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Digital proficiency and interpersonal skill development: A comparative study of female high school students in Saudi Arabia and Egypt

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ABSTRACT

This study aimed to investigate the proficiency levels of digital and interpersonal skills among female high school students in the Kingdom of Saudi Arabia (KSA) and Egypt. A total of 181 students from KSA and 146 from Egypt were surveyed using validated Likert-scale measures. The research examined various facets of digital skills, including device proficiency, information literacy, digital communication, and content creation, as well as relational abilities such as decision-making, authenticity, leadership, and interpersonal communication. The results revealed that both groups demonstrated strong digital skills ($M = 4.19$) and interpersonal skills ($M = 4.16$), with significant positive correlations across the assessed dimensions ($p < .01$). Interestingly, Saudi students significantly outperformed their Egyptian counterparts in most skill areas, with t-scores ranging from 1.745 to 4.506 ($p < .05$ to $< .001$), except for communication skills, where no significant difference was found ($t = .956$). These findings suggest that differing approaches to digital integration in educational contexts can shape students' experiences and competencies, influenced by cultural factors. To prepare students comprehensively for their future academic and professional endeavors, it is recommended to adopt a balanced approach that nurtures both technological proficiency and relational skills in the high school curricula of both countries.

Contribution/Originality: This study offers novel insights by conducting a cross-cultural examination of digital literacy and interpersonal competencies among female high school students in Saudi Arabia and Egypt. This unprecedented approach for these specific cohorts fills a critical gap in MENA educational research and underscores the need for curricula that integrate digital and relational learning objectives, ensuring that interventions resonate with students' lived experiences.

1. INTRODUCTION

In an era characterized by relentless technological expansion, digitalisation permeates virtually every dimension of human activity from sustaining friendships and professional networks to acquiring knowledge and earning a livelihood (Cabezas-González, Casillas-Martín, & García-Valcárcel Muñoz-Repiso, 2023; Gabarda Méndez, Marín-Suelves, Vidal-Esteve, & Ramón-Llin, 2023). Rather than simply augmenting existing communication channels, the diffusion of networked devices has recalibrated the very architecture of interpersonal exchange, precipitating a wholesale reimagining of teaching and learning. Illustratively, Saudi Arabia's Ministry of Education has established

the National Centre for e-Learning and Distance Learning, the Saudi Digital Library, and the Saudi Electronic University, each designed to embed digital education within the national curriculum and enhance learners' technological fluency (Aldiab, Chowdhury, Kootsookos, & Alam, 2017; Ministry of Education Saudi Arabia, 2021). Egypt's Vision 2030 agenda conveys a comparable sense of urgency, positioning high-quality, inclusive education, underpinned by technological proficiency and advanced critical thinking skills, as an essential pillar of sustainable development (Muhammad, 2024).

The pedagogical significance of digital expertise is undeniable. Empirical research indicates that skills ranging from routine device operation and advanced information literacy to multimodal content creation are associated with improved academic performance and more comprehensive collaborative learning experiences (Ben Youssef, Dahmani, & Ragni, 2022; van Dijk & van Deursen, 2011). Mastery of such skills equips students with versatile tools for navigating an ever-evolving technological landscape and, by extension, for thriving in knowledge economy workplaces. Importantly, technology-enhanced instruction has also been shown to foster non-cognitive attributes empathy, articulate communication, and team-based problem solving that complement digital proficiencies and enable learners to manage complex social interactions (McNaughton, Rosedale, Jesson, Hoda, & Teng, 2018). These interpersonal capabilities are now widely regarded as prerequisites for 21st century employability.

In today's digitally charged society, our online worlds profoundly shape how we learn, connect, argue, and even bid farewell. With social media deeply interwoven into daily life, established patterns of friendship, trust, and conflict are being redefined, prompting sociologists to revisit long-standing theories of human interaction (Milenkova & Manov, 2019). As conversations increasingly occur across screens, employers seek graduates equally adept at coding and collaboration. Consequently, educators and policymakers must cultivate both technological fluency and emotional intelligence, equipping young people with the critical judgment to navigate privacy and the empathy to thrive in teams, thus preparing them as resilient, inventive citizens for tomorrow's challenges.

Across the Middle East, Saudi Arabia and Egypt are reimagining their education systems with a shared goal: equipping students not only with technical know-how but also with the interpersonal strengths that underpin effective collaboration and leadership. In Saudi Arabia, the National Transformation Program 2020 and Vision 2030 have introduced coding, data analysis, and virtual teamwork into everyday classrooms, preparing teachers and learners alike for a world where technology and human connection are intertwined. Egypt's Vision 2030 echoes this by championing a learner-centered approach that weaves social skills into digital training, reflecting the growing consensus that technical agility and emotional intelligence are equally vital (Muhammad, 2024). Nevertheless, amid these promising reforms, little research has explored how digital and interpersonal abilities develop in tandem during the pivotal high school years, especially in the Arab context, where cultural norms and policy landscapes differ markedly. Most studies treat these skill sets as separate silos, leaving unanswered questions about how they interact to shape students' confidence, creativity, and civic engagement.

Our study addresses this gap directly by examining female high school students in both countries through three perspectives: first, mapping their current digital and social interaction strengths; second, exploring the connections between coding fluency, online collaboration, and face-to-face communication; and third, identifying how factors such as government initiatives, school resources, and societal expectations influence their development. By integrating these elements, we aim to provide practical guidance for educators and policymakers seeking to nurture the next generation of citizens—students who can code confidently and communicate compassionately as they prepare for an increasingly interconnected future.

2. LITERATURE REVIEW

This review synthesizes existing research on two interrelated skill domains that have become essential for secondary-school students in the 21st century: digital skills and interpersonal skills. Initially, studies approached these competencies in isolation; however, a growing body of interdisciplinary work now emphasizes that developing both

areas in tandem better prepares young people for the complexities of higher education, the knowledge economy, and global citizenship. For instance, online collaborative writing platforms necessitate proficiency in version-control software while also requiring adeptness in providing constructive peer feedback. Similarly, virtual reality simulations encourage learners to integrate spatial reasoning and empathetic role-play. These hybrid learning environments underscore the argument that technical and social competencies are not opposing forces but rather mutually supportive. Section 2.1 reviews current theories and evidence on adolescents' digital literacies; Section 2.2 does the same for interpersonal skills; and Section 2.3 identifies gaps that inspire the present study.

2.1. Digital Skills in High School

High school represents a crucial developmental phase in which students build the digital fluency that underpins everything from classroom learning to civic participation and future employability. During these years, learners must become comfortable with everyday tools navigating devices, safeguarding their privacy online, and recognizing the importance of intellectual property before moving on to more sophisticated tasks such as crafting multimedia content, collaborating live on cloud platforms, and tackling foundational algorithmic challenges. Equally important is cultivating a critical awareness of data ethics and the far-reaching implications of artificial intelligence, so that young people emerge not only technically competent but also thoughtful, responsible digital citizens.

2.1.1. Definition and Scope

Modern frameworks view digital competence as an integrated blend of technical, cognitive, and socio-emotional skills that equip individuals for informed, creative, and ethical use of technology. The European Commission (2020) outlines five key areas: information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving, emphasizing that true literacy goes beyond technical know-how to encompass critical judgment, creativity, and active, responsible participation. Similarly, the OECD (2019) highlights "transformative competencies" that empower learners to not only use tools but also to reshape them for personal and collective benefit, signaling a shift from functional to participatory forms of literacy.

2.1.2. Empirical Findings on Digital Proficiency

Research offers a nuanced perspective on adolescent digital competencies. Surveys conducted in Asia, Europe, and Africa reveal that most secondary students navigate everyday applications with relative ease; however, their performance declines significantly when tasked with higher-order skills or unfamiliar problem situations. For example, research by Perdana, Yani, Jumadi, and Rosana (2019) found that Indonesian students who were comfortable with file management faced challenges in creating original multimedia projects or debugging code. A study by Draganac, Jović, and Novak (2022) corroborated this pattern, indicating that high school students outperformed university cohorts only on routine digital tasks, while struggling with programming and design thinking. International assessments also reflect these findings: students often show competent "button knowledge" yet struggle to evaluate credible sources or formulate data-driven arguments. Disparities within countries significantly exacerbate the challenges of digital literacy. Research indicates that students in academically selective programs and those from higher-income families consistently outperform their peers on digital literacy assessments (Galve, 2023; Scherer & Siddiq, 2019). These results make it clear that blanket approaches cannot meet the diverse needs of all learners. Truly closing the digital gap means ensuring every student has a personal device, dependable high-speed internet, and educators who are expertly trained to weave technology into meaningful learning experiences.

2.1.3. Digital Skills Gaps and Overestimation

A recurrent motif in the literature is adolescents' inflated self-appraisals. Spisak (2023) demonstrated that respondents in all self-efficacy tiers over-reported their information literacy prowess when benchmarked against

TRAILS performance data. Jan (2018) similarly found a disconnect between students' confidence in day-to-day mobile use and their limited mastery of advanced security protocols. This miscalibration may foster complacency, depriving learners of motivation to pursue deeper learning and hindering educators' ability to target instruction effectively. Methodological critiques further reveal that many studies rely exclusively on self-report surveys, which are vulnerable to social desirability bias and cultural response styles. The consensus is moving toward performance-based tasks and multimodal analytics to obtain a more faithful picture of student competence.

2.1.4. Pedagogical Interventions and Curriculum Integration

Educational stakeholders worldwide are increasingly advocating for the embedding of comprehensive digital literacy instruction into mainstream curricula. Blended learning, project-based challenges, and gamified modules have shown promise in cultivating technical dexterity, metacognitive reflection, and collaborative dispositions (Ryleeva, Khomutnikova, & Emanova, 2022; World Economic Forum, 2023). Digital platforms, ranging from virtual classrooms to collaborative coding repositories, transform schools into interactive "sandboxes" where students design prototypes, remix media, and practice real-time peer critique. Yet, pedagogical innovation must be accompanied by sustained professional development for teachers. Initiatives such as UNESCO's ICT Competency Framework for Teachers and the World Economic Forum's Global Education 4.0 roadmap recommend iterative cycles of training, classroom experimentation, and reflective dialogue that enable educators to model digital citizenship and guide learners through complex online ecosystems (UNESCO, 2021; World Economic Forum, 2023). Whole-school approaches that integrate coding clubs, digital maker spaces, and student-run help desks appear particularly effective at normalizing skill-sharing cultures and bridging expertise gaps.

2.2. Interpersonal Skills in High School

Often labeled "soft" or "twenty-first-century" skills, interpersonal competencies encompass communication, collaboration, leadership, empathy, and conflict management. Fostering these skills during high school is essential. They not only enhance our day-to-day learning experiences and mental health but also play a crucial role in paving the way for future career success.

2.2.1. Definition and Scope

Interpersonal skills are essential for helping people interact well with others, create meaningful relationships, and work effectively in teams. According to Alshammari and Sufta (2023), these skills are vital for successful teamwork and open communication. Darling-Hammond (2020a) emphasizes that having strong interpersonal skills positively impacts academic success, career opportunities, and overall quality of life. There is a growing consensus that socio-emotional learning should be viewed as a fundamental component of education rather than an optional add-on, as it plays a crucial role in a well-rounded learning experience.

2.2.2. Empirical Evidence on Development

Research indicates that interpersonal skills develop through both formal teaching and informal interactions among peers. For instance, Alswekit, Alsessy, and Ebrahim (2021) note that qualities such as ethical reasoning, teamwork, and effective communication are essential for thriving in today's fast-paced digital world. Interestingly, studies focused on gender differences reveal that female students often excel in empathy and collaboration compared to their male peers (Arto & Päivi, 2020). However, Al-Mutairi (2020) highlights that there is considerable variation in specific abilities, such as decision-making and time management.

Upon closer examination of classroom ethnographies, we observe that students engaged in project-based learning are more likely to share insightful reflections on how they collaborate than those in more traditional lecture-based

settings. This suggests that the way we teach has a significant impact on how interpersonal skills develop, in addition to shaping individual attitudes.

2.2.3. Role in Academic Achievement and Employability

In today's world, strong interpersonal abilities are essential for both academic achievement and employability. Employers often prioritize teamwork, creative problem-solving, and clear communication over purely technical skills (Kaufman, 2019). The Partnership for 21st Century Learning (2021) argues that blending digital and interpersonal competencies is indispensable in a collaboration-driven global labor market. Classroom studies confirm that practices such as mutual respect, role rotation, and peer tutoring increase engagement and reduce disruptive behavior, freeing cognitive resources for higher-order thinking (Darling-Hammond, 2020b). When these relational skills are embedded within digital citizenship curricula, students learn to participate ethically and responsibly in online communities, extending the benefits well beyond the physical classroom.

2.2.4. Pedagogical Approaches to Enhancement

Instructional design has shifted from didactic transmission to interactive, learner-centered modalities that foreground interpersonal growth. Group projects, peer mentoring circles, and service-learning placements demonstrably enhance empathy, negotiation, and conflict resolution (Halder, 2023). Technology acts as a force multiplier: synchronous discussion boards, co-authoring platforms, and mixed reality simulations allow geographically dispersed students to practice collaboration in real-time (UNESCO, 2021). Recent meta-analyses of socio-emotional learning (SEL) curricula reveal positive, statistically significant effects on empathy, classroom climate, and academic attainment (Darling-Hammond, 2020b). When SEL is paired with community-based interventions, such as peer mediation schemes or intergenerational mentoring, the gains appear to persist beyond the instructional window, suggesting a durable transfer of relational competencies to extracurricular and civic contexts.

2.3. Research Gaps and Questions

Despite substantial bodies of work in each domain, three interconnected gaps persist, particularly concerning female adolescents in Saudi Arabia and Egypt. First, most investigations isolate digital competence from interpersonal skills, leaving their intersection under-examined. While preliminary evidence suggests that digital tools can support collaboration and empathy (Cherbonnier, Hémon, Michinov, Jamet, & Michinov, 2024), methodological heterogeneity hampers meta-analytic synthesis and obscures causal interpretation.

Second, very few comparative studies explore how divergent policy landscapes and sociocultural norms modulate skill acquisition across Middle Eastern contexts. Saudi Arabia's Vision 2030 and Egypt's Vision 2030 both emphasize digital transformation and human capital development; yet little is known about how these macro-level initiatives translate into classroom practice and student outcomes.

Third, the longitudinal trajectory of skill development remains underexplored. Cross-sectional designs predominate in the literature, yielding static snapshots rather than developmental narratives. Long-duration mixed-methods research could illuminate whether early interventions translate into sustained competence, attenuate overestimation biases, or diverge across cultural milieus. Without such evidence, curriculum designers risk implementing short-term solutions that fail to produce a lasting impact.

Addressing these gaps is crucial for both theory and practice. A refined understanding of the digital interpersonal nexus will inform the design of integrative curricula and more sensitive measurement instruments. Recent calls by the OECD (2019) and UNESCO (2021) for blended technical–socio–emotional learning underscore this urgency. Potential ethical considerations arise from relying solely on self-report instruments and from excluding male participants, which may limit generalizability.

2.3.1. Research Questions

Based on the identified gaps, this study is guided by the following research questions:

1. What is the level of digital skills among female high school students in Saudi Arabia and Egypt?
2. What is the level of interpersonal skills among female high school students in these contexts?
3. Is there a relationship between digital skills and interpersonal skills among female high school students in Saudi Arabia and Egypt?
4. Are there significant differences in digital and interpersonal skills between female high school students in Saudi Arabia and Egypt?

3. MATERIALS AND METHODS

This section provides a detailed explanation of how the investigation was designed, including the recruitment of participants, construction and validation of the survey instrument, data collection methods, and the statistical procedures applied. A quantitative, cross-sectional survey strategy was chosen because it allows researchers to establish population benchmarks, portray prevailing conditions, and test associations among key variables at a single point in time (Cohen, Manion, & Morrison, 2007). Every phase from sampling through psychometric analysis was deliberately planned to maximize reliability, bolster validity, and uphold the highest ethical standards.

3.1. Study Context and Participants

A structured questionnaire survey widely regarded as cost-efficient, anonymous, and logistically scalable (Johnson & Onwuegbuzie, 2004) served as the primary data collection method. Two governorates with distinct sociocultural profiles were purposively selected: Al Ahsa in Saudi Arabia and Menoufia in Egypt. This juxtaposition provided both logistical feasibility and contextual heterogeneity, enabling comparisons across two Arab educational settings shaped by different national policy agendas.

Focusing exclusively on female learners addresses an under-researched demographic in digital literacy and interpersonal skills scholarship, where gendered barriers can mediate access to technology and leadership opportunities. Eligible participants were female secondary school students (Grades 10 to 12) enrolled in either public or private institutions within the selected governorates. A purposive sampling frame was adopted because it ensured that the resulting dataset directly addressed the research objectives. A total of 181 Saudi and 146 Egyptian students agreed to participate. Although non-probability sampling reduces external validity, it was considered appropriate for an exploratory study centered on a clearly defined population.

To optimize response rates, a two-step distribution was implemented. First, electronic survey links were circulated via email lists, official school WhatsApp™ groups, and learning management system bulletin boards. Second, research assistants visited selected schools to demonstrate the survey on tablets, answer procedural questions, and remind students of their voluntary participation. The blended approach strikes a balance between digital convenience and a personalized, trust-building presence.

3.2. Data Collection

3.2.1. Construct Derivation and Item Pool

A questionnaire was compiled by carefully adapting items from the Digital Literacy scale proposed by Helsper, Schneider, van Deursen, and van Laar (2020) and from the Interpersonal Skills Inventory developed by Nonthacumjane (2011). This strategy preserved established construct validity while allowing for minor wording modifications to enhance cultural resonance and age appropriateness.

The final instrument comprised three logically sequenced parts:

- Part I – Demographic Profile. Respondents recorded their nationality (Saudi or Egyptian) and confirmed their grade level.

- Part II – Digital Skills. Twenty-three items measured four facets:
- Digital device proficiency (6 items).
- Information and data literacy (6).
- Digital communication (6).
- Digital content creation (5).
- Part III – Interpersonal Skills. Twenty-four items captured.
- Decision making (6).
- Authenticity and identity (6).
- Leadership (6).
- Communication and interaction (6)

All statements were rated on a five-point Likert scale (1=strongly disagree, 5=strongly agree). Pre-testing indicated that diligent respondents required 8–10 minutes to complete the survey, which was short enough to minimize fatigue yet long enough to yield nuanced data.

3.2.2. Expert Review and Pilot Study

Ten domain specialists seven in educational technology and three in home economics education scrutinized the draft instrument for semantic clarity, cultural relevance, and scale balance. Using Lawshe's content validity ratio (CVR) protocol, they rated every item as "essential," "useful but not essential," or "not necessary." Items with CVRs below the 0.78 decision threshold were refined or, in two cases, omitted. Reviewers also flagged minor translation inconsistencies between the original English and the Arabic version; these were corrected to ensure semantic equivalence.

A pilot run involving 50 female students (excluded from the main sample) generated initial psychometric evidence. Cognitive interview debriefs confirmed that participants interpreted the questions as intended, and log file analytics showed no systematic skipping patterns, supporting face validity.

3.2.3. Ethical Considerations

Participants received an online information sheet and an in-person briefing that outlined:

1. The study's aims and anticipated benefits.
2. The voluntary nature of participation.
3. Their right to withdraw without penalty, and
4. The strict confidentiality of all responses.

The protocol complied with the British Educational Research Association (2018) guidelines and received clearance from the King Faisal University Research Ethics Committee (KFU REC 2023 OCT ETHICS1368). Data was stored on encrypted drives, and no personally identifiable information was retained.

3.3. Data Analysis Procedures

All statistical work was conducted using SPSS Version 21. The analytical process included three stages: assessment of evaluator validity, internal consistency evaluation, and reliability estimation.

3.3.1. Evaluator Validity

The expert panel rated each item's clarity, relevance, and scale appropriateness on a four-point rubric. Mean clarity scores exceeded 3.5 across all items, and the overall scale content validity index reached 0.91, surpassing the 0.80 benchmark recommended for exploratory instruments. Minor lexical adjustments enhanced precision and cultural resonance.

3.3.2. Internal Consistency Validity

Pilot data was used to compute Pearson correlations between each subscale and its parent construct. For digital skills components, correlations ranged from 0.41 to 0.68 ($p < 0.01$), with Information and Data Literacy at 0.34 ($p < 0.05$). Interpersonal skills subscales correlated between 0.52 and 0.71 ($p < 0.01$). These magnitudes indicate that items measure coherent yet non-redundant aspects of their respective constructs. The coefficients are visualized in Figure 1 (Section: Wise Correlation Coefficients: Digital vs. Interpersonal Skills). The internal consistency data are summarized in Figure 1.

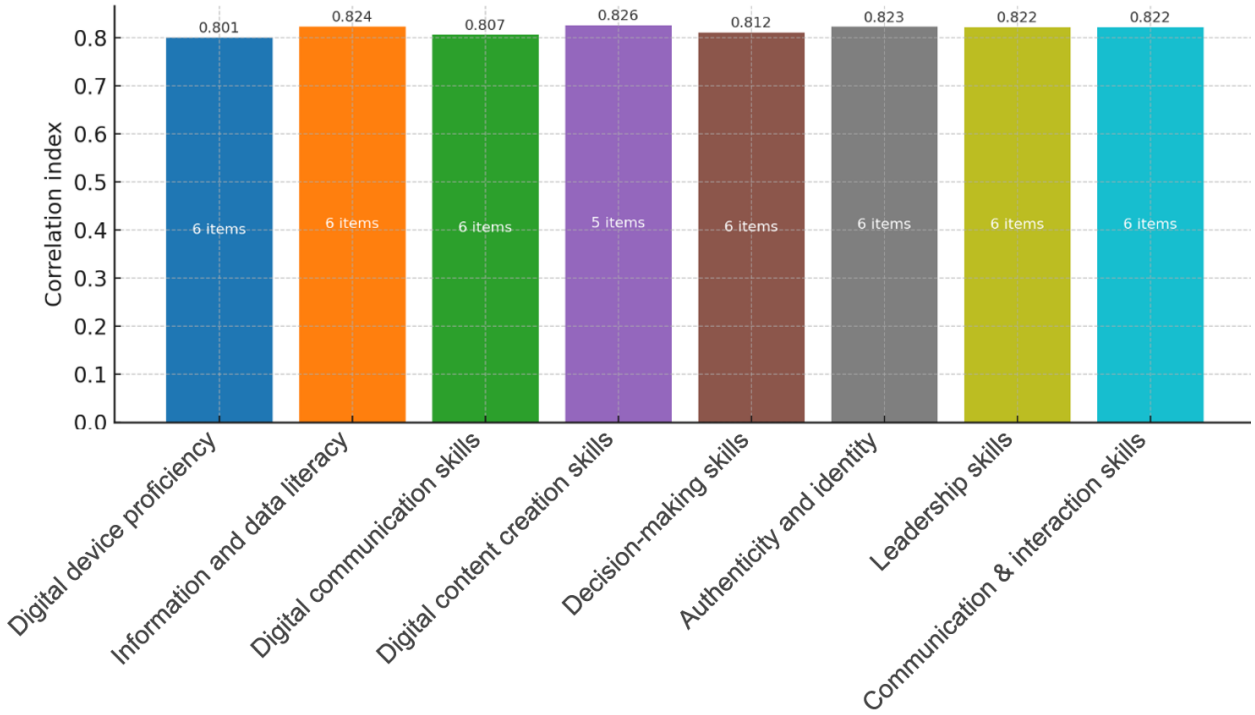

Figure 1. Section-wise correlation coefficients: Digital vs. interpersonal skills.

In Figure 1, the blue bar represents digital device proficiency, with a correlation coefficient of 0.801 (6 items). The orange bar represents information and data literacy, indicating a correlation of 0.824 (6 items). The green bar reflects digital communication skills, with a correlation of 0.807 (6 items). The purple bar highlights digital content creation, with a correlation of 0.826 (5 items). The brown bar signifies decision-making skills ($r = 0.812$; 6 items), and the grey (zinc) bar indicates authenticity and identity ($r = 0.823$; 6 items). Light green corresponds to leadership skills ($r = 0.822$; 6 items), and light blue represents communication and interaction skills ($r = 0.822$; 6 items).

3.3.3. Reliability Analysis

Cronbach's alpha values were calculated for each subscale and the two higher-order composites. Alphas ranged from 0.74 to 0.87 for digital skills facets and from 0.76 to 0.89 for interpersonal skills facets, comfortably exceeding the conventional threshold of 0.70. Split-half estimates, corrected using the Spearman–Brown prophecy formula, aligned with the alpha results, reinforcing the instrument's internal consistency. Figure 2 (Section-Wise Reliability Coefficients) summarizes these metrics. The reliability data is presented in Figure 2.

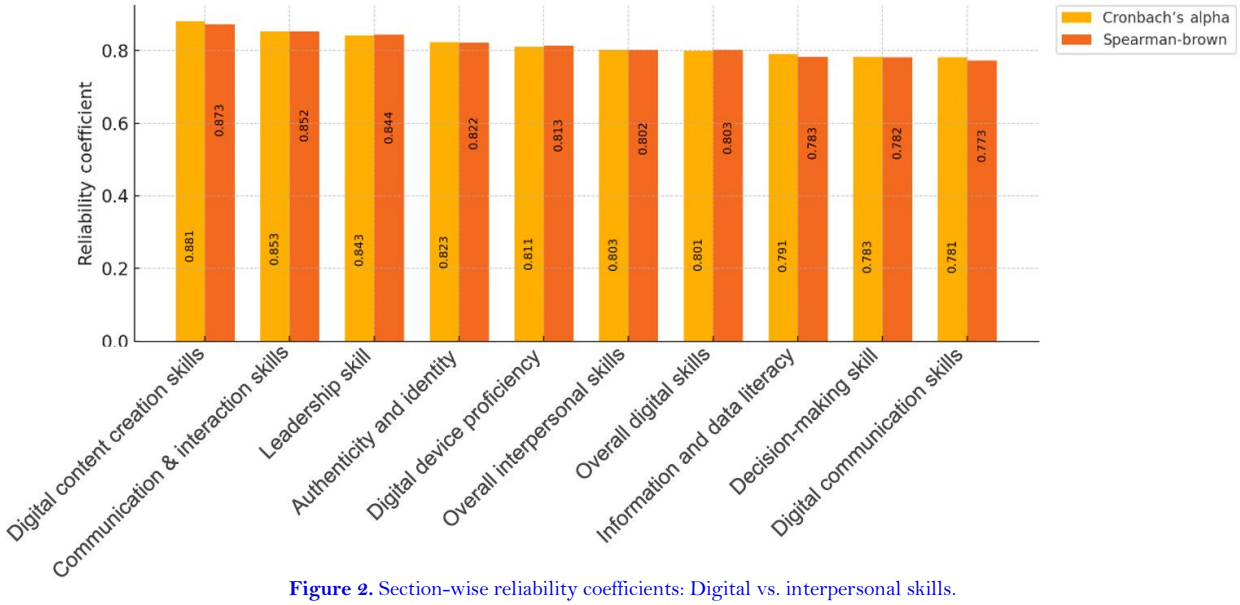

Figure 2. Section-wise reliability coefficients: Digital vs. interpersonal skills.

Multi-stage validation, pilot testing, and reliability checks underpin the instrument's psychometric soundness and, by extension, the credibility of subsequent analyses. The dual-mode survey administration (online and on-site) widened the reach. However, it may have introduced subtle mode effects, such as variations in perceived anonymity, which future research might control by standardizing delivery channels. Additionally, purposive sampling constrains generalizability beyond comparable female cohorts, although it aligns with the exploratory aim of highlighting gender-specific skill dynamics in two Arab contexts. Researchers should therefore interpret cross-cultural comparisons with an awareness of potential sampling bias.

4. RESULTS

This results section presents the empirical patterns that emerged from our survey of female secondary school students in Saudi Arabia and Egypt. It situates these patterns within the broader literature on adolescent digital literacy and interpersonal competence. Four interconnected research questions guided the inquiry: we first gauged students' overall digital proficiency, next assessed their interpersonal aptitude, subsequently investigated how closely the two sets of skills are related, and finally tested whether statistically significant differences exist between learners in the two national contexts. By threading these questions through the analytical narrative, we align our discussion with contemporary debates on holistic competence and regional equity.

To illuminate each question, we compiled a comprehensive suite of descriptive indices, comprising means, standard deviations, frequencies, and relative weight percentages, supplemented by inferential tests and Pearson correlations. Interpretation was continuously calibrated against international benchmarks articulated by the OECD, UNESCO, and the World Economic Forum, thus anchoring the findings in globally recognized standards and policy priorities (OECD, 2023; UNESCO, 2022; World Economic Forum, 2023).

Results for the first research question are derived from a four-component digital skills instrument that captures device proficiency, information and data literacy, digital communication, and digital content creation. Aggregate scores portray a cohort that is confidently connected but still progressing toward more sophisticated, generative uses of technology. Digital communication attracted the highest relative weight, indicating that online interaction and collaboration have become routine elements of students' academic and social lives. Device proficiency and information literacy followed closely, reflecting widespread access to hardware and growing critical engagement with online sources. Content creation skills, by contrast, lag, reaffirming international evidence that production-oriented

competencies develop more slowly than consumption-oriented ones during adolescence (OECD, 2023). Figure 3 visualizes these distributions, highlighting the steep gradient between communicative fluency and creative mastery.

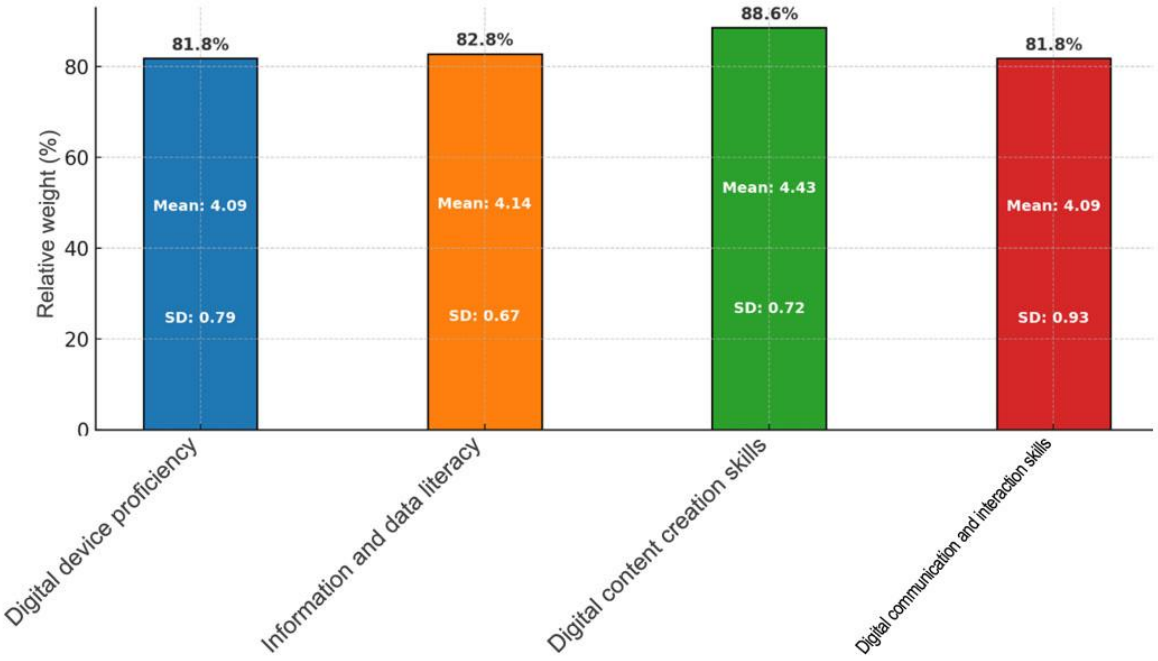

Figure 3. Relative weight (%) of digital skills components.

As Figure 3 illustrates, female high school learners in Saudi Arabia and Egypt exhibit high digital proficiency. The mean score for Digital Device Proficiency was 4.09 (SD = 0.79), indicating that students handle laptops, tablets, and smartphones with confidence, mirroring trajectories in the OECD's Digital Education Outlook (OECD, 2019). As shown in Figure 3, each colour corresponds to one of the four digital skill dimensions measured: the blue bar shows digital device proficiency (81.8%, M = 4.09, SD = 0.79); the orange bar shows information and data literacy (82.8%, M = 4.14, SD = 0.67); the green bar shows digital content creation skills (88.6%, M = 4.43, SD = 0.72); and the red bar shows digital communication and interaction skills (81.8%, M = 4.09, SD = 0.93).

Their information and data literacy were similarly strong. A mean of 4.14 (SD = 0.67) indicates that these adolescents can efficiently locate, evaluate, and use online information, a critical ability in an era where the reliability of web-based sources influences both academic outcomes and everyday decisions an observation underscored by van Dijk and van Deursen's review of digital inequalities (van Dijk & van Deursen, 2011).

Digital communication skills emerged as the most developed area, with a mean rating of 4.43 (SD = 0.72). Such performance aligns with global evidence that young people routinely employ social media, instant messaging, and collaboration tools, thereby honing their expressive reach and intercultural awareness, a trend UNESCO also documents in its latest global report (UNESCO, 2021).

Students are not just passive consumers of information; they are actively engaged in creating their own digital content. With an impressive average score of 4.09 (SD = 0.93) in Digital Content Creation Skills, many are exploring video production, graphic design, and coding. This creative aspect aligns with the World Economic Forum's view that digital literacy today includes not only basic operational skills but also imaginative and strategic production (World Economic Forum, 2023).

Overall, these results suggest that educational systems in both countries have effectively integrated technology into their daily classroom experiences. However, the strong emphasis on digital communication skills also suggests an increasing reliance on online platforms for academic and social interactions. The interconnectedness of device usage, learning, and communication underscores how digital fluency can positively impact broader educational and community outcomes.

4.1. Interpersonal Skills of Female High School Students

To address the second research question, we evaluated interpersonal competence across four interconnected domains: decision-making, authenticity and identity, leadership, and communication and interaction. Figure 4 illustrates how these young women navigate choices, express core values, guide peers, and engage in various contexts. This qualitative insight enriches our understanding of student capabilities, as discussed in Section 4.3 regarding its link to digital competencies. Moreover, the findings underscore the need for educational frameworks that integrate digital and interpersonal skill development into school curricula, thereby preparing students for today's interconnected world.

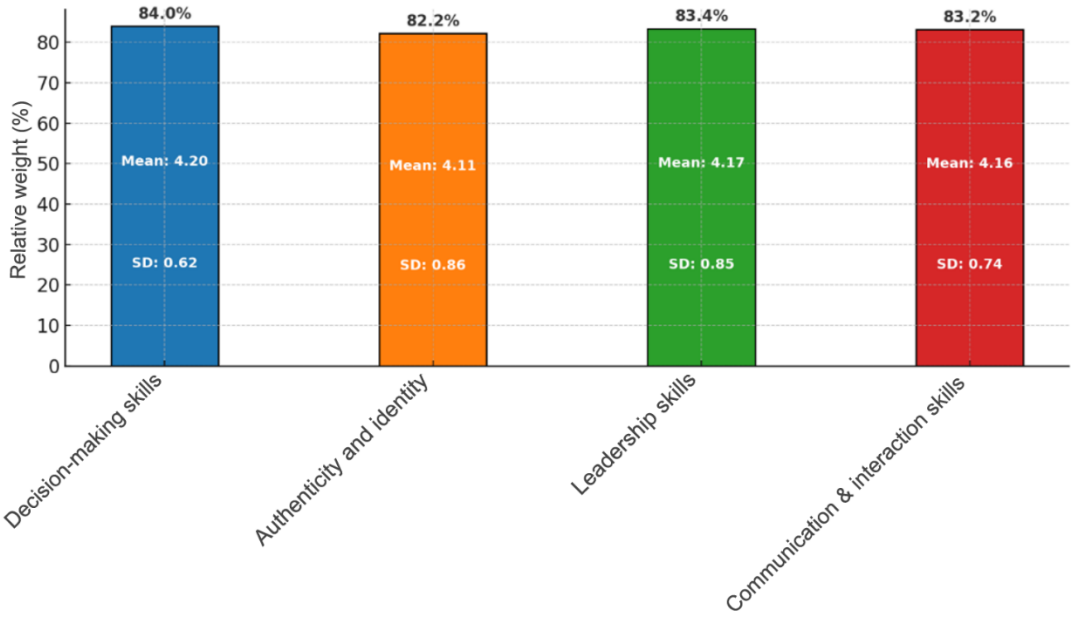

Figure 4. Relative weight (%) of interpersonal skills components.

As shown in Figure 4, each color corresponds to one of the four interpersonal skill domains measured: the blue bar represents decision-making skills (84.0%, M = 4.20, SD = 0.62), the orange bar represents authenticity and identity (82.2%, M = 4.11, SD = 0.86), the green bar represents leadership skills (83.4%, M = 4.17, SD = 0.85), and the red bar represents communication and interaction skills (83.2%, M = 4.16, SD = 0.74).

Figure 4, which depicts the relative weight of each interpersonal skills component, shows that female secondary students in Saudi Arabia and Egypt possess strong interpersonal competence. The highest mean, Decision-Making Skills (4.20 ± 0.62), indicates that learners weigh alternatives judiciously and reach sound conclusions. Such aptitude underpins academic achievement and professional effectiveness because refined decision-making feeds directly into problem-solving and leadership (Trilling & Fadel, 2009; van Dijk & van Deursen, 2011).

Authenticity and identity rank next (mean = 4.11, SD = 0.86), signaling a sustained commitment to self-expression and cultural rootedness. Al Saeed (2022) and Shdaifat, Al-Kloub, Al-Khawaldeh, and Al-Jarrah (2010) emphasize that fostering personal and national identity in adolescence is vital, particularly in societies experiencing rapid change.

Leadership skills, communication, and interaction skills yield means of 4.17 and 4.16 (SDs = 0.85 and 0.74). These results confirm that students already possess qualities valued in collaborative, learner-centered settings. Reform agendas emphasizing active learning and project-based work aim precisely to cultivate such attributes (Trilling & Fadel, 2009). High scores across these domains suggest that participants are prepared to navigate academic challenges and social dynamics inside and beyond school. Such preparedness is likely to translate into higher academic motivation and smoother transitions to tertiary education later.

Table 1. Correlation matrix between digital and interpersonal skills components.

Topics	Digital device proficiency	Information & data literacy	Digital communication skills	Digital content creation skills	Digital skills	Decision-making skills	Authenticity & identity	Leadership skills	Communication & interaction skills	Interpersonal skills
Digital device proficiency	–	0.520**	0.513**	0.575**	0.799**	0.414**	0.328**	0.374**	0.375**	0.436**
Information & data literacy		–	0.467**	0.644**	0.785**	0.590**	0.326**	0.515**	0.495**	0.561**
Digital communication skills			–	0.754**	0.828**	0.463**	0.398**	0.485**	0.425**	0.518**
Digital content creation skills				–	0.896**	0.517**	0.404**	0.555**	0.460**	0.566**
Digital skills					–	0.596**	0.440**	0.580**	0.528**	0.626**
Decision-making skills						–	0.518**	0.640**	0.671**	0.822**
Authenticity and identity							–	0.651**	0.648**	0.835**
Leadership skills								–	0.674**	0.869**
Communication & interaction skills									–	0.881**
Interpersonal skills										–

Note: **Significant at $p < 0.01$.

The data affirms that the sampled students have developed a robust interpersonal toolkit. These competencies support daily interactions, civic engagement, and future workplace adaptability. By nurturing these qualities alongside digital expertise, schools can graduate learners who are not only technologically adept but also socially resilient and ethically grounded. Their breadth aligns with UNESCO's advocacy for educational models that balance technical proficiency with deliberate socio-emotional growth (UNESCO, 2021).

4.2. Relationship Between Digital and Interpersonal Skills

The third research question asked whether female high school students who are digitally adept also excel in interpersonal domains. To explore this, we calculated Pearson correlation coefficients for every pairing of digital skill and interpersonal skill dimensions; the full matrix appears in Table 1. The pattern is clear: all coefficients are positive and statistically significant at the $p < 0.01$ level, indicating a consistent tendency for technical fluency to coincide with socio-emotional strength.

Digital device proficiency shows a moderate correlation with decision-making skills ($r = 0.414$, $p < 0.01$) and with the composite interpersonal skills score ($r = 0.436$, $p < 0.01$). Stronger associations are observed elsewhere. Digital communication skills correlate robustly with leadership skills ($r = 0.485$, $p < 0.01$) and with overall interpersonal skills ($r = 0.518$, $p < 0.01$), indicating that students who navigate online exchanges effectively are also more likely to guide peers, coordinate group tasks, and articulate shared objectives. Similar, statistically significant links exist among the remaining variable pairs, underscoring the pervasive connection between digital and interpersonal skills.

These data confirm that digital literacy is not an isolated competence but rather one embedded in a broader network of social abilities. Engaging with technology, whether by collaborating on cloud-based documents, curating multimodal content, or troubleshooting software, places students in iterative cycles of negotiation, feedback, and joint problem-solving that hone softer capacities such as empathy, strategic thinking, and adaptive leadership. This interpretation echoes van Dijk and van Deursen (2011)'s contention that educational technology catalyzes a blended growth of technical and socio-emotional faculties. It also aligns with policy guidance from the OECD (2019) and UNESCO (2021), both of which advocate integrated pedagogies that braid digital tasks with teamwork and reflective dialogue.

4.3. Cross-Regional Comparison

The fourth research question investigated whether meaningful gaps separate Saudi and Egyptian cohorts in either skill domain. Independent samples t-tests compared group means and standard deviations for every digital and interpersonal dimension; the resulting statistics are summarized in Table 2. By juxtaposing these national profiles, we identify where policy investments, infrastructural realities, or curricular emphases may be generating divergent trajectories in students' holistic competence, thereby providing an empirical basis for targeted educational interventions.

Table 2 underscores distinct national patterns: Across nearly all digital skill dimensions, Saudi female students score markedly higher than their Egyptian peers. Mean differences are statistically significant for Digital Device Proficiency, Information & Data Literacy, Digital Communication, Digital Content Creation, and the composite Digital Skills index (all $p < 0.01$ or $p < 0.001$), a profile that aligns with the country's Vision 2030 initiative to incorporate advanced technologies into education (Kingdom of Saudi Arabia, 2016).

Comparable gaps appear in the interpersonal domain. Saudi learners outperform Egyptians in decision-making, authenticity and identity, leadership, and the overall interpersonal skills construct. The only exception is communication and interaction skills ($t=0.956$, $p=0.340$), where no significant difference emerges an outcome suggesting that ubiquitous social media use may equalize everyday communicative practices across borders. These cross-regional contrasts echo Helsper et al. (2020) and Muhammad (2021), who observe that strategic investment can

accelerate digital competence, whereas interpersonal growth is more sensitive to local cultural and pedagogical contexts.

Table 2. T-test results for differences in digital and interpersonal skills between Saudi Arabia and Egypt.

Topics	Country	N	Mean	Std. deviation	T-Test value	Significance (p)
Digital device proficiency	Egypt	146	25.49	4.07	3.687	0.000
	KSA	181	27.13	3.91		
Information and data literacy	Egypt	146	24.25	3.57	2.622	0.009
	KSA	181	25.27	3.43		
Digital communication skills	Egypt	146	25.55	4.35	4.506	0.000
	KSA	181	27.40	3.08		
Digital content creation skills	Egypt	146	19.67	3.93	3.530	0.001
	KSA	181	21.12	3.49		
Overall digital skills	Egypt	146	94.96	12.89	4.393	0.000
	KSA	181	100.92	11.60		
Decision-making skills	Egypt	146	24.79	3.64	1.745	0.042
	KSA	181	25.52	3.81		
Authenticity and Identity	Egypt	146	23.82	4.26	3.376	0.000
	KSA	181	25.38	4.06		
Leadership skills	Egypt	146	24.44	3.62	2.417	0.016
	KSA	181	25.49	4.14		
Communication and interaction skills	Egypt	146	24.74	4.27	0.956	0.340
	KSA	181	25.18	3.97		
Overall interpersonal skills	Egypt	146	97.79	13.02	2.507	0.013
	KSA	181	101.57	13.93		

The t-test evidence indicates that although both cohorts demonstrate strong skill sets, Saudi students hold a consistent edge. This advantage likely reflects differential policy priorities, resource allocations, and infrastructure quality. Saudi Arabia's sustained funding for broadband access, device provision, and teacher upskilling appears to have translated into higher digital proficiency, which, via the positive correlations documented earlier, may, in turn, support stronger interpersonal performance.

5. DISCUSSION

Our analysis provides a nuanced insight into how female secondary school students in Saudi Arabia and Egypt integrate their digital expertise with their human, face-to-face capabilities. At first glance, the two skill sets appear discrete; yet, our data testifies to their deep entanglement: learners who skillfully navigate devices, sift information, and craft online messages also tend to communicate persuasively in person, take initiative, and make sound decisions. The paragraphs that follow unpack this synergy, situate the cross-national contrasts in their larger policy contexts, and sketch avenues for research that can push the field beyond snapshot surveys into richer, longitudinal understandings of twenty-first-century competence.

5.1. Digital Fluency and Interpersonal Agility

A key scholarly contribution of this work lies in its empirical confirmation that digital and interpersonal proficiencies rise and fall together. This finding extends Van Deursen and Van Dijk's (2014) argument that "second-level" digital divides hinge not on who owns a device but on who can marshal it for critical inquiry, collaboration, and creativity. Social cognitive theory adds explanatory heft here: Bandura (2001) reminds us that learning is inherently social, unfolding through observation, imitation, and reciprocal feedback loops. In digitally mediated group projects, students must decode peers' intentions, negotiate meaning, and refine their own stances behaviors that train the same muscles needed for leadership and conflict resolution offline. Recent classroom studies echo this pattern, showing that participation in online co-design tasks sharpens both critical thinking and social empathy (Livingstone & Bulger, 2014).

5.2. Integrated Pedagogies

Because technical and socio-emotional competencies appear to support each other, it is pedagogically short-sighted to teach coding or multimedia production in isolation from dialogue, teamwork, and ethical reasoning. Instead, our results support calls from the OECD (2019) and UNESCO (2021) for curricula that integrate data literacy with collaborative problem solving and intercultural communication. When a class creates a podcast series, for example, learners simultaneously practice audio editing, audience analysis, scriptwriting, and the delicate art of peer critique—a synergy we observed in the higher scores of students who reported frequent engagement with such projects. In other words, integrated tasks serve multiple purposes: they develop digital skills while fostering soft skills that employers and civic organizations value.

5.3. Unequal Infrastructures, Unequal Outcomes

Although integrated pedagogies offer clear benefits, our comparison shows that Saudi students outperform their Egyptian peers on most metrics; a gap that mirrors broader policy differences. Saudi Arabia's Vision 2030 has channeled resources into broadband upgrades, one-to-one device schemes, and continuous teacher development, creating fertile ground for impactful digital initiatives. By contrast, Egypt's tighter budgets and uneven rural connectivity have delayed comparable investments, often leaving teachers to manage large classes with minimal technology. Moreover, when digital tools are integrated into everyday lessons, students are more likely to embrace exploration and collaboration; conversely, opportunities to cultivate higher-order skills diminish when their use is sporadic. These observations are not a critique of any single policy but rather highlight how infrastructure, curriculum design, and teacher support together determine whether device access yields genuine, comprehensive competence.

While our cross-sectional survey provides valuable insights, important developmental questions remain. Future research should follow cohorts over several years to understand how digital and interpersonal dynamics evolve and whether early involvement in integrated projects offers lasting benefits. Incorporating objective performance tasks, such as collaborative problem-solving simulations evaluated by external judges, would enhance self-reported data and reveal subtle differences in strategic behaviors. Moreover, qualitative approaches can deepen our understanding: classroom ethnographies, focus groups, and reflective journals from teachers can shed light on the micro-interactions that shape technology use and the norms of collaboration. Lastly, expanding the demographic focus to include male and mixed-gender teams will help determine whether the trends observed here apply across different social configurations.

In summary, our findings present a compelling case that digital fluency and interpersonal agility are not parallel tracks but intersecting threads of a single tapestry. Education systems that treat them as such—coupling robust infrastructure with project-based, dialogic pedagogy stand the best chance of preparing young people to lead, collaborate, and innovate in a digitally saturated world.

6. CONCLUSION

This investigation aimed to shed light on how female high school students in Saudi Arabia and Egypt navigate their digital skills and social interactions. By examining their proficiency levels, understanding how these skills interact with one another, and comparing the patterns in both countries, we have gained insight into how young women in the Arab region are preparing or where they still require support to thrive in a world that is becoming increasingly connected and collaborative. The findings indicate that these students possess a strong foundation in both areas, while also highlighting important regional differences that require focused policy attention.

6.1. Key Findings

A recent study found that Saudi students consistently outperformed their Egyptian counterparts in various aspects of digital literacy. This included everything from comfortably navigating technology and critically assessing online information to effectively communicating and producing creative content.

However, their advantages extended beyond technical skills; they also excelled in areas such as decision-making, authenticity, leadership, and clear communication. Interestingly, the analysis revealed a strong positive connection between digital skills and interpersonal strengths. Students who were more adept at using digital tools tended to also thrive in social skills, indicating that engaging in technology-rich learning can foster emotional and social growth.

This aligns with the recommendations from organizations such as the OECD and UNESCO, which advocate for education systems to adopt holistic approaches that combine both technical skills and social development. It highlights a future where learning extends beyond academics to encompass essential life skills.

6.2. Contextual Influences and Educational Strategies

The increased digital communication skills among Saudi students likely reflect easier access to high-speed internet, widespread ownership of devices, and the growing acceptance of remote learning platforms that emerged during the COVID-19 pandemic. At the same time, their enhanced interpersonal skills suggest that classroom practices in Saudi Arabia are effectively promoting critical thinking, collaborative problem-solving, and encouraging student participation.

In contrast, Egypt's lower scores may be influenced by various structural issues, including patchy internet coverage, limited access to technology, and insufficient professional development opportunities for teachers. Additionally, the national policy environment plays a significant role; Saudi Arabia's Vision 2030 plans focus on investing in digital infrastructure, enhancing STEM education, and cultivating 21st century skills. Egypt, on the other hand, is still in the process of developing similar initiatives.

These differences illustrate that the challenges faced are not just about individual students but reflect broader system-level issues. It emphasizes the need to align curriculum, funding, and teacher training to support both digital skills and interpersonal development effectively.

6.3. Strengths, Limitations, and Future Directions

One key strength of this study is its cross-cultural, female-focused perspective, which enhances Arab educational research by examining multiple dimensions of two complex skill sets simultaneously rather than in isolation. However, our reliance on self-report surveys may introduce social desirability bias, and the cross-sectional design limits causal inferences. Future research should triangulate data with objective performance tasks, longitudinal tracking, and more comprehensive qualitative methods such as classroom observations, focus groups, and reflective journals to better understand developmental trajectories and contextual nuances. Expanding the sample to include male and mixed-gender cohorts would further clarify whether the observed patterns are specific to female students or applicable across genders.

6.4. Implications for Policy and Practice

The evidence presented here reinforces a straightforward but powerful message: digital know-how and interpersonal skills are mutually reinforcing, not competing priorities. Ministries of education and school leaders, therefore, need to promote curricula that integrate coding with communication, data literacy with ethical reasoning, and online collaboration with civic engagement. Comprehensive teacher training—covering technical skills and socio-emotional pedagogy is essential. Countries can look to ambitious frameworks, such as Saudi Arabia's Vision 2030, as proof that holistic, well-resourced strategies can significantly improve student competencies in a relatively short period. For Egypt and similar systems, scalable investments in broadband access, device availability, and classroom-

based digital projects may serve as levers for narrowing current gaps. Ultimately, equipping young women with both digital fluency and interpersonal agility is not only a matter of academic performance; it is a prerequisite for active participation in the digital economy and for leadership roles within their communities and beyond.

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