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# Designing and Validating a Technological Innovation Scale for the English as Foreign Language Learning Context

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**Abstract**

This study aimed to develop and validate a Technological Innovation Scale (TIS) specifically for the Iranian context of English as a Foreign Language (EFL). A mixed-methods approach was employed, involving 375 EFL teachers selected through convenience sampling. The research began with a qualitative phase, using expert interviews and focus groups to generate and refine scale items. This was followed by a quantitative phase, where the scale's reliability and validity were tested in both a pilot and a main study. The pilot, conducted with 100 teachers, produced a Cronbach's Alpha of .87, indicating good reliability. The main study further confirmed this with an overall Cronbach's Alpha of .84. Factor analysis supported the scale's construct validity. The results suggest that the TIS is a reliable and valid tool for assessing technology integration in Iranian EFL education, providing useful insights for educators and policymakers seeking to improve technology integration in education.

*Keywords:* EFL teachers; Innovation; Scale development; Technological innovation

## 1. Introduction

For the last decade, Technological Innovation (TI) has dramatically transformed educational paradigms globally, with a remarkable impression on the field of EFL education (Başar & Şahin, 2022). The

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integration of innovative technologies in EFL classrooms has not only enhanced teaching methodologies but also enriched students' learning experiences by providing more interactive, engaging, and accessible means of acquiring language skills (Ihnatova et al., 2021). In fact, the adoption of TI in education has gained substantial notice in the last few years, leading to significant advancements in learning and teaching processes (Chege et al., 2020). However, in spite of the burgeoning body of research on TI (Başar & Şahin, 2022; Chege et al., 2020), there are several critical gaps that need to be addressed, particularly in the context of EFL education in Iran. The lack of context-specific instruments is the first gap that should be mentioned. Most existing scales and measurement tools for TI in education are designed for general use and lack specificity for particular educational contexts (Kelly et al., 2021). Although existing instruments provide valuable insights, they do not specifically address the unique dynamics of EFL learning environments. There is a clear need for a scale that is tailored to the Iranian EFL context, considering cultural, pedagogical, and linguistic factors that influence technology use and its effectiveness in this setting. The insufficient focus on EFL contexts is another gap that should be considered. While there are several investigations on the role of TI in education (Clauss, 2017; Kelly et al., 2021), studies specifically targeting the EFL context in terms of scale development for TI are relatively scarce. The unique challenges and opportunities presented by integrating technology into language learning require dedicated research to develop tools that accurately capture these dynamics. Existing research often overlooks the particular requirements of EFL learners and teachers, particularly in Western contexts, where cultural and educational practices significantly differ from those in non-Western countries. The limited exploration of psychometric properties is another gap that could be mentioned. Many studies on TI tools do not rigorously examine the psychometric properties of the scales used. Reliability and validity are critical for ensuring that these tools provide accurate and consistent measurements (Souza et al., 2017). There is a remarkable gap in the literature respecting the development and validation of scales that specifically measure TI in the EFL context, with robust psychometric testing to confirm their validity and reliability.

Thus, in the Iranian educational context, where traditional teaching methods still prevail, the infusion of technology poses unique challenges and opportunities, the development of a valid and reliable scale to measure TI in this setting can provide educators, policymakers, and researchers with precious insights into the impact of technological interventions. This scale could serve as a tool for evaluating current practices, identifying

areas for improvement, and guiding future technological advancements in EFL education. To accomplish the goal of this study, researchers must undertake a comprehensive process involving the creation of scale items, pilot testing, and rigorous statistical analysis to evaluate the psychometric properties of the scale. This process ensures that the final scale is both contextually relevant and scientifically sound.

## 2. Literature Review

### *2.1. Innovation in Education*

Innovation involves implementing new methods and ideas into practical use, resulting in beneficial changes and advancements in areas like society, technology, and business (Haefner et al., 2021). It encompasses the development or adoption of original concepts and approaches that enhance progress and efficiency (Ridley, 2020). Innovation can appear in various forms, such as breakthroughs in technology, enhancements in organizational structures, or innovative solutions to problems. Achieving successful innovation often involves a blend of creativity, research, and the capability to make adjustments for different circumstances (Li et al., 2022). Innovation in language teaching plays a pivotal role in improving student learning outcomes (Murray, 2008; Wedell, 2009). It is defined as the attempt to enhance education by introducing new or different methods, as perceived by those who implement them (Carless, as cited in Chapelle, 2013). The successful application of these innovations in educational contexts requires careful consideration (Alderson, 2009). Therefore, the management of innovation is critical to the advancement of education (Waters, 2009). A key aspect of using innovative language teaching methods is effectively engaging students in the learning process (Davis, 2017). Technology, as a major innovation, significantly contributes to the learning process and increases student engagement.

### *2.2. Technological Innovation in Language Teaching*

Technological innovation has profoundly transformed the landscape of education, particularly in language teaching (Meighan, 2021). The integration of advanced technologies has reshaped traditional teaching methods, offering new and enhanced learning experiences (Pratama et al., 2023). This revolution in educational practices has enabled educators to impart linguistic skills more effectively by incorporating tools and platforms that cater to diverse learning styles (Rosenbusch, 2020). This section explores the key aspects of TI in language teaching and its significant implications for both educators and learners.

Technological innovations pertain to the introduction of advanced or significantly improved technologies, methods, or processes that drive advancements across various fields, including education (Radicic & Petković, 2023). In today's globalized and modern era, technology has dramatically altered educational practices, pushing both learners and teachers of English to adopt more innovative and creative approaches (Min, 2014). As technology evolves, it continuously changes learners' prospects and learning habits. Traditional teaching methods often fail to satisfy the demands and desires of the current generation, making technology an indispensable component of modern language education (Rao, 2019). Consequently, both educators and learners increasingly rely on technology for teaching and learning purposes (Abu Bakar & Nosratirad, 2013). Several innovative technologies have become integral to language teaching, including the Internet, computers, mobile phones, mobile apps, podcasts, and multimedia tools (Rao, 2019). These technologies, as noted by various researchers (e.g., Brooks, 1997; Min, 2014), have revolutionized the way languages are taught and learned, offering numerous advantages and introducing some challenges.

With regard to the Internet, a global network of billions of devices has made English language teaching and learning more accessible than ever before (Rao, 2019). Teachers utilize online resources to prepare lessons, integrate multimedia in classrooms, and stay updated with the latest educational trends (Dourda et al., 2018). Learners benefit from easy access to educational materials, enabling them to expand their vocabulary, understand grammatical structures, and develop language skills independently (Mohamed, 2021). The Internet also enhances collaboration and communication between educators, students, and parents, facilitating a more efficient educational process (Agung et al., 2020).

In addition, multimedia technology, which combines text, graphics, animation, video, and sound, plays an instrumental role in advancing language education (Min, 2014). It enables educators to design engaging, interactive classes that boost learners' motivation, communicative competence, and cultural understanding (Motteram, 2013; Sulima, 2019). However, the use of multimedia also presents challenges, such as high costs, technical issues, and the potential for distraction (Pang et al., 2021; Panthee, 2012). Moreover, the introduction of computers has revolutionized language teaching through Computer-Assisted Language Learning (CALL) (Hubbard, 2009). Computers stimulate learners' interest, enhance their learning experiences, and reduce the workload of teachers by streamlining lesson preparation, data management, and real-

time feedback (Enayati & Gilakjani, 2020; Zapata & Sagarra, 2007). CALL programs also promote interaction and provide valuable feedback, making them powerful tools in language education (Warschauer & Kern, 2000). Furthermore, mobile phones and Applications, due to their portability and convenience, have evolved into critical tools in language education (Traxler, 2007). These devices permit learners to access educational resources anytime and anywhere, fostering independent learning and alleviating teachers' workload (Thornton & Houser, 2005). Nonetheless, mobile learning also faces challenges such as network issues, device limitations, and potential distractions (Sundgren, 2017; Al-Hunaiyyan et al., 2016).

Further, Podcasts, which are digital audio files accessible online, offer flexible and engaging learning opportunities outside traditional classrooms (Bueno-Alastuey & Nemeth, 2020). They enhance learners' listening skills, provide personalized learning experiences, and support independent study (Stanley, 2006; Rosell-Aguilar, 2013). Research has shown that podcasts can significantly improve language skills, making them a valuable resource in language education (Tomé Díez & Richters, 2020). Finally, Web-based learning, frequently considered online or e-learning, offers access to a vast array of authentic resources and interactive tools that enhance language learning (Felix, 2001; Son, 2005). This includes online courses, automated writing evaluation programs, and weblogs, all of which contribute to improving both teaching efficacy and learners' language proficiency (Murray & McPherson, 2004).

### *2.3. Importance of Measuring Technological Innovation*

Measuring technological innovation in education is essential for several reasons. Firstly, it allows educators to evaluate the effectiveness of technological tools and interventions in achieving educational objectives (Zhou & Luo, 2018). Secondly, it helps to identify the particular demands and priorities of students, enabling the development of more tailored and effective teaching strategies (García et al., 2017). Thirdly, it provides a framework for continuous improvement and innovation, ensuring that educational practices keep pace with technological advancements (Cavdar & Aydin, 2015). So, enough attention should be paid to the validation of new scales in different contexts. In fact, the psychometric properties of a scale should be considered an important factor for developing TIS. The psychometric properties of a scale (i.e., validity & reliability), are essential factors determining its effectiveness and precision. Validity refers to how well a scale evaluates the concept it is intended to measure (Sechrest, 2005).

Different forms of validity exist, such as criterion-related validity, construct validity, and content validity. As mentioned by Clark and Watson (2019), content validity ensures that the scale adequately represents all relevant dimensions of the concept, while construct validity evaluates the theoretical basis and structure of the scale (Clark & Watson, 2019). Criterion-related validity investigates the link between the scale and other established measures of the same construct (Villado et al., 2016). Reliability, in contrast, relates to the scale's consistency and stability over time and across different groups, and it can be evaluated through methods like inter-rater reliability, KR21, KR20, and internal consistency (Cohen et al., 2017).

A reliable scale produces consistent results under consistent conditions, which is essential for making accurate and generalizable conclusions. Several studies have attempted to measure TI in education, but few have focused specifically on the EFL context. Existing scales such as the unified theory of acceptance and use of technology and the technology acceptance model provide valuable insights into users' perceptions and acceptance of technology. However, these models are primarily designed for general educational settings and do not capture the unique dynamics of language learning environments (Venkatesh et al., 2003).

Despite its critical importance, there is a significant lack of valid and reliable tools specifically designed to assess TI in the EFL context. Most of the current scales are broad and do not address the specific characteristics and challenges of language learning environments. This highlights the need for a scale that is context-specific and capable of providing precise and meaningful evaluations. In light of the importance of TI and the absence of a valid, comprehensive scale for its assessment, this study aimed to create and validate a TIS within the context of Iranian. The following research question is posed by the researchers for the investigation:

1. Does the technological innovation scale show the psychometric properties of validity and reliability?

## 3. Methodology

### *3.1. Participants*

A total of 475 EFL teachers, chosen through convenience sampling, participated in the various phases of this study. In the initial phase, 100 EFL teachers (both male & female, with an average age of 29) who

possess characteristics similar to those of the main study participants were selected to test the reliability of the questionnaires in a pilot study. In the subsequent phase, 375 EFL teachers (181 males &174 females, with an average age of 31) who taught English in various contexts across Iran were chosen for the main phase of the study. They were asked to complete the demographic section of the questionnaire and respond to each item.

### *3.2. Instrument: TIS*

To conduct the study, the researchers initially developed a TIS, which was later validated using data collected from 375 EFL instructors. The scale comprised two segments. The first segment collected information such as age, gender, teaching experience, and education from the participants, while the second part consisted of a 32-item questionnaire, with responses ranging from 1 (Never) to 5 (Almost Always). Higher scores reflected a higher level of innovation in English language teaching among the participants. The questionnaire was designed to be completed within 20 minutes. The procedures and steps involved in the development and validation of the questionnaire are detailed below.

### *3.3. Procedure*

To undertake this research, the TIS was developed based on three specified standard procedures for creating an assessment scale with appropriate psychometric properties (Dörnyei, 2003; Ghaedsharafi et al., 2019): (1) searching related material in the literature on TI, (2) analyzing available assessment tools on TI, and (3) consulting with EFL experts. In fact, In the process of validating TIS, an exploratory sequential design was used. It's a type of mixed method design in which qualitative data is gathered and analyzed initially, and quantitative data is collected and examined afterward. This design can be used if the researcher thinks the quantitative data should confirm or validate their qualitative findings. Thus; the current research was carried out in two major stages as follows.

#### 3.3.1. Qualitative Data Collection

In this phase, first, different constructs about the characteristics of innovative teachers and their related items were found through literature and interviewing ELT experts. In order to reach the selected constructs, different questionnaires about innovation in the English language era, related papers, and the idea of well-educated teachers and ELT experts were studied. After that, 38 items under 5 constructs were written by the researcher. Next, by consulting with different experienced EFL experts one construct with 6 items was removed from the initial sample of the

questionnaire. Finally, 32 remaining items under 4 constructs were distributed among selected teachers for the next step.

3.3.2. Quantitative Data Collection

To gain a clearer understanding of the constructs, the researcher created an initial categorization of the items based on components identified during the qualitative phase. These components were organized into four general constructs: mobile-based learning, multimedia, web-based technology, and computer-based learning, for the first version of the questionnaire. The reliability of this preliminary version was assessed through a pilot study involving 100 EFL teachers with characteristics similar to those in the main study. The collected data were analyzed using SPSS, and Cronbach's alpha was calculated to evaluate the questionnaire's reliability. The resulting Cronbach's alpha of 0.87 indicated high internal consistency.

In addition to gathering data from approximately 100 EFL teachers during the pilot study, the researcher also sought expert feedback on the content of the scale. A professional editor, an expert in language teaching, and a news editor, all with near-native proficiency in English, reviewed and revised the questionnaire items for language clarity. Based on the initial data analysis, necessary modifications were made, resulting in a revised questionnaire with 32 items. This updated version was then used for statistical validation in the main study, where it was distributed to 375 EFL teachers across different contexts in various provinces. Teachers completed the questionnaire, providing their responses and demographic information. Following data collection, Exploratory Factor Analysis (EFA) was conducted to eliminate any unrelated items.

### *3.4. Data Analyses*

An EFA using varimax rotation was utilized to pinpoint the underlying constructs of the technological innovation questionnaire. During the validation process, various statistical analyses were performed. For instance, orthogonal varimax rotation was applied to explore the correlations among the constructs. Additionally, Watkin's parallel analysis was used to confirm the resampling methods' results, which indicated that four factors were optimal for extraction regarding technological innovation. The adequacy of the sample size for conducting EFA was assessed using the KMO index of sampling adequacy and Bartlett's test of sphericity. Finally, the Total Variance Explained and the Rotated Factor Matrix were employed to finalize the constructs and corresponding items of the questionnaire.

## 4. Results

### *4.1. Pilot Study*

The reliability of the developed questionnaires was estimated in the pilot study on 100 EFL teachers who were selected randomly. The findings are shown in Table 1.

Table 1. *Cronbach's Alpha Reliability Indices (Pilot Study)*

| Questionnaires | N | Cronbach's Alpha | N of Items |
|---|---|---|---|
| Technological Innovation | 100 | .87 | 32 |

The estimated value of Cronbach's Alpha for the questionnaire (innovation in English language teaching questionnaire) was ($N$=100, $\alpha$ = .87) which was a "good" value.

### *4.2. Reliability Indices for the Main Study*

Before conducting EFA, the Cronbach's alpha reliability of the scale for each component was assessed. Table 2 displays the reliability indices of TIS.

Table 2. *Reliability Indices*

| Questionnaires | N | Cronbach's Alpha | N of Items |
|---|---|---|---|
| Technological Innovation | 375 | .848 | 32 |
| Web-Based | | .832 | 8 |
| Multimedia | | .829 | 10 |
| Computer-Based | | .832 | 5 |
| Web-Based | | .848 | 9 |

The reliability indices for the questionnaire were .848. The reliability indices for the four components of TI were as follows; mobile-based learning ($\alpha$ = .832), multimedia ($\alpha$ = .829), computer-based learning ($\alpha$ = .832), and web-based technology ($\alpha$ = .848). All of these reliability indices are considered appropriate. Based on the guidelines mentioned by George and Mallery (2020), the developed questionnaire demonstrated a "good" reliability, with an alpha value greater than .80.

### *4.3. Construct Validity of TIS*

As reported above, the developed scale enjoyed good reliability while retaining all 32 items. To validate the developed instrument, an EFA with varimax rotation was conducted to investigate the underlying constructs of the TIS. The questionnaire included 32 items and was filled and returned by 375 EFL teachers. The orthogonal varimax rotation was

employed because as displayed in Table 4.3, all of the correlations among the constructs were lower than +/- .32.

Table 3. *Component Correlation Matrix of TIS*

| Component | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| 1 | 1.000 | | | | | | |
| 2 | .173 | 1.000 | | | | | |
| 3 | .167 | .148 | 1.000 | | | | |
| 4 | .174 | .165 | .164 | 1.000 | | | |
| 5 | .045 | .028 | .040 | .129 | 1.000 | | |
| 6 | .034 | .030 | .011 | .040 | .052 | 1.000 | |
| 7 | .006 | .077 | .032 | .044 | .049 | .003 | 1.000 |

To discover the optimum number of factors to extract, the results of the scree plot, (Figure 1), resampling method (Figure 2), and Watkin's parallel analysis (Table 3) were consulted. Figure 1 included two, four, and eight points of reflection; i.e., suggesting two, four, or eight factors to be extracted.

Figure 1. *Optimum Number of Factors to be Extracted for the TI*

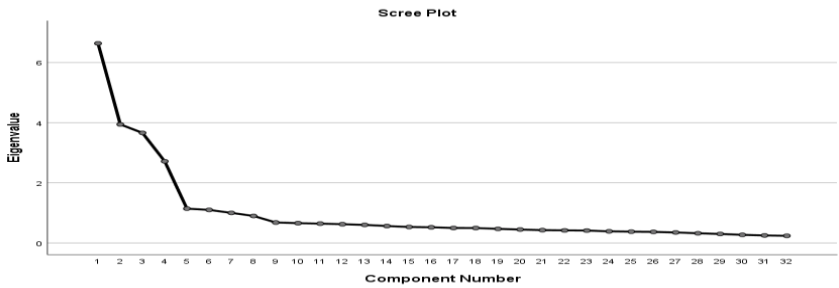
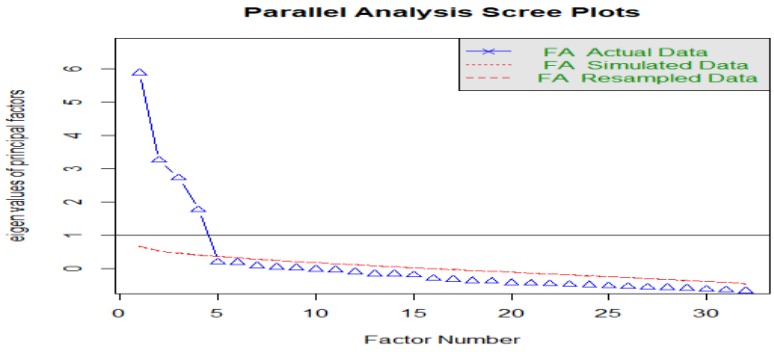



Figure 2 displays the results of the resampling method (Revelle, 2020). This plot suggested four factors should be extracted as underlying constructs of technological innovation.

Figure 2. *Optimum Number of Factors to be Extracted Using Resampling Technique*




Finally, the findings of Watkins' parallel analysis (Table 4) confirmed the results of the resampling methods; i.e., four factors were the optimum number of factors to be extracted for technological innovation.

**Table 4.** Watkins' Parallel Analysis for TI

| Items | Observed Eigenvalue | Simulated Eigenvalue | Decision | Items | Observed Eigenvalue | Simulated Eigenvalue | Decision |
|---|---|---|---|---|---|---|---|
| 1 | 1.597 | 6.634 | K | 17 | .957 | .500 | D |
| 2 | 1.517 | 3.942 | K | 18 | .932 | .499 | D |
| 3 | 1.454 | 3.660 | K | 19 | .904 | .471 | D |
| 4 | 1.406 | 2.716 | K | 20 | .877 | .449 | D |
| 5 | 1.358 | 1.143 | D | 21 | .851 | .429 | D |
| 6 | 1.317 | 1.100 | D | 22 | .826 | .420 | D |
| 7 | 1.277 | 1.002 | D | 23 | .799 | .414 | D |
| 8 | 1.239 | .899 | D | 24 | .772 | .389 | D |
| 9 | 1.205 | .683 | D | 25 | .746 | .378 | D |
| 10 | 1.170 | .661 | D | 26 | .719 | .371 | D |
| 11 | 1.139 | .646 | D | 27 | .693 | .352 | D |
| 12 | 1.107 | .626 | D | 28 | .665 | .324 | D |
| 13 | 1.076 | .603 | D | 29 | .638 | .302 | D |
| 14 | 1.045 | .565 | D | 30 | .609 | .272 | D |
| 15 | 1.012 | .535 | D | 31 | .578 | .252 | D |
| 16 | .987 | .523 | D | 32 | .531 | .240 | D |

K= Keep, D =Drop

Table 5 presents the KMO index of sampling adequacy and Bartlett's test of sphericity. For exploratory factor analysis, an adequate sample size is required. The KMO index was .889, which is above the .60 threshold (Pallant, 2016), indicating that the sample size was sufficient for factor analysis. Additionally, Bartlett's test results were significant ($\chi^2$ (496) = 5179.22, $p < .05$), suggesting that the correlation matrix was suitable for factor analysis, with correlations among variables being neither too high nor too low.

Table 5. *KMO and Bartlett's Test for TI*

| | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .889 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 5179.220 |
| | Df | 496 |
| | Sig. | .000 |

Table 6 displays the number of factors to be extracted and their total variance by Principal Component Analysis.

Table 6. *Total Variance Explained for TI*

| | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| Component | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 6.634 | 20.730 | 20.730 | 6.634 | 20.730 | 20.730 | 4.907 | 15.334 | 15.334 |
| 2 | 3.942 | 12.319 | 33.049 | 3.942 | 12.319 | 33.049 | 4.746 | 14.832 | 30.166 |
| 3 | 3.660 | 11.439 | 44.488 | 3.660 | 11.439 | 44.488 | 4.211 | 13.159 | 43.325 |
| 4 | 2.716 | 8.487 | 52.975 | 2.716 | 8.487 | 52.975 | 3.088 | 9.651 | 52.975 |
| 5 | 1.143 | 3.571 | 56.546 | | | | | | |
| 6 | 1.100 | 3.439 | 59.985 | | | | | | |
| 7 | 1.002 | 3.130 | 63.115 | | | | | | |
| 8 | .899 | 2.810 | 65.925 | | | | | | |
| 9 | .683 | 2.134 | 68.059 | | | | | | |
| 10 | .661 | 2.064 | 70.123 | | | | | | |
| 11 | .646 | 2.018 | 72.142 | | | | | | |
| 12 | .626 | 1.957 | 74.098 | | | | | | |
| 13 | .603 | 1.883 | 75.981 | | | | | | |
| 14 | .565 | 1.766 | 77.748 | | | | | | |
| 15 | .535 | 1.672 | 79.420 | | | | | | |
| 16 | .523 | 1.635 | 81.054 | | | | | | |
| 17 | .500 | 1.563 | 82.617 | | | | | | |
| 18 | .499 | 1.558 | 84.175 | | | | | | |
| 19 | .471 | 1.473 | 85.648 | | | | | | |
| 20 | .449 | 1.404 | 87.052 | | | | | | |
| 21 | .429 | 1.340 | 88.392 | | | | | | |
| 22 | .420 | 1.313 | 89.706 | | | | | | |
| 23 | .414 | 1.294 | 90.999 | | | | | | |
| 24 | .389 | 1.216 | 92.216 | | | | | | |
| 25 | .378 | 1.183 | 93.398 | | | | | | |
| 26 | .371 | 1.159 | 94.557 | | | | | | |
| 27 | .352 | 1.099 | 95.656 | | | | | | |
| 28 | .324 | 1.011 | 96.667 | | | | | | |
| 29 | .302 | .945 | 97.612 | | | | | | |
| 30 | .272 | .851 | 98.463 | | | | | | |

| | | | |
|---|---|---|---|
| 31 | .252 | .788 | 99.251 |
| 32 | .240 | .749 | 100.000 |

The findings revealed that EFA extracted four factors for the technological innovation questionnaire which accounted for 52.97 percent of the total variance. Table 7 displays the results of the factor rotation.

**Table 7.** Rotated Factor Matrix for TIS

| | Component | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| TI27 | .806 | | | |
| TI28 | .805 | | | |
| TI31 | .790 | | | |
| TI25 | .783 | | | |
| TI26 | .776 | | | |
| TI24 | .762 | | | |
| TI32 | .728 | | | |
| TI30 | .728 | | | |
| TI29 | | | | |
| TI14 | | .780 | | |
| TI10 | | .777 | | |
| TI13 | | .767 | | |
| TI16 | | .762 | | |
| TI11 | | .756 | | |
| TI18 | | .755 | | |
| TI15 | | .752 | | |
| TI9 | | .736 | | |
| TI3 | | | .785 | |
| TI7 | | | .775 | |
| TI5 | | | .773 | |
| TI8 | | | .770 | |
| TI6 | | | .760 | |
| TI1 | | | .760 | |
| TI2 | | | .758 | |
| TI21 | | | | .785 |
| TI23 | | | | .775 |
| TI20 | | | | .752 |
| TI19 | | | | .751 |
| TI22 | | | | .750 |
| TI17 | | | | |
| TI12 | | | | |
| TI4 | | | | |

The results indicated that eight items (items 27, 28, 31, 25, 26, 24, 32, and 30) were loaded under the first factor. This factor can be labeled as the “using web-based technology” factor. Item 29 which was supposed to

load under this factor, did not show any meaningful; i.e. >=.30, factor loading.

Eight items (items 14, 10, 13, 16, 11, 18, 15, and 9) were loaded under the second factor. This factor can be labeled as a "multimedia" factor. Items 12 and 17 which were supposed to load under this factor, did not show any meaningful; i.e. >=.30, factor loadings.

Table 8. *The Finalized 28-Item of TIS*

| |
|---|
| 1. 1. I use a mobile phone for language teaching. |
| 2. I use social media (such as I-Gap and WhatsApp) as an interaction tool for language teaching. |
| 3. I use LingQ (language learning tool) which is a mobile application for teaching different skills. |
| 4. I motivate students to listen to a bit of English every day (radio, music) at home. |
| 5. I motivate them to have a video conference through different mobile applications. |
| 6. I motivate them to have a free discussion via mobile applications. |
| 7 I use Adobe Connect features for teaching through mobile. |
| 8. I motivate students to listen to English authentic songs to improve their listening skills. |
| 9. I motivate students to listen to English authentic songs to improve their speaking performance. |
| 10. I motivate students to listen to English authentic songs to improve their pronunciation level. |
| 11. I use cartoons for teaching English in the classroom. |
| 12. I use different conversations of film for teaching vocabulary. |
| 13. I use different conversations of film for teaching listening. |
| 14. I use podcasts for language teaching. |
| 15. I use different conversations of film for teaching speaking. |
| 16. I expose learners to authentic material through a computer. |
| 17. I motivate students to use the word processor of Microsoft Word for writing accuracy. |
| 18. I use Digital Game-Based Learning. |
| 19. I use Skype or other similar applications as tools for blended learning. |
| 20. I use Adobe Connect features for teaching through a computer. |
| 21. I guide students to use the Automated Writing Evaluation Program to improve their writing accuracy. |
| 22. I use the web version of Phonemic Chart, English Accents Coach, and Youngish which are all online tools to improve students 'pronunciation. |
| 23. I use the web version of language learning applications (such as Ling Q & Duolingo …) on the computer for language teaching. |
| 24. I use online corpora which refers to electronic authentic language databases that can be available via the internet or as software installed in desktops. |
| 25. I motivate learners to use the Grammarly Language Tool (Online assessment tool for writing) to reduce their errors in writing. |
| 26. I motivate students to search for new ways of learning different skills on the web and give reports in the classroom. |

27. I recommend students to use Italki which provides a place for learners to find a teacher for language learning.
28. I use a virtual classroom for teaching language.

Seven items (items 3, 7, 5, 8, 6, 1, and 2) were loaded under the third factor. This factor can be labeled as a "mobile-based learning" factor. Item 4 which was supposed to load under this factor, did not show any meaningful; i.e. >=.30, factor loading. And finally; five items (items 21, 23, 20, 19, and 22) were loaded under the third factor. This factor can be labeled as a "computer-based learning" factor.

Table 8 represents the finalized version of TIS. Measuring the four main components of using web-based technology, multimedia, mobile-based learning, and computer-based learning.

The four components underlying the scale: (1) Mobile-based Learning (Items 1, 2, 3, 4, 5, 6, 7); Multimedia (Items 8, 9, 10,11, 12 13, 14, 15); Computer-based learning (Items 16, 17, 18, 19, 20); Web-based Technology (Items 21, 22, 23,24, 25, 26, 27, 28).

## 5. Discussion

The results of the current investigation revealed that the TIS developed for the Iranian foreign language learning context is both reliable and valid. The analysis demonstrated that the scale exhibits strong psychometric properties, making it a useful tool for assessing the integration of TI in the EFL context. In fact, the reliability of the scale was established through Cronbach's Alpha, which yielded satisfactory results in both the pilot and main studies. The overall Cronbach's Alpha of .87 in the pilot phase and .84 in the main phase of the research indicated that the scale has a high degree of internal consistency. This reliability is further reinforced by the subscale alphas for the four components of TI: computer-based learning, mobile-based learning, multimedia, and web-based technology, all of which had alpha values exceeding .80. According to George and Mallery (2020), reliability indices above .80 are considered "good," and thus, these findings suggest that the scale reliably measures the intended constructs. The consistent reliability across the four components indicates that the scale can be applied with confidence across different technological modalities in language teaching. This is crucial in an educational context where technology use is varied, and teachers might emphasize different tools depending on their teaching context and objectives.

In addition, the validity of the scale was supported through factor analysis, which indicated a clear factor structure aligned with the theoretical constructs of TI in language teaching. The identification of

four distinct factors: mobile-based learning, multimedia, computer-based learning, and web-based technology, confirms the multidimensional nature of TI in ELT. However, it is noteworthy that not all items are loaded as expected onto their respective factors. For example, item 29, which was anticipated to load onto the "using web-based technology" factor, did not meet the threshold for meaningful factor loading. Similarly, items 12 and 17 did not show significant loadings under the "multimedia" factor, and item 4 under the "mobile-based learning" factor exhibited a similar issue. These discrepancies might suggest that these items either do not align perfectly with the conceptual definitions of their intended factors or that they might be capturing aspects of technological innovation that overlap with other factors. Despite these minor deviations, the majority of items were loaded appropriately, providing strong evidence for the construct validity of the scale. The clear factor structure supports the idea that the scale measures distinct, yet related, aspects of technological innovation, which is essential for a nuanced understanding of how technology can be integrated into language teaching.

Studies by Zou et al. (2018) and Kim and Park (2017) on technological tools in language learning have found similar factor structures, which reinforce the validity of the current research findings. These studies also highlight the importance of distinguishing between different technological modalities in education, which our factor analysis successfully achieved.

Therefore, the finalized scale comprised 28 items grouped under the factors of multimedia, web-based technology, computer-based technology, and mobile-based technology. As noted by Hwang and Lee (2017), it is essential for researchers to compare their scale validation results with those of previous studies to ensure that their identified factors are consistent with established frameworks and theories. In this study, the results were found to be consistent with prior research, which also identified all the above-mentioned constructs as key aspects of TI (e.g., Abraham, 2007; AbuSeileek, 2013; Link et al., 2022).

Specifically, several components and themes identified in this study align with the general characteristics of innovative teachers described in the literature. Regarding web-based technology, items such as *using online corpora, using online assessment tools such as Grammarly for writing, using Italki which provides a place for learners to find a teacher for language learning, using the web version of some online tools to improve students' pronunciation, using the web version of Ling Q and Duolingo, using automated writing evaluation program, using the virtual classroom for teaching language, motivating students to search new way*

*of learning different skill on the web* were noted in previous investigations (e.g., Link et al., 2022; Lu, 2017; Williamson et al., 2012; Wilson & Czik, 2016).

Considering multimedia, items such as using *different conversations of films for teaching vocabulary, listening and speaking, listening to English authentic songs to improve learners' listening and speaking performance, using cartoons for teaching English in the classroom, using podcasts for language teaching, and listening English authentic songs to improve their pronunciation level,* were supported by the literature (e.g., Abraham, 2007; Al-Seghayer, 2001; ChanLin et al., 2006; Pun, 2013).

With regard to mobile-based technology, the supporting items from the literature are as follows: *using LingQ (language learning tool) which is a mobile application for teaching different skills, using mobile applications for free discussion, listening to a bit of English every day (radio & music) at home, using Adobe Connect features for teaching through mobile, having a video conference through different mobile applications, using the mobile phone for language teaching,* and *using social media (such as I Gap and Whats app) as an interaction tool for language teaching* (e.g., Aburezeq & Ishtaiwa, 2013; Alamer & Al Khateeb, 2021; Ali & Bin-Hady, 2019; Anas, 2019; Cheng &Kim, 2019; Huang, 2021; Jeno et al., 2019; Masters, 2019; Metruk, 2021).

With respect to computer-based technology, the literature supported items such as *using Digital Game-Based Learning, using Adobe Connect features for teaching through a computer, using the word processor of Microsoft Word for writing accuracy, exposing learners to authentic material through a computer, and using Skype or other similar applications as tools for blended learning* (e.g., AbuSeileek, 2013; Haghverdi, 2015; Norafkan, 2013; Souzanzan & Bagheri, 2017; Strang, 2012).

## 6. Conclusion

This research aimed to investigate the underlying components of the TIS within the Iranian EFL context. The results show that the TIS is a reliable and valid instrument for assessing the use of technology in English language teaching in Iran. While some items may require further refinement, the overall structure and reliability of the scale are strong. The findings indicate that an innovative teacher effectively integrates web-based technology, multimedia, computer-based technology, and mobile-based technology into their teaching practices.

The development and validation of this scale have important implications for educators and policymakers in the Iranian EFL context.

The TIS can be used as a diagnostic tool to assess current technology use in language teaching and identify areas for professional development. For example, teachers who score lower in specific components of the scale might benefit from targeted training in areas like mobile-based learning or multimedia use.

The validated TIS provides educators and researchers with a dependable tool for assessing TI in language teaching. It helps identify strengths and weaknesses in teachers' use of various technological tools, guiding professional development efforts and enhancing the overall quality of language instruction. The scale's ability to distinguish between different aspects of technological integration makes it a valuable resource for both diagnostic and research purposes in language education.

This scale represents a significant advancement in language education, offering a systematic way to evaluate and improve technology use in teaching. Future research could refine the scale further and test its applicability in other educational contexts, thereby broadening its relevance and impact. Although the scale showed strong reliability and validity, the study also identified areas where it could be improved. Future studies might focus on revising items that did not perform as expected to increase the scale's precision. Additionally, research could explore the scale's applicability in different educational settings or its use in measuring the effectiveness of specific technological interventions in language teaching.

The current research does have some limitations. Efforts were made to enhance the generalizability of the findings by selecting participants with diverse genders, majors, teaching experiences, and educational levels. However, since the scale was validated with a sample of approximately 375 Iranian EFL teachers, caution should be exercised when generalizing the findings to the broader population of EFL instructors globally. Additionally, as the scale was specifically developed for an EFL context, future research should explore its applicability in other educational settings involving different languages to better address diverse language education contexts.

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