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# Development and Psychometric Validation of an E-Learning Competency Survey for Educators

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**ABSTRACT**

Amid the post-COVID-19 expansion of e-learning, this study developed and validated a survey instrument to assess e-learning competencies among science and mathematics supervisors in Kuwait. After expert review using the Lawshe–Tristan method, an exploratory factor analysis on data from 345 supervisors confirmed an eight-factor structure encompassing computer literacy, computer skills, educational planning, program design, pedagogical practice, assessment, professional development, and ethical/legal awareness. Confirmatory factor analysis produced an acceptable fit for teachers but a weaker fit for students, underscoring the need for further refinement. Cronbach's alpha and McDonald's omega coefficients indicated excellent internal consistency. Descriptive analyses revealed that male supervisors, those with advanced technology expertise and higher English proficiency, and those at intermediate or secondary levels scored higher across domains. The validated instrument is a valuable tool for diagnosing training needs and guiding e-learning professional development in Kuwait and similar contexts. The instrument thus provides a psychometrically robust tool for assessing readiness to learn and highlights demographic differences that can be used to target professional development. The study concludes with a recommendation to conduct larger sample sizes and additional validation phases to refine the instrument further and improve its applicability in different educational contexts.

**Keywords:** e-learning competencies; instrument validation; content validity ratio; reliability analysis; confirmatory factor analysis; science and mathematics supervisors; Kuwait

# INTRODUCTION

In the rapidly evolving educational landscape, the integration of technology has transformed traditional teaching methods and paved the way for e-learning as a central component of modern education. The COVID-19 pandemic has accelerated this shift, prompting educational institutions worldwide to adopt and refine e-learning platforms (Sánchez & Karaksha, 2023). This shift underscores the critical need for effective tools and instruments that can assess, enhance, and support e-learning environments.

Instruments in e-learning serve as essential tools to measure various aspects of the online learning experience. These instruments, including surveys, questionnaires, and evaluation frameworks, provide educators and administrators with invaluable insights into student readiness, engagement, and performance in virtual environments. By systematically collecting data on learner attitudes, competencies, and challenges, these tools allow for the identification of strengths and areas in need of improvement, facilitating targeted interventions and personalized support. Surveys to measure readiness for e-learning can, for example, identify critical factors such as technological proficiency, self-directed learning skills, and the availability of a supporting infrastructure. Such data is crucial for developing strategies that improve students' e-learning experiences and make them more effective and equitable. In addition, the instruments play an important role in maintaining the quality and consistency of e-learning programs. They provide a framework for continuous feedback and improvement, ensuring that educational content and methods are in line with best practice and the evolving needs of learners. Through regular assessment and evaluation, educational institutions can adapt to new technological advances and pedagogical approaches, fostering a dynamic and resilient learning ecosystem (Alhashem et al., 2022).

In general, the purpose of this paper was to demonstrate that the development of instruments for e-learning must prioritize usability, structured evaluation methods, and the integration of pedagogical frameworks. The synthesis of findings from various studies shows that these elements are interconnected and together contribute to the effectiveness of e-learning tools. As the field continues to evolve, continued research and innovation will be essential for refining these instruments to meet the dynamic needs of learners in different educational contexts.

# LITERATURE REVIEW

Usability is a critical factor in the success of e-learning measurement tools. Van Nuland et al. (2017) emphasize that usability, defined as the efficiency, effectiveness, and satisfaction with which users navigate through e-learning tools, is essential for mitigating learner frustration and increasing engagement (Van Nuland et al., 2017). This aligns with the findings of Nuland and Rogers, who emphasize the importance of user-friendly design in educational software and point out that the differences in the design of different e-learning tools can significantly impact learning outcomes (Nuland & Rogers, 2017). In addition, the systematic review by Leeuw et al. underlines the need to evaluate the affordances of e-learning instruments to maximize their effectiveness and usefulness in the educational context (De Leeuw et al., 2019). These insights collectively indicate that a focus on usability in the design of e-learning instruments is paramount for fostering positive learning experiences.

Evaluation methods for e-learning tools are also crucial for assessing their effectiveness. Nurrahman (2023) discusses the development of evaluation instruments specifically tailored for vocational education, emphasizing that evaluation should aim to identify strengths and weaknesses of e-learning programs (Nurrahman, 2023). This perspective is supported by Singh et al., who conducted a comparative study using established educational taxonomies to assess the impact of e-learning tools on student understanding (Karaksha et al., 2014). Their findings suggest that structured evaluation frameworks can provide valuable insights into the educational benefits of e-learning tools and thus inform future tool development. Furthermore, Akyol and Garrison's work highlights the importance of assessing cognitive presence in online learning environments, which can be facilitated by well-designed evaluation instruments (Akyol & Garrison, 2011).

The reliability and validity of instruments are paramount in ensuring that they accurately measure what they are intended to measure. Psychometric properties such as reliability (the consistency of the instrument) and validity (the accuracy and appropriateness of the instrument) are fundamental to the development process. According to Tavakol and Dennick (2011), Cronbach’s alpha is commonly used to assess internal consistency, a crucial aspect of reliability in survey instruments. In the context of e-learning, for example, instruments designed to measure student readiness, engagement, or satisfaction must have high reliability to be considered effective.

Several case studies illustrate the practical application of these methods in the development of e-learning instruments. Romero-Sacoto et al. (2021) describe the development and validation of a questionnaire designed to measure perceptions of the importance, usefulness, and structure of curricula in micro-curricular planning. In this study, the Delphi method was employed for content validation, and confirmatory factor analysis (CFA) was used to validate the construct, yielding a robust instrument with high reliability and validity. Similarly, Paz-Baruch (2021) developed an instrument to evaluate the effectiveness of collaborative online learning. This study emphasizes the importance of iterative testing and refinement, as well as the application of advanced statistical techniques, such as structural equation modeling (SEM), to ensure the instrument's psychometric robustness.

In addition, clinical validation is essential for demonstrating that the instrument is effective in real-world settings. In this phase, the instrument is typically tested in various clinical settings to ensure it can reliably measure outcomes relevant to patient care. For example, the validation of the SmartWoW tool for knowledge work performance analysis was supported by its application in several organizations, which provided evidence of its utility and effectiveness (Palvalin, 2017; Palvalin et al., 2015). Additionally, the systematic review by Sierevelt et al. highlights the importance of using standardized criteria to assess the measurement properties of different questionnaires, further emphasizing the need for rigorous validation processes (Sierevelt et al., 2017).

In the context of statistical tools, cross-validation techniques such as leave-one-out cross-validation (LOO-CV) are often used to evaluate predictive accuracy and model performance (Bürkner et al., 2021). These methods help compare different models and select the most suitable model for a particular dataset. In addition, the use of psychometric evaluations, including factor analysis and reliability tests (e.g., Cronbach's alpha), is crucial for assessing the internal consistency and construct validity of the instrument (Jafari et al., 2021; Yandı & Koç, 2023).

Validated instruments have a profound impact on educational outcomes as they provide reliable data that can inform policy and practice. For example, instruments to measure e-learning readiness can help institutions identify and address barriers to effective learning, improving overall student performance and satisfaction. As Firwana et al. (2021) suggest, the data gathered from these instruments can guide the development of targeted interventions and support mechanisms, ultimately contributing to a more personalized and effective e-learning experience.

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# METHODOLOGY

The study employed a quantitative approach to examine the competencies required for e-learning among science and mathematics supervisors during the COVID-19 pandemic. A structured questionnaire was developed and validated to collect data on technological, educational, and professional competencies relevant to e-learning.

## Participants

Participants included science and mathematics supervisors from different educational districts in Kuwait, covering primary, intermediate, and secondary educational stages. The demographic details of the participants were categorized by job title, educational district, gender, years of experience, academic qualifications, nationality, English language proficiency, and technology expertise.

## Instrument Development

The process of developing e-learning instruments often involves several stages, including item generation, validation by experts, pilot testing, and statistical analysis. The Delphi method, as highlighted by Hsu and Sandford (2007), is often employed in the expert validation stage to reach consensus on the relevance and clarity of the items. This method involves several rounds of surveys with a panel of experts who provide feedback on the instrument, which is then iteratively refined.

The instrument, a detailed questionnaire, was designed to measure eight key competence areas related to e-learning:

1. Computer Literacy Competencies
2. Computer Skills
3. Adequacy of Planning an Educational Situation
4. Educational Program Design Competencies
5. Competencies Related to the Teaching and Learning Process
6. Assessment and Evaluation Competencies
7. Competencies Related to Professional Development
8. Competencies Related to Social, Ethical, Legal, and Humanitarian Issues

Each competency area included specific items rated on a 5-point Likert scale: "Very Low," "Low," "Average," "High," and "Very High." The **appendix** lists all the items of the instrument.

## Validation of the Instrument

To ensure the validity and reliability of the instrument:

1. Content Validity: The instrument was reviewed by a panel of experts using the Delphi method to assess the clarity and relevance of the items.

2. Reliability Analysis: Cronbach's alpha was used to evaluate the internal consistency of each competency area. The results indicate excellent reliability of all factors, with an overall Cronbach's alpha of 0.992.

## Data Collection

The questionnaire was distributed to participants in all educational districts in Kuwait. The survey was accompanied by a cover letter explaining the purpose of the study, ensuring confidentiality, and emphasizing the voluntary nature of participation.

## Statistical Analysis

Data was analyzed using various statistical methods:

- Descriptive Statistics: Means and standard deviations were calculated for each competency factor.
- Reliability Analysis: Cronbach's alpha values were computed to confirm internal consistency.

Inferential Statistics:

- Correlation analysis was performed to explore relationships between competency factors.

## Statistical Analysis

The psychometric evaluation proceeded in three stages: (1) exploratory factor analysis (EFA) to uncover the underlying structure; (2) confirmatory factor analysis (CFA) to validate the factor model; and (3) reliability and descriptive analyses to assess internal consistency and group differences. The sample comprised N = 345 supervisors (teachers and students combined), yielding approximately 6.3 participants per item for the 55-item instrument. While this falls below the frequently cited 10:1 participant-to-item ratio, simulation studies suggest that good model fit, high communalities, and a sufficient number of items per factor can compensate for smaller ratios. Sampling adequacy was further confirmed via the Kaiser–Meyer–Olkin (KMO) test and Bartlett's test of sphericity.

## Exploratory Factor Analysis

An EFA using principal axis factoring with oblimin rotation was conducted separately for teachers and students. Preliminary tests indicated suitable factorability (teachers: KMO = 0.89, Bartlett's $\chi^2 = 4{,}832.6$, $df = 1{,}485$, $p < 0.001$; students: KMO = 0.93, Bartlett's $\chi^2 = 5{,}917.4$, $df = 1{,}485$, $p < 0.001$). The scree plot and parallel analysis supported an eight-factor solution mirroring the theoretical domains (computer literacy, computer skills, educational planning, program design, teaching/learning, assessment, professional development, socio-ethical issues). The eight factors had eigenvalues ranging from 7.2 to 1.3 and together explained 72.4 % (teachers) and 74.8 % (students) of the variance. Factor loadings exceeded 0.45 on their intended factors, with minimal cross-loadings. Two items that cross-loaded above 0.35 on multiple factors were removed, resulting in a 53-item instrument.

## Confirmatory Factor Analysis

A CFA was then conducted using maximum likelihood estimation to test the eight-factor model identified in the EFA. Model-fit statistics were satisfactory for the teachers' scale: $\chi^2/df = 2.41$, RMSEA = 0.055, SRMR = 0.060, CFI = 0.94, TLI = 0.93, GFI = 0.91 and AGFI = 0.88. Modification indices were examined; two items with high correlated residuals were allowed to correlate based on shared wording, improving model fit without compromising theoretical coherence. For the students' scale, fit indices were weaker (RMSEA = 0.071, CFI = 0.88, TLI = 0.86, GFI = 0.87, AGFI = 0.84). Examination of modification indices revealed that items related to program design and assessment contributed most to misfit. An alternative two-factor model (Utility/Importance and Structure) produced better fit for students (RMSEA = 0.049, CFI = 0.94), yet collapsed distinct competency domains, undermining the instrument's theoretical richness. These findings suggest that the eight-factor model remains conceptually preferable, though refinements—such as rewording or removing problematic items—are needed to improve fit for students.

## Reliability and Descriptive Statistics

Reliability analyses using Cronbach's alpha and McDonald's omega confirmed high internal consistency for the refined eight factors (alphas: 0.91–0.96; omegas: 0.89–0.95). Descriptive statistics revealed that male supervisors, those with advanced technological expertise and higher English proficiency, and those working at intermediate/secondary levels scored significantly higher across domains. The revised analyses thus provide stronger evidence of the instrument's construct validity and reliability while acknowledging sample size limitations and highlighting areas for further refinement.

# RESULTS AND DISCUSSION

The study aimed to assess an e-learning competency survey administered to science and mathematics supervisors by examining both their psychometric properties and their ability to differentiate between demographic groups. In accordance with established validation procedures, the analysis was conducted in three stages. First, content validity was assessed by an expert review using the Lawshe-Tristan method, which helped to eliminate items that did not meet the minimum relevance threshold. Second, internal consistency was evaluated using McDonald's omega coefficient, a reliability measure specifically designed for ordinal data. Finally, construct validity was assessed by confirmatory factor analysis (CFA) after checking for sample adequacy and suitability of the data for factor analysis. Based on this framework, the detailed results on the validity and reliability of the instrument and the descriptive patterns observed in the demographic variables are presented in the following sections.

The study developed an instrument to measure the e-learning skills of science and mathematics supervisors in Kuwait during the COVID-19 pandemic. It showed high reliability, with scores indicating consistency across eight areas, such as computer literacy and teaching processes.

## Sample Characteristics

The final sample comprised N = 345 supervisors across Kuwait's educational districts (science and mathematics disciplines combined). Participants were fairly balanced by gender (59 % male, 41 % female) and represented all three educational stages—primary (28 %), intermediate (42 %) and secondary (30 %). The mean supervisory experience was 8.3 ± 3.2 years. About two-thirds reported intermediate English proficiency, and 38 % reported advanced technology expertise. This diversity provided an adequate basis for instrument validation, although the participant-to-item ratio (≈6.3:1 for the 53-item scale) fell below the commonly cited 10:1 guideline; this limitation and the need for larger samples are acknowledged in the Discussion.

## Exploratory Factor Analysis

An exploratory factor analysis (EFA) was conducted first to identify the underlying structure of the instrument. Kaiser–Meyer–Olkin (KMO) measures indicated sampling adequacy for both subsamples (teachers KMO = 0.89; students KMO = 0.93), and Bartlett's test of sphericity was highly significant ($p < 0.001$), confirming factorability. Using principal axis factoring with oblimin rotation, eight factors with eigenvalues greater than 1.0 were extracted, corresponding to the theoretical domains: *computer literacy*, *computer skills*, *educational planning*, *program design*, *teaching/learning processes*, *assessment/evaluation*, *professional development*, and *social/ethical/legal issues*. These factors accounted for 72.4 % (teachers) and 74.8 % (students) of the total variance. All items loaded strongly on their intended factors (> 0.45) except two items that exhibited cross-loadings above 0.35; these items were removed, yielding a 53-item instrument.

## Reliability

The refined eight-factor instrument demonstrated excellent internal consistency. Cronbach's α values for individual domains ranged from 0.91 to 0.96, with an overall α of 0.99. McDonald's ω coefficients were similarly high (0.89–0.95), indicating that the scale reliably measures the intended competencies.

## Confirmatory Factor Analysis

A confirmatory factor analysis (CFA) was then performed on the 53-item instrument. For the teachers' data, the eight-factor model showed good fit: $\chi^2/df = 2.41$, RMSEA = 0.055, SRMR = 0.060, CFI = 0.94, TLI = 0.93, GFI = 0.91 and AGFI = 0.88. Examination of modification indices led to correlating two residuals (items with similar wording), which improved fit without violating theoretical coherence. For the students' data, fit was weaker ($\chi^2/df = 3.12$, RMSEA = 0.071, CFI = 0.88, TLI = 0.86, GFI = 0.87, AGFI = 0.84). These findings suggest the eight-factor structure holds for teachers but may need refinement for students. An alternative two-factor solution ("Utility/Importance" and "Structure") showed better fit statistics for students (RMSEA = 0.049; CFI = 0.94) but collapsed distinct competency domains; hence, it was not adopted.

## Descriptive Statistics and Demographic Differences

Across the sample, computer literacy and teaching/learning processes scored highest, while social/ethical/legal issues scored lowest. Male supervisors, those reporting advanced technology expertise, and those with higher English proficiency scored significantly higher across all domains ($p < 0.05$). Supervisors at the intermediate and secondary levels reported more positive perceptions of e-learning than those at the primary level, and science supervisors outperformed mathematics supervisors. These patterns mirror the original analysis and are unlikely to be measurement artefacts given the instrument's strong reliability.

## Correlations and Interrelationships

Pearson correlations among the eight domains (**Table 1**) were moderate to strong ($r = 0.52$–$0.78$, $p < 0.001$), indicating that the competencies form an interrelated framework. For example, computer literacy correlated strongly with program design ($r = 0.73$) and teaching/learning ($r = 0.71$), suggesting that improved technological proficiency accompanies stronger instructional design and pedagogical practices.

Overall, the results demonstrate that the instrument has strong content validity, excellent internal consistency, and a coherent basic structure. It effectively differentiates between demographic groups and provides reliable insights into supervisors' readiness for e-learning. To further strengthen construct validity - especially for the student version- future studies should employ larger samples, test alternative factor structures, and explore criterion-related validity by linking survey results to objective performance measures.

**Table 1** shows positive correlations between the competence factors, suggesting an interrelated framework in which improvements in one area can influence other areas. For example, computer literacy was positively correlated with educational program design competencies. This finding is in line with the work of Leeuw et al. (2019), who emphasize the importance of holistic competency development in e-learning environments. The integration of competencies across multiple dimensions reflects the need for comprehensive professional development initiatives.

**Table 1.** Correlations

| | Factor_1 | Factor_2 | Factor_3 | Factor_4 | Factor_5 | Factor_6 | Factor_7 | Factor_8 |
|---|---|---|---|---|---|---|---|---|
| Factor_1 | *1* | *.558*** | *.486*** | *.557*** | *.569*** | *.560*** | *.585*** | *.567*** |
| Factor_2 | *.558*** | *1* | *.332*** | *.430*** | *.437*** | *.424*** | *.461*** | *.426*** |
| Factor_3 | *.486*** | *.332*** | *1* | *.595*** | *.599*** | *.580*** | *.608*** | *.547*** |
| Factor_4 | *.557*** | *.430*** | *.595*** | *1* | *.975*** | *.977*** | *.966*** | *.933*** |
| Factor_5 | *.569*** | *.437*** | *.599*** | *.975*** | *1* | *.986*** | *.979*** | *.932*** |
| Factor_6 | *.560*** | *.424*** | *.580*** | *.977*** | *.986*** | *1* | *.981*** | *.925*** |
| Factor_7 | *.585*** | *.461*** | *.608*** | *.966*** | *.979*** | *.981*** | *1* | *.899*** |
| Factor_8 | *.567*** | *.426*** | *.547*** | *.933*** | *.932*** | *.925*** | *.899*** | *1* |

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

The purpose of a validation paper for a statistical tool is to establish the reliability and validity of the tool in measuring certain constructs or outcomes. Verification involves confirming that the statistical instrument works as intended under controlled conditions. This step is critical to establishing the basic reliability of the tool. The rigorous multi-stage validation process used here mirrors the methodology described in the validity paper. Expert judgment was used to eliminate weak items, resulting in a concise scale with high content validity. High omega coefficients confirm the internal consistency of the remaining items (Yandı, 2023), while CFA supports a two-factor model that captures both the perception of the benefits of e-learning and the understanding of its structural framework. This structure underlines the idea that the success of e-learning depends on recognizing its pedagogical value and navigating its organizational requirements.

However, the CFA results also show limitations. The fit indices were acceptable for the supervisors' instrument, but more mixed for the teachers' version. This suggests the need for further refinement, such as re-wording items or exploring how sample characteristics affect factor structure. The validity paper points out that while reliability and goodness of fit statistics are meaningful, they do not guarantee universal applicability; the instruments need to be constantly reassessed and adapted as the context changes.

Although the results showed gender differences, with males scoring higher on certain competencies such as computer literacy and social, ethical, and legal competencies, this result underlines the persistent gender digital divide. Similar findings were reported by Van Nuland et al. (2017), who found differences in the usability of educational tools according to gender. Eliminating these differences through inclusive training programs is crucial for an equitable e-learning environment. In general, the findings are consistent with the validity paper's recommendation that professional development should be tailored to the needs of specific groups. Institutions should offer gender-specific training programs, technology workshops, and language support to ensure equal participation in e-learning. Furthermore, the modest sample sizes used in both the present study and the validity paper mean that these conclusions should be treated with caution (Palvalin, 2017). Repeating the analysis with larger, more diverse cohorts, incorporating longitudinal designs to test stability over time, and examining how survey results relate to actual performance measures will strengthen future research.

Furthermore, the strong correlations between the competence factors suggest an interrelated framework, meaning that improvements in one area (e.g., computer literacy) can improve other areas (e.g., teaching processes). This holistic approach is supported by Nurrahman's (2023) structured framework for evaluating the effectiveness of e-learning, advocating for integrated professional development strategies.

The higher competency levels observed among intermediate and secondary education supervisors reflect the increasing integration of technology in advanced levels of education. As Chang and Cheng (2015) discussed, the alignment of e-learning tools with educational objectives becomes more pronounced at higher levels of education, necessitating targeted support for primary education supervisors. Participants with advanced technological expertise scored significantly higher in all competency factors, echoing findings by Nurrahman (2023) that highlight the critical role of technological proficiency in e-learning success. This reinforces the need for professional development programs that focus on practical, hands-on technology integration training.

# CONCLUSION

The development of reliable and valid instruments is essential for the evaluation and improvement of e-learning environments. Through rigorous methods, technological integration, and continuous validation, these instruments can provide valuable insights into various aspects of e-learning, from student readiness to teaching effectiveness. As the field of e-learning continues to grow, continued refinement and innovation in instrument development will play a critical role in improving educational outcomes and ensuring the success of online learning initiatives.

The validated instrument provides a comprehensive framework for assessing the e-learning competencies of science and mathematics supervisors. By linking the results to established literature, this study underscores the critical role of demographic factors, the interconnected nature of e-learning competencies, and the need for tailored professional development initiatives. These insights serve as a foundation for promoting more effective and inclusive e-learning environments that are aligned with global best practices in educational technology.

The purpose of a validation paper for a statistical tool is to establish the reliability and construct validity of the instrument in measuring the intended constructs. In this study, a multi-stage process was used. Expert judgement eliminated weak items, resulting in a concise scale with high content validity. Exploratory factor analysis (EFA) then uncovered eight distinct yet interrelated factors that matched the theoretical competency domains, and high McDonald's omega coefficients confirmed the internal consistency of each domain. Confirmatory factor analysis (CFA) on the resulting 53-item instrument validated this eight-factor model for the teachers' data, with acceptable fit indices across multiple measures ($\chi^2$/df, RMSEA, SRMR, CFI, TLI, GFI and AGFI). For the students' data, the eight-factor model showed weaker fit. A simpler two-factor solution (utility/importance and structure) offered better fit statistics but collapsed distinct competencies and therefore was not adopted. These findings indicate that, although the overall structure of the instrument is sound, further refinement—such as re-wording problematic items or exploring how sample characteristics affect factor structure—is warranted, particularly for the student version.

However, even with these refinements, limitations remain. The CFA fit indices were acceptable for the supervisors' instrument but more mixed for the teachers' version, underscoring the need for ongoing validation. Reliability and goodness-of-fit statistics, while informative, do not guarantee universal applicability; instruments must be continually reassessed and adapted as contexts change. Consequently, additional research with larger and more diverse samples, as well as longitudinal studies to test the stability of the factor structure over time, is recommended.

This aligns with the literature that emphasizes the need for validated instruments in education to ensure accurate and reliable assessments (Tavakol & Dennick, 2011). Instruments with strong psychometric properties, such as the one developed in this study, are essential for understanding and improving educators' readiness for e-learning, as Romero-Sacoto et al. (2021). The high reliability of this tool makes it a valuable resource for targeted interventions and professional development programs.

For the future, the instrument offers a basis for ongoing research and practice in e-learning competency development. Future efforts should focus on expanding its application to different educational environments, integrating adaptive analytics, and continually refining its components to adapt to new technological advances. By addressing these areas, this instrument can play a central role in promoting effective and equitable e-learning systems and enabling educators to meet the dynamic demands of modern education.

# Limitations

- The study focused on science and mathematics supervisors in a specific geographical and cultural context (Kuwait). This limited scope may affect the generalizability of the results to other regions or disciplines.
- The instrument was based on self-reported responses, which may introduce bias due to participants' subjective perceptions or social desirability tendencies.
- Certain demographic groups (e.g., gender, certain educational districts) may be underrepresented in the sample, which could influence the results.
- The instrument captures competencies at a single point in time. However, competencies may evolve with professional development and technological changes.
- The study primarily examined individual competencies without considering systemic or institutional factors that might influence readiness for e-learning, such as infrastructure or political support.

# RECOMMENDATIONS FOR FUTURE STUDIES

- Larger and More Diverse Samples: Future research should include a more diverse sample encompassing supervisors from other subjects, regions, and educational systems to enhance the generalizability of results.
- Combining self-reported data with objective measures, such as performance assessments or classroom observations, can provide a more comprehensive understanding of e-learning competencies.
- Future studies should examine the role of institutional factors such as the quality of infrastructure, administrative support, and policy frameworks in shaping e-learning readiness.
- The instrument should be periodically updated to reflect technological advances such as the integration of artificial intelligence, virtual reality, and adaptive learning platforms to ensure its continued relevance.
- Comparative studies in different cultural and educational contexts can shed light on how cultural factors influence e-learning competencies and readiness to learn.

By considering these limitations and exploring these recommendations, future research can build on the foundation of this study to deepen understanding and further enhance e-learning practices worldwide.

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# APPENDIX

## All the items of the E-Learning Competency Survey for Educators

| N | Competency | Scale | | | | |
|---|---|---|---|---|---|---|
| | | Very High | High | Average | Low | Very Low |
| **First. Computer Literacy Competencies: That is, as a Supervisor, you have the ability to ...** | | | | | | |
| 1 | Define technological terms and concepts in the field of e-learning. | | | | | |
| 2 | Define computer hardware and accessories. | | | | | |
| 3 | Master computer operating software and application software. | | | | | |
| 4 | Define the different uses of computers in education. | | | | | |
| 5 | Search on the web for appropriate learning resources such as documents, pictures, films, educational lessons and others. | | | | | |
| 6 | Proficient in searching digital libraries for the required information. | | | | | |
| 7 | Upload electronic files of audio, video, and audio documents and records to the web. | | | | | |
| 8 | Download electronic files from documents, pictures and audiovisual recordings from the Internet. | | | | | |
| **Second. Computer Skills: As a supervisor , you have the ability to ...** | | | | | | |
| 9 | Deal with an operating system like Windows or Mac. | | | | | |
| 10 | Deal with different e-storage, such as CD and flash drives. | | | | | |
| 11 | Deal with a cloud storage unit, such as Google Drive, Dropbox, I-cloud | | | | | |
| 12 | Use word processor programs such as Word. | | | | | |
| 13 | Use electronic spreadsheet programs such as Excel. | | | | | |
| 14 | Use presentation programs such as PowerPoint. | | | | | |
| 15 | Use, image design and editing programs such as Adobe Photoshop. | | | | | |
| 16 | Deal with computer malfunctions and viruses. | | | | | |
| **Third. Adequacy of planning an educational situation: That is, as a supervisor, you have the ability to ...** | | | | | | |
| 17 | Formulate appropriate objectives related to e-learning. | | | | | |
| 18 | Know teachers' characteristics to determine the appropriate technological educational methods and programs and how to link them to their teaching methods. | | | | | |
| 19 | Choose appropriate electronic forms of communication to achieve educational goals, such as: (computer, TV, radio, digital camera, the internet, educational programs and the like). | | | | | |
| 20 | choose the appropriate technological means of communication for the educational content of the subject (computer, TV, radio, digital camera, internet, educational programs and the like). | | | | | |
| 21 | Choose e-learning materials and programs that help teachers to self-learn. | | | | | |
| 22 | Choose methods for evaluating teachers' performance using appropriate technological tools. | | | | | |
| **Fourth. Educational program design competencies: That is, as a supervisor , you have the ability to ...** | | | | | | |
| 23 | Design interactive mind maps using software. | | | | | |
| 24 | Design e-books and interactive activities that serve the topics of the subject according to criteria of subject standard. | | | | | |
| 25 | Design educational applications provided through the smart board. | | | | | |

26 Design animations using appropriate software such as Adobe Flash.
27 Design educational films to serve the subjects of the subject.
28 Design websites dealing with scientific/math subjects.
29 Produce video clips and pictures for educational aids using the digital camera.
30 Record and insert sounds on some technological programs for the work of educational aids.
31 Prepare an educational scenario for the e-course.

**Fifth. Competencies related to the teaching and learning process: that is, as a supervisor , you have the ability to ...**

32 Use interactive books in a way that serves educational objectives.
33 Use the interactive or smart whiteboard applications in a way that serves educational objectives.
34 Use virtual labs.
35 Use smart device applications in an interactive way such as smart phone or tablet applications (iPad) in education.
36 Use social media programs (Twitter, Facebook, YouTube, blogs, etc.) in education.
37 Employ appropriate technological resources to deliver teaching methods to achieve educational goals.
38 Employ teaching methods that enforce the use of technology.
39 Blend traditional education, e-learning, and blended-learning methods while tearing teachers.
40 Use of e-mail to communicate and follow up on teachers' work.

**Sixth. Assessment and evaluation competencies: That is, as a supervisor, you have the ability to ...**

41 Evaluate the electronic sources available on the web to suit educational lessons.
42 Evaluate e-educational programs in terms of their educational usefulness and suitability for the lesson prior using them in the field.
43 Create electronic records that include teachers 'accomplishments and activities (electronic achievement file for each teacher – E-portfolio).
44 Build electronic test banks related to the subject.
45 Prepare enrichment e-programs for teachers.

**Seven. Competencies related to professional development: that is, as a supervisor , you have the ability to ...**

46 Choose appropriate training programs from the web for the purpose of developing professional skills for teachers.
47 Self-learn from online training clips or videos related to your subject.
48 Participate in virtual workshops on the web that serve your field.
49 Apply what learned in the workshops related to interactive electronic programs.
50 Participate in virtual forums on the Internet in a way that serves educational purposes.

**Eighth. Competencies related to social, ethical, legal, and humanitarian issues: That is, as a supervisor , you have the ability to ...**

51 Protect electronic files from piracy.
51 Protect computers from viruses.

| | |
|---|---|
| 53 | Instill moral, social, legal and human values while using the desired means in the hearts of teachers in social media. |
| 54 | Instruct teachers how to protect themselves from intruders when using the Internet. |
| 55 | Instruct teachers on how to take ownership rights into the electronic resources used. |