, p > 0.927) also had no significant indirect correlation with using AI applications and tools through school leadership support (p > 0.05). In contrast, accomplishment had a significant positive indirect correlation with using AI applications and tools through school leadership support (b = 0.281, C.R. = 4.341, p < 0.001).

5. Discussion

Based on the assumptions outlined in the PERMA well-being model [32] and transformational leadership theory [33], we investigated and examined the PERMA elements (positive emotions,

engagement, relationships, meaning, and accomplishment) with respect to constructs related to teachers' well-being and adoption of AI in inclusive classrooms. We hypothesized that each of the five PERMA well-being variables would be positively associated with teachers' use of AI applications and tools in inclusive classrooms and that those relations would be moderated by leadership support. Based on a sample of N = 342 inclusive teachers, our hypothesis could be fully confirmed. To our knowledge, this is the first study bringing together research on teacher well-being and using artificial intelligence applications and leadership support. Our research aligns with the tradition of a field known as *positive psychology* [32], which advocates practical ways for schools to develop initiatives that support both teacher well-being and a thriving learning environment for students, particularly when teachers use new teaching methods such as AI [34].

Our results show that engagement, relationships, accomplishment, positive emotion, and meaning are all positively correlated with teachers' adoption and use of AI tools. Teachers who are deeply engaged in classroom activities and recognize their positive impact on student learning are likely to support the adoption of new technology in classrooms. Moreover, positive relationships with peers, administration, and family also play a crucial role in fostering mutual respect and trust, enabling teachers to effectively tackle challenges related to remote learning. This is in line with studies by Butler and Kern [60] and Mercer et al. [65], which emphasize the importance of social relationships and engagement for positive educational outcomes and, as mentioned by Butler and Kern [60], Dreer [66], and Mercer et al. [65], for improved emotional functioning and positive outcomes. In line with the study hypothesis, the results underscore a robust correlation between accomplishment and the utilization of AI applications and tools. This noteworthy finding suggests that achievement is a vital factor for success when employing digital educational tools in inclusive classrooms. These findings are supported by prior findings of Dreer [66], who found significant links between the concept's achievement goals and various aspects of job-related well-being and satisfaction. Wassink et al. [67] found that individuals who perceive their work as meaningful are more likely to report higher job satisfaction and are more likely to take on challenging tasks. They also demonstrated strong associations between positive emotions, meaning, and teachers' job satisfaction and their subsequent retention, hope, gratitude, school engagement, physical vitality, and physical activity.

An important finding of our study was the critical moderating role of school leadership support in enhancing the effectiveness of well-being components. The findings revealed a significant negative moderating relationship between positive emotions, engagement, relationships, meaning, and the use of these platforms, influenced specifically by the level of support from school leadership. However, faculty members may benefit from personalized support and coaching as they integrate AI, which could reduce negative emotions like anxiety or frustration. Leaders who embody a positive change mindset can inspire faculty to view AI use as aligned with meaningful educational transformation. Clear communication about expectations and the role of AI in enhancing teaching practices could foster higher engagement and alignment with institutional goals. In contrast, studies such as those by [31] demonstrate that positive leadership significantly influences teachers' emotions by shaping their perceptions of control and value in their work. From a positive psychology perspective, such leadership contributes to what [32] describes as "the good life" for teachers. Similarly, Polatcan et al. [68] found that transformational leadership indirectly enhances teacher innovativeness by fostering teacher agency. The presence of high teacher trust further strengthens this relationship, indicating that supportive and trusting school environments are crucial for promoting innovation and

engagement among teachers, particularly when adopting new tools like AI in the classroom. In [57], authors found that transformational leadership positively impacts the digital infrastructure of schools by improving teachers' attitudes toward digital technology, increasing their technical proficiency, and enhancing their ability to effectively integrate digital tools, such as AI, into their teaching practices. Berkovich and Eyal [63] noted that principals' ability to recognize emotions indirectly impacts teachers' emotional well-being through transformational leadership behaviors. A possible explanation for our findings is that inadequate or inconsistent leadership support may create a disconnect between teachers' emotional well-being and their engagement with online learning tools [69]. This disconnect could lead to stress and frustration, reducing their effectiveness in using these tools despite otherwise positive emotions. Such a lack of support could undermine the potential benefits of online platforms, emphasizing the critical role of leadership in fostering a supportive environment. Our findings also confirm that school leadership support significantly moderates the relationship between teachers' sense of accomplishment and their use of AI applications and tools, driving innovation, improving technology integration, and enhancing teachers' job satisfaction and organizational commitment. Previous research highlights that transformational leadership by principals is crucial in addressing challenges and fostering creativity, innovation, and organizational commitment among teachers [70,71]. Schmitz et al. [57] found that transformational leadership positively impacts digital school infrastructure, enhancing teachers' attitudes, technical proficiency, and effective use of digital tools, leading to higher technology integration.

6. Conclusions and implications

The findings of this study clearly demonstrate that while positive emotions and meaning did not directly correlate with the use of AI applications and tools in inclusive classrooms, engagement, relationships, and accomplishment were found to be key factors driving AI adoption. Teachers deeply engaged in classroom activities, fostering positive relationships, and achieving their goals were more likely to utilize AI effectively. By focusing on the interconnectedness of leadership, teacher well-being, and technology adoption, this study offers valuable insights into optimizing educational practices in the era of digital innovation. We emphasize the need for targeted interventions that support specific well-being components—such as engagement, relationships, and accomplishment—to enhance the adoption of AI tools in inclusive classrooms with the critical role of school leadership in supporting teacher well-being. Moreover, for effective AI practice, creating a supportive school culture that values teacher well-being is a key factor in successful technology integration. Schools should consider implementing comprehensive well-being programs that address the PERMA components, with a particular focus on fostering engagement, building positive relationships, and recognizing accomplishments. Such programs could help mitigate the negative effects of stressors, particularly during periods of rapid technological change or crisis, and promote a more sustainable approach to AI integration in education. School leaders should implement strategies to enhance teachers' well-being, as this can significantly influence their readiness and capacity to adopt AI tools in their teaching. Professional development for school leaders should include training focused on offering both psychological and instructional support to teachers, especially in inclusive classrooms. Such training would provide leaders with the necessary skills to create a supportive environment that promotes the effective integration of educational technologies. We also recommend that decisions regarding the use of AI and the selection of appropriate applications and tools for

inclusive classrooms should be informed by positive emotions and meaning to support overall well-being that may influence other areas of educational practice AI. This includes how AI tools can evoke positive emotions in teachers, the meaningful connections they can create with the content being taught, and how these tools enhance the overall instructional experience. By focusing on these aspects, AI strategies can be more effectively aligned with educational goals and support the emotional and meaningful engagement of both teachers and students in inclusive classrooms.

Author contributions

Samah Hatem Almaki1: Conceptualization, Methodology creation, Investigation, Resources, Writing - Original Draft; Nofouz Mafarja: Data curation, Result Analysis, Methodology, Writing original Draft – review & editing; Hamama Mubarak Saif Al Mansoori: Data Collection. All authors have read and approved the final version of the manuscript for publication.

Use of Generative-AI tools declaration

The authors declare they have not used Artificial Intelligence (AI) tools in the creation of this article.

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Conflict of interest

The authors assert that they do not have any conflicts of interest.

Ethics declaration

The author declared that no ethics approval is required for the study.

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