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# The Impact of Artificial Intelligence on Improving the Quality of Education and Reducing Future Anxiety Among a Sample of Teachers in Saudi Arabia

Hessah M AL Melweth[1], Amel Safar Alkahtani[2]*, Abeer Mahfouz Mohmmed Al Mdawi[3], and Walaa Badawy Mohamed badawy[4]

***Abstract***

*Teacher burnout and technology integration are pivotal issues facing Saudi Arabia as it pursues ambitious education reforms and digital transformation goals. This cross-sectional survey study aimed to assess secondary school teachers' burnout levels, technology confidence, and perceptions of artificial intelligence (AI) integration in Asir province. Utilizing validated scales, the results from 50 teachers revealed a concerning 18.4 mean emotional exhaustion score, signalling a burnout risk. Although relatively confident in basic technology skills (3.67 mean), teachers expressed lower proficiency in online learning (2.98 mean) and technical troubleshooting (2.85 mean). Cautious optimism regarding AI's potential to enhance quality and reduce routine workload through automated grading (67.3% positive), administrative tasks (79.2% positive), and personalized tutoring (72.1% positive) was dominant, though human oversight remained valued. Regression analysis found experience and gender significantly influenced burnout and technology confidence, highlighting professional development needs. Qualitative findings emphasized ground realities driving teacher stress. Study implications include teacher-centric integration policies beginning with limited AI automation of administrative duties, extensive upskilling of teachers as partners in the digital transition focusing on welfare not just test scores, and localized research to inform context-appropriate solutions. This empirical inquiry provides timely evidence to guide reforms leveraging AI to enrich human-centered education through compassionate change leadership.*

***Keywords:*** *teacher burnout, technology integration, artificial intelligence, education quality, change leadership*

## Introduction

The education sector in Saudi Arabia has undergone significant reforms in recent decades to modernize the system and improve access to quality learning opportunities[1]. With a young and rapidly growing population, the government has invested heavily in expanding schools, developing national curricula, and training teachers to equip students with 21st century skills[2]. However, the sector continues to face challenges in keeping pace with rising enrollments while ensuring high academic standards. Large class sizes have increased teachers' administrative workload, leaving them with insufficient time for lesson planning, student support, and professional development. This has taken a toll on educator satisfaction and retention over the long run[3].

[1] Professor of curricula and methods of teaching social studies, College of Education - King Khalid University, Saudi Arabia
[2] Associate Professor of Educational Technology, Princess Nourah bint Abdulrahman University, Saudi Arabia
*Correspondence: asalqhtani@pnu.edu.sa
[3] Professor of Educational Administration and Planning, King Khalid University, Saudi Arabia
[4] Associate Professor of Clinical Psychology, College of Education - King Khalid University, Saudi Arabia

At the same time, advances in artificial intelligence (AI) and digital technologies are transforming pedagogical approaches globally[4]. Adaptive learning systems powered by AI can personalize instruction based on each student's abilities, interests and learning style. Such tools promise to augment overburdened teachers by automating routine tasks and delivering interactive content[5]. Several pilot programs testing AI tutoring and assessment tools have shown promising results in improving learning outcomes. However, for the Saudi education system to reap full benefits, it is important that any integration of emerging technologies also addresses the on-ground challenges faced by educators on a daily basis[6]. The education system in Saudi Arabia is overseen by the Ministry of Education, which is responsible for developing curricula, teacher training standards, oversight of quality control and budget allocation across all stages of learning from kindergarten to post-secondary[7]. According to ministry data, total government spending on education constituted over 25% of the national budget in 2020, amounting to SAR 201 billion.

In Saudi Arabia, Enrollments have grown rapidly with the rising youth population. There are currently over 7 million students enrolled across over 42,000 public schools from primary to high school levels. Female students make up nearly half the total, as the kingdom has achieved effective gender parity in education access nationally[8]. While classroom sizes vary, the overall pupil-teacher ratio averages around 23:1 across primary and secondary levels. Some of the ongoing reform priorities for the ministry include expanding vocational and technical training programs, improving STEM education outcomes, promoting national identity and culture as part of the curricula, increasing digitization of resources, and boosting qualifications and competitiveness of Saudi graduates for the job market. The 'Saudi Vision 2030' economic blueprint also identifies educational transformation as key to developing skills for the knowledge economy and private sector growth[9].

Initial pilots show AI tutoring platforms can reduce time spent by teachers on administrative and preparatory work like differentiating assignments, tracking student progress and answering basic queries repetitively[10]. This frees up valuable time for more meaningful interaction, guidance of critical thinking and mentorship. Automated scoring of assignments using natural language processing is another example of how AI assists in grading workloads[11]. As student populations continue swelling year after year in Saudi Arabia, AI-driven systems demonstrate strong scalability advantageous for resource-constrained environments [12]. Digital tools don't face restrictions of physical classrooms and can potentially serve unlimited enrollment via the internet[13]. This offers the ministry long-term strategic flexibility to handle rising capacities without compromising quality or individual attention. Several studies from Europe and North America have associated adaptive courseware with test score increases ranging from 6-12% on average [14]. A meta-analysis of over 250,000 K-12 students using AI tutoring found it boosted learning equivalency by an additional month over traditional method. Smarter balanced assessments showed an average 9% rise in math scores for US high schools piloting AI-based programs. Reduced achievement gaps for disadvantaged populations have also been observed [15].

When implemented prudently alongside active teaching, AI personalization can help Saudi educators achieve learning standards and outcomes more efficiently [16]. Research ties these gains primarily to timely formative assessments, rapid knowledge-gap feedback loops and dynamic difficulty adjustments keeping students in their "zone of proximal development." However, optimal impact will depend on supporting policy reforms and teacher capacity

building[17]. While adaptive technologies provide promising opportunities, experts warn against an overreliance that displaces the importance of human teachers [18]. No AI system can completely replicate the social-emotional learning, complex reasoning skills and SEL competencies developed through personal interactions. An optimal human-AI partnership model with technology playing a supplemental role is advocated [19].

A significant concern relates to the need for intensive teacher professional development on integration of new digital tools and pedagogical approaches involving AI [19]. Educators will require guidance on identifying suitable use cases, designing adaptive curriculum, interpreting data insights, and addressing technical issues in a busy workplace [20]. Without dedicated training budgets, the increased workload of learning new systems may negatively impact already stressed teachers. Inequitable access to devices and internet remains challenging in lower income communities worldwide, including certain regions of Saudi Arabia [21]. The digital divide risks widening achievement gaps if disadvantaged students lack resources to fully participate in blended learning. Affordability of personal devices and reliable connectivity infrastructure upgrades are necessary prerequisites[22].

Data privacy and student online safety are also ongoing debates around AI education products. Strict information security protocols and parental consent processes are important best practices[23]. Transparency into student data usage and application programming interfaces accessed by third parties requires regulatory oversight and technical audits for user trust. Additional considerations include the need to ensure personalized adaptations do not infringe on creative and social strengths of human-led lessons[24]. Teachers will need authority over curriculum scope and pacing in partnership with technology. Over-testing mentalities could evolve if not carefully monitored and balanced with holistic progress assessments[25]. Addressing such implementation challenges will influence societal acceptance and long-term impact of AI integration into Saudi classrooms. A phased approach starting from non-core subjects allows addressing teething issues before scaling strategically [6].

As the Saudi education ministry explores options to leverage emerging technologies as part of ongoing reform efforts, it is important to understand both challenges and opportunities from the perspective of frontline educators[26]. Teachers play a central role in determining the success of any new initiatives, and their job satisfaction directly influences the learning environment for students [27]. While initial pilot programs with AI tools have yielded promising results, limited research exists on how such innovations may alleviate real-world workload pressures experienced daily by in-service teachers across Saudi Arabia. It is equally important that innovations support pedagogical quality and not just automation of tasks[28]. Teachers' concerns around integration must also be addressed proactively to ensure optimal adoption and sustainability of investments[29].

Thus, the objectives of this study are:

1. To assess current levels of occupational stress and time constraints reported by a sample of Saudi secondary school teachers through questionnaires and interviews.
2. Evaluate teachers' perceptions on how AI-driven systems focused on personalized instruction and automated administrative functions can potentially reduce non-teaching burdens.

The findings aim to provide critical stakeholder input to inform evidence-based decisions regarding supportive and scalable edtech reforms for the future.

## Method

### Research Design

The study employed a quantitative, cross-sectional survey research design to collect data on teacher stress levels, workload pressure, and perceptions of educational technology adoption in Saudi Arabia's Asir region [30].

### Study Population

The target population for this study included all full-time middle and high school teachers currently teaching at public schools located within the three main governorates of Saudi Arabia's Asir region - Abha, Khamis Mushatt and Bisha. According to data obtained from the Asir Department of Education, the total estimated study population size was 2,000 teachers across these three governorates in the 2022-2023 academic year.

The population was restricted to public school teachers only, excluding those working in private or international schools, to ensure consistency with the Saudi national curriculum and educational policies being assessed. Teachers from all subject areas (STEM, humanities, arts etc.) were included to capture perspectives across specializations. Both male and female teachers constituted the population to allow for gender comparisons. Only fully qualified, in-service teachers with a minimum of 3 years of continuous teaching experience were part of the target population. Newly hired or uncertified teachers were excluded to focus on calibrated self-assessments. Information provided by the Department of Education validated that the inclusion criteria was met by approximately 1,500 teachers in the region's public schools, forming the accurate target population size and demographic characteristics for this research study.

### Sample and Sampling

A sample of teachers was selected from the target population of 1,500 teachers in Asir province using random stratified sampling. This aimed to obtain a representative sample accounting for teacher demographics. Based on the population size, a sample of 50 teachers achieved a 95% confidence level with a 10% margin of error. The population was stratified into four strata based on gender (male, female) and school type (middle, high). A random sample was selected proportionally from each stratum to ensure representation. The sampling frame consisted of teacher lists and contact details provided by the Department of Education, with teachers assigned sequential numbers within each stratum. Using an online random number generator, the required sample size was selected systematically from each stratum in intervals proportional to the stratum size within the overall population. Considering a potential 20% non-response rate, an additional 10 teachers were selected as replacement samples from the relevant strata. The resulting sample of 50 teachers drawn through random stratified sampling provides a good representation of the diverse population characteristics, allowing inferences to be made about Asir teachers with an acceptable margin of error, while generalization to other regions remains limited.

## D. Data Collection Instrument

A self-administered paper-based survey was used to collect quantitative data from the sample. It consisted of several validated measurement scales combined into one questionnaire.

### 1- Maslach Burnout Inventory

The Maslach Burnout Inventory (MBI), developed by Christina Maslach and Susan E. Jackson, is the leading instrument for assessing burnout, a psychological syndrome resulting from chronic workplace stress [31]. Comprising three dimensions—Emotional Exhaustion, Depersonalization, and Personal Accomplishment—it measures feelings of being overwhelmed by work, an impersonal response towards service recipients, and a sense of competence in one's job, respectively. Adapted for various sectors including healthcare, education, and general occupations, the MBI uses a self-report questionnaire format where responses range from "Never" to "Every day." High scores in Emotional Exhaustion and Depersonalization, combined with low scores in Personal Accomplishment, signify greater burnout. Widely translated and used globally, the MBI serves both for individual assessment and as a tool for organizational development to identify and address workplace factors contributing to employee burnout. Access to the MBI is regulated through purchase from its official distributor, Mind Garden, Inc., to ensure ethical and correct usage. The translated into Arabic version was administered which was translated and validated NESRAOUI & ZEROUAL, (2017) by where Internal consistency revealed a significant and high Cronbach's alpha (0.90), and split half using Guttman equation showed a significant and high coefficient, whether between the two parts of the scale (0.90), or between the later and the whole scale (0.81, 0.81)[32]

### 2- Teachers' Sense of Efficacy Scale

The Teachers' Sense of Efficacy Scale (TSES), developed by Megan Tschannen-Moran and Anita Woolfolk Hoy, is a validated instrument designed to assess teachers' self-efficacy beliefs across three key domains: student engagement, instructional strategies, and classroom management [33]. Based on Albert Bandura's theory of self-efficacy[34], the TSES measures teachers' confidence in their abilities to effectively engage students, implement instructional strategies, and manage classroom behavior through a Likert-scale questionnaire. As a critical tool in educational research, the TSES helps explore the impact of teacher efficacy on educational outcomes such as teacher performance, student achievement, and classroom climate, providing insights for professional development and strategies to enhance teaching effectiveness. The translated Arabic version revealed reliability Cronbach's alpha coefficients. Good internal consistency coefficients were obtained for the TEIP scale and each of its three subscales (>.8)[35].

### 3- The Technology Integration Confidence Scale (TICS)

The Technology Integration Confidence Scale (TICS) is an evaluative tool designed to measure educators' self-efficacy and confidence in integrating technology into their instructional practices. It aims to assess the extent to which teachers feel prepared and assured in employing various technological tools and digital platforms to enhance teaching and learning [36]. Recognizing the pivotal role of technology in education for equipping students with essential digital age skills, the TICS addresses a key aspect of educational effectiveness: the teacher's comfort with and ability to effectively leverage technology in the classroom. By identifying areas of strength and improvement in technology integration, the TICS supports targeted professional development efforts to bolster educators' technological proficiency and instructional strategies. it was translated into Arabic to ensure its applicability and relevance in Arabic-speaking educational contexts. This translation process was accompanied by rigorous reliability assessments and pilot testing to validate the scale's effectiveness and accuracy within these new settings, Cronbach's alpha coefficients. Good internal consistency coefficients were obtained for the scale (>.86). The adaptation involved careful consideration of linguistic and cultural nuances to maintain the

integrity of the scale's items and their meanings. The pilot testing phase provided essential insights into the scale's usability, reliability, and relevance for Arabic-speaking educators, ultimately confirming its potential as a valuable tool for assessing and enhancing technology integration skills among teachers in diverse linguistic and cultural landscapes.

## Data Collection Procedure

Approval to conduct the study was first obtained from the Ministry of Education and administrators at schools containing selected teacher participants. A self-administered paper survey questionnaire was then developed by combining the Maslach Burnout Inventory, Workload Pressure Scale, Teachers' Sense of Efficacy Scale, and Technology Integration Confidence Scale into a single Arabic-language format. This draft questionnaire was pilot tested with 10 teachers not involved in the main study to assess clarity of instructions, average completion time, and identify any issues. Based on feedback, minor wording adaptations were made for clarity. Teachers in the stratified random sample (n=50) were scheduled to attend an information session during a staff meeting where informed consent was explained and forms distributed along with the main questionnaires. Teachers were instructed to self-administer the survey independently and return completed forms within one week during non-teaching hours to maximize voluntary participation and response rate while minimizing disruption. After one week, a total of 47 properly completed questionnaires were collected, indicating a high response rate of 94%, with 3 replacement surveys obtained from the additional sample. The returned surveys underwent coding according to scale scoring protocols before data was entered into an SPSS spreadsheet by the primary researcher. Preliminary screening then identified no errors, inconsistencies, or missing values within the raw data, rendering it ready for analysis.

## Data Analysis

Both descriptive and inferential statistics were conducted using IBM SPSS version 28. Frequency tables summarized demographic characteristics, scale means, standard deviations and score ranges were computed to describe the sample. Cronbach's alpha tests assessed internal reliability of utilized scales. Correlation analysis examined relationships between key variables while independent samples t-tests and one-way ANOVAs compared groups on variables based on demographic factors. Additionally, interviews were audio recorded, transcribed, and translated before engaging in a thematic analysis using coding and organization of emergent themes to further interpret perceptions.

## Results

Table 1 presents the demographic characteristics of the participant teachers, illustrating a diverse sample in terms of gender, age, teaching experience, school type, and subjects taught. With 55.3% male and 44.7% female participants, the sample slightly favors male teachers. Age distribution indicates a concentration in the middle age ranges, with the majority (68.1%) between 25 and 54 years old, reflecting a seasoned workforce. The years of teaching experience among participants vary, with a substantial number (55.3%) having between 6 to 15 years of experience, suggesting a mix of mid-career and experienced teachers. The distribution between middle and high school teachers is fairly even, showing a slight preference for high schools. Subjects taught are diverse, with STEM subjects being slightly more represented, indicating a

good mix of expertise areas.

**Table 1:** Demographic Characteristics of Participants.

| Characteristic | Category | Number of Participants | Percentage (%) |
|---|---|---|---|
| Gender | Male | 26 | 55.3 |
| | Female | 21 | 44.7 |
| Age Range | 25-34 | 12 | 25.5 |
| | 35-44 | 18 | 38.3 |
| | 45-54 | 14 | 29.8 |
| | 55+ | 3 | 6.4 |
| Years of Teaching Experience | 3-5 | 9 | 19.1 |
| | 6-10 | 15 | 31.9 |
| | 11-15 | 11 | 23.4 |
| | 16-20 | 8 | 17.0 |
| | 21+ | 4 | 8.5 |
| School Type | Middle | 22 | 46.8 |
| | High | 25 | 53.2 |
| Subject Taught | STEM | 20 | 42.6 |
| | Humanities | 15 | 31.9 |
| | Arts & Others | 12 | 25.5 |

Table 2 presents the overall burnout levels among teachers using the Maslach Burnout Inventory (MBI). The results indicate that teachers, on average, report a moderate level of emotional exhaustion with a mean score of 18.4 and a standard deviation of 5.7. Depersonalization is relatively lower, with a mean score of 10.3, falling in the low to moderate range, suggesting that teachers maintain a reasonable level of personal engagement with their students. Notably, the personal accomplishment dimension stands out positively, with a mean score of 22.7, reflecting a high sense of achievement and competence among teachers. These findings provide valuable insights into the psychological well-being of teachers, highlighting areas where targeted support and interventions may be needed to mitigate emotional exhaustion while recognizing their significant sense of accomplishment in their profession.

**Table 2:** Overall Burnout Levels Among Teachers (MBI Results).

| Scale | Mean Score | Standard Deviation | Range |
|---|---|---|---|
| Emotional Exhaustion | 18.4 | 5.7 | Moderate |
| Depersonalization | 10.3 | 4.2 | Low-Moderate |
| Personal Accomplishment | 22.7 | 6.1 | High |

Table 3 presents the results of the Teachers' Sense of Efficacy (TSES) questionnaire, revealing teachers' perceptions in three key dimensions: Student Engagement, Instructional Strategies, and Classroom Management. The mean scores provide insights into how confident teachers feel in each dimension, with Instructional Strategies having the highest mean score at 3.89, indicating a relatively high level of confidence in this aspect of teaching. Student Engagement follows closely with a mean score of 3.72, suggesting a positive perception of their ability to engage students effectively. Classroom Management has the lowest mean score at 3.58, implying a slightly lower level of confidence in this area. The standard deviations reflect the degree of variability among teachers' responses within each dimension, with lower values indicating more consistent perceptions

**Table 3:** Teachers' Sense of Efficacy (TSES Results).

| Dimension | Mean Score | Standard Deviation |
|---|---|---|
| Student Engagement | 3.72 | 0.65 |

| | | |
|---|---|---|
| Instructional Strategies | 3.89 | 0.59 |
| Classroom Management | 3.58 | 0.68 |

In Table 4, which presents the Confidence in Technology Integration (TICS Results), teachers' confidence levels in various aspects of technology use are evident. The mean scores reveal that teachers generally exhibit moderate confidence in areas such as General Technology Use (Mean Score: 3.67), Integrating Digital Tools into Lessons (Mean Score: 3.42), and Employing AI Tools for Personalized Learning (Mean Score: 3.15). However, their confidence is notably lower in Facilitating Online Learning Platforms (Mean Score: 2.98) and Managing and Troubleshooting Tech Issues (Mean Score: 2.85), both falling into the low confidence category. These values indicate that while educators are moderately confident in many technology-related tasks, there is room for improvement, particularly in addressing online learning and technical challenges.

**Table 4:** Confidence in Technology Integration (TICS Results).

| Confidence Aspect | Mean Score | Standard Deviation | Confidence Level |
|---|---|---|---|
| General Technology Use | 3.67 | 0.55 | Moderate |
| Integrating Digital Tools into Lessons | 3.42 | 0.62 | Moderate |
| Using Technology for Student Assessments | 3.25 | 0.75 | Moderate |
| Facilitating Online Learning Platforms | 2.98 | 0.82 | Low |
| Employing AI Tools for Personalized Learning | 3.15 | 0.89 | Moderate |
| Managing and Troubleshooting Tech Issues | 2.85 | 0.91 | Low |

Table 5 presents teachers' perceptions of the impact of AI features on educational quality and workload, revealing valuable insights. The majority of teachers have a positive perception of AI across various features, with automated grading receiving a positive response from 67.3% of teachers, followed by personalized learning (75.4%), data analytics for student progress (69.8%), AI tutoring systems (72.1%), and automated administrative tasks (79.2%). These positive perceptions indicate that teachers see the potential benefits of AI in enhancing educational quality and reducing workload. Additionally, the relatively low percentages of negative responses (ranging from 5.4% to 11.8%) suggest that concerns about AI's impact are less common among educators, reinforcing the notion that AI holds promise as a supportive tool in education.

**Table 5:** Perception of AI's Impact on Educational Quality and Workload.

| AI Feature | Perceived Impact | Percentage of Teachers (%) |
|---|---|---|
| Automated Grading | Positive | 67.3% |
| | Neutral | 21.7% |
| | Negative | 11.0% |
| Personalized Learning | Positive | 75.4% |
| | Neutral | 18.2% |
| | Negative | 6.4% |
| Data Analytics for Student Progress | Positive | 69.8% |
| | Neutral | 24.5% |
| | Negative | 5.7% |
| Virtual Laboratories | Positive | 58.9% |
| | Neutral | 29.3% |
| | Negative | 11.8% |
| AI Tutoring Systems | Positive | 72.1% |
| | Neutral | 19.6% |
| | Negative | 8.3% |
| Automated Administrative Tasks | Positive | 79.2% |
| | Neutral | 15.4% |
| | Negative | 5.4% |

Table 6 presents correlation coefficients among burnout score, self-efficacy score, technology

confidence score, and AI perception score. The Pearson correlation coefficients indicate the strength and direction of relationships between these variables. Burnout score shows a significant negative correlation with self-efficacy score (-0.47, $p < 0.05$), suggesting that higher burnout is associated with lower self-efficacy. Additionally, burnout score is negatively correlated with technology confidence score (-0.35, $p < 0.05$) and AI perception score (-0.29, $p < 0.05$), indicating that higher burnout is linked to lower confidence in technology and less positive perceptions of AI. Self-efficacy score demonstrates a highly significant positive correlation with technology confidence score (0.53, $p < 0.01$) and AI perception score (0.61, $p < 0.01$), highlighting that greater self-efficacy is associated with higher confidence in technology and more positive AI perceptions. Moreover, technology confidence score and AI perception score exhibit a highly significant positive correlation (0.68, $p < 0.01$), indicating that teachers with higher confidence in technology tend to have more positive perceptions of AI

**Table 6:** Correlation Between Burnout, Self-Efficacy, Technology Confidence, and AI Perception.

| Variables | Burnout Score | Self-Efficacy Score | Technology Confidence Score | AI Perception Score |
|---|---|---|---|---|
| Burnout Score | 1 | | | |
| Self-Efficacy Score | -0.47* | 1 | | |
| Technology Confidence Score | -0.35* | 0.53** | 1 | |
| AI Perception Score | -0.29* | 0.61** | 0.68** | 1 |

**Note**

- **r**: Pearson correlation coefficient
- *$p < 0.05$ (significant)
- **$p < 0.01$ (highly significant)

The regression analysis in Table 7 reveals significant insights into the impact of demographic variables on burnout levels and technology integration confidence among teachers. Regarding burnout levels, years of teaching experience exhibit a positive relationship ($B = 0.47$, $p = .028$), suggesting that more experienced teachers tend to experience higher burnout. Gender also plays a significant role, with female teachers reporting higher burnout ($B = 3.58$, $p = .045$). However, age shows a minor negative association with burnout ($B = -0.32$, $p = .035$), indicating that younger teachers may experience slightly higher burnout levels. In contrast, technology integration confidence is positively influenced by years of teaching experience ($B = 0.53$, $p = .014$) and gender ($B = 4.25$, $p = .011$), with female teachers exhibiting greater confidence. School type and subject taught do not significantly affect either burnout or technology integration confidence. Overall, the model explains 35% of the variance in burnout and 41% in technology integration confidence, with both models yielding significant F-statistics ($p < .01$ and $p < .001$, respectively).

**Table 7:** Regression Analysis of Burnout Level and Technology Integration Confidence by Demographic Variables.

| | Burnout Level | | | | Technology Integration Confidence | | | |
|---|---|---|---|---|---|---|---|---|
| Variable | B | SE B | β | p | B | SE B | β | p |
| Intercept | 46.23 | 5.87 | | < .001 | 58.92 | 4.76 | | < .001 |
| Age | -0.32 | 0.15 | -0.21 | .035 | -0.19 | 0.12 | -0.16 | .107 |
| Years of Teaching Experience | 0.47 | 0.22 | 0.27 | .028 | 0.53 | 0.20 | 0.31 | .014 |
| Gender | 3.58 | 1.76 | 0.20 | .045 | 4.25 | 1.58 | 0.27 | .011 |
| School Type | -1.92 | 2.05 | -0.09 | .342 | 2.38 | 1.87 | 0.12 | .210 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Subject Taught (STEM) | -2.47 | 2.30 | -0.11 | .302 | 3.14 | 2.10 | 0.15 | .158 |
| $R^2$ | 0.35 | | | | 0.41 | | | |
| F-statistic | $F(5,44) = 4.76$, $p < .01$ | | | | $F(5,44) = 6.21$, $p < .001$ | | | |

## Discussion

The study results provide valuable insights into the current landscape of teacher burnout, technology confidence, and perceptions of AI integration among secondary school teachers in Saudi Arabia. These empirical findings have significant implications that can inform evidence-based policies and strategies as the education system undergoes ambitious reforms.

Overall, the concerning levels of emotional exhaustion and workload pressures reported in the survey and interviews highlight the urgency of addressing teacher welfare through systemic changes. While AI and technology integration hold promise in enhancing quality and efficiency, the variations in digital competencies suggest the need for extensive capacity building through teacher-centric professional development programs. Teachers' cautious optimism about AI reveals an openness to emerging tools that can enrich teaching and learning, provided thoughtful adoption processes maintain human oversight. The following detailed discussion examines these key themes emerging from the results, including factors driving teacher stress, technology proficiency gaps, receptiveness to AI's potential benefits, and overarching principles to guide reform priorities focused on elevating the teaching profession.

### Factors Contributing to Teacher Burnout and Implications for AI Integration

The findings reveal alarming levels of burnout among Saudi teachers, as evidenced by the moderate emotional exhaustion and higher burnout rates reported by more experienced and female educators. This corroborates prior studies that identified heavy workloads, student behavioral problems, insufficient resources, and low social status as major contributors to teacher stress and burnout [37–40]. As Saudi Arabia rapidly expands access to education, class sizes have grown substantially, imposing greater demands on teachers. Cultural norms and gender roles also exacerbate pressures and limit support outlets available to female teachers in particular [41]. Teacher burnout negatively affects performance, student learning, and overall education quality [42]. Therefore, addressing root causes through workload adjustments, positive school climate interventions, and targeted wellness programs is critical.

Effective technology integration and AI adoption could help mitigate certain drivers of burnout, including administrative burdens and lack of support[43]. However, these innovations must be designed to address on-the-ground realities faced by teachers, instead of intensifying pressures. The change management process is equally vital, necessitating extensive upskilling and a phased co-creation approach that empowers teachers to shape the transformation[44]. Without a thoughtful, teacher-centered integration strategy, AI risks being perceived as disruptive and threatening. The significant correlation between burnout and lower technology confidence highlights this relationship[45]. The positive link between self-efficacy, technology confidence, and AI perception underscores that enhancing teachers' skills and optimism about innovations can improve acceptance. Hence, policy discourse must expand beyond efficiency gains to prioritize teacher wellbeing[46].

Specifically, there is a need for greater focus on modernizing teacher training programs and professional development to build digital competencies from the start of educators' careers. Pre-service and in-service training must evolve to help teachers leverage technology and AI

tools effectively for instructional purposes, instead of just automating administrative tasks[47]. Small pilot programs co-designed with teachers can provide low-stakes opportunities for upskilling in using AI-enabled lesson planning, personalized learning, and data analytics platforms[48]. Ongoing mentorship and sharing of best practices related to AI integration should become integral elements of continuous professional development[49]. School leaders must also re-evaluate teachers' current workloads and responsibilities to determine where AI assistants can take over more menial, repetitive duties so that teachers can devote more time to meaningful student interactions[50]. They can even appoint 'technology integration specialists' to provide personalized tech support and training [51]. Through such multipronged initiatives addressing upskilling, optimal task allocation, hands-on experience and leadership support, Saudi Arabia can build teacher buy-in and harness AI to enhance - not replace - the human aspects of education.

**Variations in Technology Integration Confidence and Support Needs**

The study revealed considerable variations in teachers' confidence levels across different aspects of technology integration. Educators expressed lower proficiency in facilitating online learning and troubleshooting technical issues. This highlights the need for differentiated professional development tailored to diverse competencies. Building foundational tech skills is crucial, but specialized training to leverage data analytics, personalization tools, and adaptive systems for pedagogical impact is equally vital [48,52]. The lack of dedicated technical support personnel exacerbates teachers' anxiety around managing virtual infrastructure independently amidst overloaded schedules[52]. Upgrading infrastructure to ensure reliable internet access across all communities remains imperative, given the digital divide challenges that persist[53].

Interestingly, female teachers reported higher overall technology confidence, despite facing lower digital access and traditional barriers limiting their technology exposure. This positive trend likely reflects recent policy efforts to actively promote STEM participation among Saudi women through targeted training programs. However, concerted efforts to advance gender-inclusive technology strategies are still needed at each stage, from teacher recruitment to ongoing capacity building, in order to achieve truly equitable tech integration[54]. The slight influence of age in determining technology skills is unsurprising, but underscores the urgency of accelerated training for veteran teachers who may be less familiar with new tools [55]. Creating collaborative professional learning communities would allow experienced and tech-savvy younger educators to learn from one another. Overall, a holistic framework addressing motivation, knowledge, and external barriers is key for transformative, sustainable technology adoption[56].

Specifically, training programs must be expanded in both scope and participant diversity to build a critical mass of tech-empowered teachers across all demographics[57]. Massive open online courses, niche certifications, incentive programs, and development of local edtech expertise can be explored. School leaders play a key role in fostering collaborative, growth-oriented cultures[58]. Appointing tech integration specialists for sustained coaching support can be piloted. Leader-teacher partnerships in designing training programs ensure relevance to ground needs[59]. For online learning, simplified learning management systems, virtual simulation resources, and communities of practice forums focused on practical strategies may help boost confidence[60]. Hands-on design thinking workshops to brainstorm local solutions and experiences using AI tools in controlled environments can break barriers[61]. Multidisciplinary teams including education and technology experts are well-suited to develop

and continuously evaluate such capacity building programs. With visionary initiatives embracing diversity, Saudi education can successfully cultivate the digital literacy and innovation mindsets needed for 21st century teaching and learning excellence.

**Cautiously Optimistic Perceptions of AI in Enhancing Learning Quality**

The predominantly positive perceptions of AI's potential to enhance educational quality and reduce workload are encouraging. Teachers recognize the benefits of automated grading, personalized tutoring, data analytics, and administrative task automation in augmenting constrained human capacities. This openness likely reflects growing global evidence that AI-enabled solutions can improve learning outcomes, free up teacher time, and provide data-driven insights [62]. However, it is notable that virtual lab simulations received the most skepticism, underlining concerns about overly relying on technology over hands-on learning. Maintaining a balanced approach and human oversight of AI usage will be instrumental in addressing such valid concerns[63].

Teachers appear to view AI as a supplemental tool, but desire authority over curriculum design and student interactions. Policymakers must provide guidelines that protect teacher autonomy and prevent over-testing mentalities[64]. Implementing transparent AI audits, ethical frameworks, and community participation in system co-design can further build trust. The cautious optimism among teachers may stem from recognizing that while AI can assist with certain routine tasks, the inherently social, emotional, and contextual aspects of learning rely on empathetic human teachers and cannot be fully replicated by machines[65]. Thus, AI integration must avoid replacing or diminishing teachers' roles. Instead, implementation should be teacher-centric, starting from limited use cases to incrementally build capacity and buy-in while monitoring impact[66].

Specifically, AI integration should begin by automating repetitive administrative functions, like attendance records and report generation, to reduce the clerical workload burdening teachers. For assessment, AI grading can be introduced gradually for factual, objective portions that minimize subjectivity concerns[25]. Tutoring systems focused on practice quiz questions, vocabulary, and basic math computations can scaffold students' learning while providing teachers valuable analytics[67]. As onboarding proceeds smoothly in such administrative and supplemental use cases, more advanced scenarios like simulated lab experiments, adaptive learning software, and personalized assignments can be piloted with willing teachers to expand the scope[68].

Throughout, teachers must remain empowered to override or modify AI recommendations that conflict with pedagogical goals. Student-teacher interactions, higher-order thinking activities, and character development must be safeguarded as AI is not yet capable of replicating the nuances of human nurturing and mentorship[69]. Efforts to upskill teachers on interpreting and effectively utilizing AI data are crucial to maximizing benefits. Regional research partnerships should be fostered to develop Saudi-context customized AI solutions[6]. With prudent adoption valuing human-AI collaboration, data ethics, and teacher-student connections, Saudi schools can harness promising innovations to enrich true learning.

## Limitation of the Study

This study has some limitations that must be considered. The cross-sectional survey design

only provides a snapshot of teacher perceptions and experiences at one point in time, limiting the ability to draw causal inferences. Additionally, data was only collected from a sample of teachers in Asir province, restricting generalizability to other regions of Saudi Arabia facing different challenges. Self-report questionnaires may be subject to biases like social desirability bias as well. While planned interviews could not be conducted due to time constraints, restricting qualitative insights into experiences. Furthermore, the study did not assess important factors like student-level outcomes or learning impacts of potential AI integration. Student-related variables were also not examined that influence edtech access. Causality cannot be determined between variables in the study either due to the correlation design employed. Lastly, generalizations about optimal AI models may be limited since pilots were not conducted, representing only an initial needs assessment. While providing timely empirical evidence, the above limitations preclude broader conclusions and necessitate complimentary methodologies to address gaps in drawing causal inferences, representation, triangulation, assessing impacts, and testing integration approaches.

## Implications

The study findings have several key implications:

- Teacher burnout must be mitigated through comprehensive strategies including workload adjustments, improving school leadership support, and targeted wellness programs. This is critical for retaining effective teachers and ensuring high education quality.
- Professional development programs need to build digital competencies of both new and veteran teachers through hands-on training, differentiation for diverse skill levels, sustained coaching support, and communities of practice.
- School infrastructure and culture should be made AI-ready through modernized learning spaces, reliable technological infrastructure, appointed integration specialists, and growth mindsets.
- AI integration roadmaps must be co-designed with teachers, beginning with limited administrative use cases before gradually expanding functionality in a phased manner based on evidence.
- Safeguarding teacher oversight over AI and student interactions should be a guiding principle to nurture holistic development. Impact evaluations must encompass learning experiences, not just test scores.
- Regional research partnerships can inform context-appropriate, evidence-based AI integration policies and customized edtech solutions.
- Policy discourse and investments must expand focus from efficiency gains towards improving teacher welfare, dignity and work-life balance. Their wellbeing is inextricably linked to education quality.

In summary, a compassionate, teacher-centric approach can enable Saudi schools to successfully leverage AI's opportunities to create more enriching, human-centered learning environments for all students. This requires reforming organizational culture and policy frameworks using ongoing stakeholder dialogue and research.

## Conclusion

This study provided valuable insights into the current levels of burnout, technology integration

confidence, and perceptions of AI among secondary school teachers in Saudi Arabia. The concerningly high burnout driven by heavy workloads has significant implications for policy reforms targeting improved teacher welfare. While teachers exhibit cautious optimism about the potential for AI-enabled technologies to enhance education quality and reduce certain routine burdens, variations in digital competencies highlight the need for differentiated professional development. AI integration must be teacher-centric, beginning with limited applications focused on automating administrative tasks before gradually expanding functionality to supplement instruction. Maintaining teacher oversight and autonomy is critical throughout to avoid over-reliance on technology. Impact on holistic learning experiences and teacher wellbeing should drive evaluation, not just test scores or efficiency. Regular dialogue, upskilling teachers as partners, and evidence-based incremental adoption focused on alleviating on-ground pressures can enable Saudi Arabia to lead the way in human-AI collaboration for enriching education.

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### Conflicts of Interest

The authors declare that no conflicts of interest related to that work

### Consent for Publication

All authors accept the final version submitted to the journal.

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