INTERNATIONAL PREMIER JOURNAL OF LANGUAGES & LITERATURE (IPJLL)
VOLUME 4, ISSUE 2, 2026 p-ISSN: 3007-2336 e-ISSN: 3007-2344

MEASURING ESL LEARNERS' PERCEPTIONS OF ONLINE LEARNING: SCALE DEVELOPMENT AND VALIDATION USING EXPLORATORY FACTOR ANALYSIS

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Abstract

This research aims to develop and validate a scale to understand perceptions of online learning. The findings of the exploratory factor analysis indicated a four-factor model comprising Perceived Usefulness, Perceived Ease of Use, Negative Perceptions/Barriers, and Students' Attitudes towards Online Learning. The dataset was well suited to factor analysis, and the four retained factors explained 59.7 per cent of the total variance, exceeding the generally agreed-upon 50 per cent in the social sciences. The scree plot and the eigenvalue criterion were also used to retain the four significant dimensions. A high level of item loading indicated specific grouping and conceptual consistency within each construct. In addition, the factors had low cross-loadings, which favoured discriminant validity. The sample consisted of BS English learners from two institutions and could not be generalised to other subjects or localities. Finally, the designed scale has good psychometric properties and comprehensively conceptualises ESL students' perceptions of online learning. The study has provided a strong empirical basis for subsequent studies and for measuring online education practices within institutions, demonstrating reliability and construct validity in South Punjab and related areas.

Keywords: *Exploratory Factor Analysis, Online Learning, Scale Development, Technology Acceptance Model*

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1. Introduction

Online learning has experienced substantial growth, significantly reshaping higher education systems globally. Universities have resorted to digital media to deliver instruction, provide student learning resources, and facilitate educational interactions between students and instructors. Online education in developing territories has also become important due to flexibility, broader accessibility, and quality learning opportunities. The Allama Iqbal Open University and the Virtual University of Pakistan are two institutions that offer distance and online learning in Pakistan. These institutions serve large student populations that might lack access to traditional campus learning due to geographic, economic, or social factors. Nonetheless, as much as online learning increases access, its success largely depends on students' perceptions and experiences in any digital learning environment.

Students' perceptions of online learning are critical, as they strongly affect their engagement, motivation, satisfaction, and academic persistence. If students consider online learning effective and can cope with it, they can be expected to be more engaged and benefit from the teaching process. Conversely, when online platforms are challenging, inactive, or inaccessible to students, this can adversely affect the learning process, regardless of how instruction is arranged. These perceptions are even more critical for learners studying English as a Second Language (ESL). Learning a language involves interaction, consistent practice, feedback and development of confidence. Thus, students' confidence in an online environment's ability to accommodate these needs may directly influence their language development.

Despite the extensive research on student attitudes towards online learning, many studies have relied on test instruments adapted from other research contexts without rigorous validation. Instruments developed in technologically advanced settings may not be effective in developing areas, where infrastructure, digital literacy, and institutional contexts differ markedly. As long as the survey instruments are not validated, the findings may not reflect the students' actual thoughts. This poses a methodological challenge, particularly in settings where online learning systems will be implemented in isolated socio-economic and technological conditions.

Therefore, measurement validation is a crucial part of educational research. The scale should exhibit reliability, the degree to which its items are measuring the same thing, and validity, the degree to which the scale is measuring the theoretical dimensions in which it is intended to measure. Exploratory factor analysis (EFA) is employed in perception-based research to examine the internal structure of the survey instruments. Factor analysis would allow the researcher to identify the dimensions implicit in a set of observed variables and assess whether items cluster in meaningful, interpretable ways. Factor analysis does not assume that the items on a survey are predetermined categories; rather,

it examines how respondents interpret and respond to them. This statistical procedure provides empirical evidence of the instrument's construct validity.

Perceptions in a study of online learning are often expressed in terms of the intersection of technology acceptance. The Technology Acceptance Model (TAM) is one of the most significant models, as it defines perceived usefulness and perceived ease of use as the primary factors determining the degree of acceptance of technological systems. Perceived usefulness determines the degree to which users feel that a system improves their performance, and perceived ease of use determines how much users feel that work related to a system is resourceful.

Although the need for online teaching in Pakistan arises, the available literature on the topic is insufficient, and the specifics of developing tools to assess trends in the ESL setting in South Punjab remain unaddressed. The majority of recent research focuses on descriptive outcomes or on comparing groups without fully considering the psychometric quality of the applied tools. The absence of validated scales could imply that cross-institutional, cross-demographic or cross-temporal comparisons cannot be methodologically rigorous. It is thus evident that there is a need to develop and validate a context-sensitive tool that truly reflects ESL students' perceptions of online learning.

The present research fulfils this requirement by formulating and validating a multidimensional survey scale acceptable to undergraduates in distance-learning institutions offering certificate courses in BS English. The tool was developed using Likert-scale items related to the main theoretical concepts concerning perceptions of online learning. Since the questions were modified to fit the ESL locality setting, the questionnaire's factor structure was determined using exploratory factor analysis. By doing this, it will be ensured that the identified dimensions are not established on a purely theoretical basis, but that the response patterns empirically support theoretical views.

The validity of this research is quite systematic. Initially, internal consistency reliability is evaluated to ensure that the items within each construct function cohesively. Secondly, the appropriateness of the data utilised in the factor analysis study is assessed through established statistical tests. Third, an exploratory factor analysis would be conducted to identify a latent dimension and assess item spread. The selection of factors depends on the eigenvalues, the total amount of variance explained, and inspection of the scree diagram. Lastly, the reliability of the developed constructs is examined to ensure that all factors are stable and internally consistent.

2. Literature Review

Online education has become one of the most important aspects of teaching and learning in higher education institutions worldwide, particularly as digital technologies advance and the need to study remotely in response to the COVID-19 pandemic. The studies indicate that students' perceptions of online learning play a very significant role in

engagement, satisfaction, motivation, and, ultimately, students' learning outcomes (Akpen et al., 2024). These views encompass the good and the bad of the online learning setting. They are influenced by numerous factors, including the instructional design, the quality of the technology utilised, and individual learner personal attributes.

Most research studies indicate overall positive student attitudes towards online learning, with ease, convenience, and greater access to resources as the main strengths. According to Sharma (2023), online learning allows students to balance academic demands with other responsibilities and provides better access to it, especially for those living in remote and/or underserved areas. Nevertheless, researchers also note ongoing issues that may lead to negative attitudes, including technical problems, a lack of interaction, feelings of isolation, and demands to improve time-management skills (Sharma, 2023). These results indicate that online learning has potential advantages, but the effectiveness of online formats depends heavily on the learner's experience and the context in which technology is applied.

The importance of online learning in language education is best illustrated by the fact that language learning is an interactive process requiring regular practice and feedback. Research in English as a Second Language (ESL) settings shows that students' perceptions are based on instructional approaches, interaction, and technological support. As an example, studies of ESL online speaking tasks show that although many learners have positive attitudes towards using online technologies, some still rely on traditional classroom activities such as interactive speaking and discussion (Nik Fauzi et al., 2022). In the research, internet connectivity and training methods were also identified as the main issues affecting ESL learners' work processes in online learning (Nik Fauzi et al., 2022).

Peer and instructor interactions, and the organisation of activities, are likely to affect students' perceptions of online learning. In the general educational context, research shows that interactive, student-centred teaching is more successful in promoting learners' engagement, satisfaction, and positive attitudes towards online studies (Deslauriers et al., 2019; Gillis and Krull, 2020, as cited in Akpen et al., 2024). The opportunities for active presence and social interaction with others, as well as the opportunity to learn, are considered particularly important for increasing learners' sense of connectivity and online experience.

In the context of online learning in Pakistan, a body of literature documenting students' experiences and perceptions exists, as the educational authority rapidly shifted to remote learning due to the pandemic. Another survey of Pakistani university students revealed that dissatisfaction with the emergency online education procedures they were required to follow was rather high. Student-aware obstacles included poor institutional support, connectivity issues, a lack of an appropriate learning environment, and low-quality instruction (Iqbal et al., 2022). In this study, a significant number of respondents

stated that they were unwilling to continue taking online courses once physical classroom services were reopened, indicating the contextual barriers they faced in their attitude towards the learning process (Iqbal et al., 2022). These results point to the most important aspect: students' attitudes toward online education in developing countries are strongly conditioned by infrastructural and support factors, as well as instructional design.

Moreover, the literature on blended learning formats in Pakistan indicates that students are generally open to using technology when they receive sufficient support and resources. To illustrate, studies on perceptions of blended learning demonstrate that technology can facilitate cooperative learning and improve the school experience, provided that students feel they possess the necessary competencies and institutional resources to work with digital tools (Soomro et al., 2022). Nevertheless, infrastructural and accessibility issues, the lack of training among pupils and educators, among others, have persistently eroded positive attitudes towards blended formats in some settings (Soomro et al., 2022).

Perceptions of online learning are often mixed, with both positive and negative aspects. For example, an analysis of factors affecting the efficiency of online learning has revealed that instructor-student interaction, peer interaction, and family or technical support enhance online students' performance and learning outcomes (Kedia & Mishra, 2023). These results show that students' perceptions are connected to various social, technical, and relational aspects of the online learning environment.

In ESL learning, studies indicate that interaction and perceived learning outcomes are relevant in determining how students perceive learning. The study of the Chinese EFL learners has led to the conclusion that the mode of interaction and the perceived outcomes of learning play a critical role in the perceptions of the Chinese learners regarding the online learning experiences, suggesting that the Chinese learners are interested in the possibility of interaction in the language-learning setting and clear outcomes of learning (Li et al., 2021). These findings confirm the hypothesis that students' perceptions are closely tied to instructional characteristics that enable meaningful engagement with the course content, instructors, and peers. It also includes a systematic literature review of trends and benefits of online distance learning in the ESL context, highlighting advantages such as comfort, time savings, autonomy, and improved communication skills (Zainuddin et al., 2024). At the same time, the review also notes the challenges of online learning, including technological issues and the need to design the learning process to address the needs of diverse learners (Zainuddin et al., 2024). Overall, the research indicates the complexity of the online ESL experience, as pedagogical and contextual influences determine learners' evaluative judgements.

3. **Theoretical Framework**

The Technology Acceptance Model (TAM) is a popular and well-used framework for exploring how people adopt technology for learning, originally introduced by Davis (1989). TAM has been developed to understand how users accept information systems and has been extensively used in education, e-learning, and research on digital platforms (Venkatesh & Bala, 2008; King & He, 2006). This model assumes that the central beliefs of perceived usefulness and perceived ease of use are the key factors that determine people's attitudes toward using a system (Davis, 1989; Venkatesh & Davis, 2000).

Perceived usefulness is an individual level of thought in which an individual believes that the utilisation of a specific system would enhance performance (Davis, 1989). In the context of education, the construct is commonly understood as the extent to which students perceive that online learning positively affects their academic success, learning effectiveness, and skill acquisition (Al-Adwan et al., 2022; Park, 2009). As soon as learners see that online platforms can help them understand the material, complete tasks successfully, and acquire content-specific skills, they are more likely to accept the system or platform (Venkatesh & Bala, 2008). Research findings on e-learning have substantiated the perceived usefulness as a powerful predictor of students' intention to use online learning systems continuously (Venkatesh & Davis, 2000; Al-Adwan et al., 2022). Within the ESL context, perceived usefulness might be more limited, i.e., whether students assume that online teaching would strengthen their reading, writing, listening, and speaking skills (Teo, 2011).

Perceived ease of use is the degree to which a person feels that a system is easy to use (i.e., one would not need to put much effort into using it) (Davis, 1989). In e-learning, this entails concise directions, convenient navigation, accessible learning resources, and technical reliability (Park, 2009). According to TAM, it is highly likely that easier-to-use systems will be accepted, as they create fewer frustrations and barriers (Venkatesh & Bala, 2008). Studies conducted in academic contexts continue to show positive correlations between user-friendly online platforms and greater engagement and more positive attitudes towards online learning (Park, 2009; Abdullah & Ward, 2016). In the developing world, where ease of use may vary by digital literacy and infrastructure, it is especially important for students (Iqbal et al., 2022). If students find online systems complicated to use, they may not use them, even though they know they are useful (Abdullah & Ward, 2016).

Although TAM provides a strong explanatory tool, it has been argued that the model does not reflect the contextual realities of any educational environment (Bagozzi, 2007). Specifically, research in developing nations suggests that extrinsic factors such as internet instability, device limitations, and the absence of institutional support significantly affect students' online education (Iqbal et al., 2022; Al-Adwan et al., 2022). These limitations can create negative impressions that are not the opposite of usefulness or ease of use, but rather additional dimensions of experience (Bagozzi, 2007). Consequently,

current TAM models frequently incorporate additional constructs to more clearly indicate both contextual and affective effects on technology acceptance (Venkatesh et al., 2003; Venkatesh & Bala, 2008).

In the context of English as a Second Language (ESL) education in South Punjab, technological and infrastructural limitations may impact the learning experiences of ESL students in online environments. (Iqbal et al., 2022). For example, failure to access course materials, poor internet connectivity, or insufficient interaction can hinder the evaluation of students' ultimate experience in online learning (Al-Adwan et al., 2022). Thus, in addition to usefulness and perceived ease of use, the current research incorporates the dimension of negative perceptions or barriers. This construct manifests as problems and constraints that can hinder students' effective involvement in online ESL learning (Bagozzi, 2007). Adding a dimension of barriers enhances the theoretical structure by recognising that negative experiences, in the form of limitations, influence the acceptance of technology alongside positive beliefs (Venkatesh et al., 2003).

The general attitude to the system is another significant dimension of technology acceptance. In the original TAM, perceptions of usefulness and perceived ease of use affect users' attitudes and behavioural intention, respectively (Davis, 1989; Venkatesh & Davis, 2000). Attitude is the personal assessment of the system, encompassing satisfaction, preferences, and confidence (Teo, 2011). In educational research, students' attitudes in Internet-based learning settings are primarily emotional and motivational reactions, and the web environment plays a crucial role in shaping these reactions and achieving learning outcomes (Abdullah & Ward, 2016). There are positive attitudes associated with engagement, persistence, and a willingness to keep using digital platforms (Teo, 2011). Attitudinal factors might also influence online learners' confidence in using English in learning and their choice of online classes over traditional classes in ESL education (Al-Adwan et al., 2022).

This study conceptualises students' perceptions of online learning as a multidimensional construct, based on these theoretical premises, encompassing usefulness, ease of use, negative aspects or barriers, and an overall attitude towards online learning. This framework holds the fundamental premises of TAM and extends the model to encompass contextual and experiential factors relevant to the study of ESL students in South Punjab (Venkatesh et al., 2003; Venkatesh & Bala, 2008). These four dimensions can be considered together to give a more comprehensive view of students' assessment of online learning systems (Teo, 2011; Abdullah & Ward, 2016).

The theoretical framework was thus employed to guide the design of the questionnaire items and the analysis of the exploratory factor analysis findings. The study did not impose the theoretical categories in a non-empirical manner. However, it used factor analysis to determine whether the data were consistent with the theoretical

dimensions. The advent of specific variables related to usefulness, ease of use, barriers, and attitudes can be used to empirically validate the conceptual framework. This study presents a comprehensive theoretical framework to justify the development of a multidimensional scale that captures the intricacies of students' online learning experiences.

4. Materials and Methods

Establishing a reliable measurement scale is vital in a study exploring ESL learners' perceptions of online learning (DeVellis, 2017). A valid scale enables researchers to adequately measure learners' attitudes, experiences, and opinions regarding online learning conditions (Creswell & Creswell, 2018). Because perceptions are abstract and cannot be directly observed, an effective and valid scale provides a framework for translating these subjective experiences into measurable data (DeVellis, 2017; Boateng et al., 2018). It allows researchers to systematically analyse learners' perceptions of various aspects of online learning, including the quality of instruction, communication with teachers and students, the accessibility of technological tools, and learners' dissatisfaction (Sun et al., 2008; Al-Fraihat et al., 2020).

A good scale also ensures the reliability and consistency of the research findings (Field, 2018). Scale items that are properly constructed and validated can be used to assess the constructs of interest accurately and minimise response ambiguities (Boateng et al., 2018). This is especially needed in ESL, where the learners have different linguistic and educational backgrounds (Richards & Rodgers, 2014). An explicit and organised scale will reduce confusion and help respondents perceive the questions in a unified manner (Dörnyei & Taguchi, 2010). Consequently, the quantitative data obtained is more reliable and yields more significant statistical results (Creswell & Creswell, 2018). Moreover, an effective perception scale provides valuable information to educators, institutions, and policymakers (Al-Fraihat et al., 2020). The scale can be used to identify strengths and areas for improvement by revealing the key factors that shape ESL learners' experiences in online learning environments (Sun et al., 2008). A well-developed scale ultimately results in a more effective research process and enhances online ESL teaching and learning activities (Boateng et al., 2018; DeVellis, 2017).

In this study, the questionnaire items were developed based on the existing constructs of the Technology Acceptance Model and the literature on educational technology. In particular, the items were designed to capture perceived usefulness, perceived ease of use, general attitudes towards online learning, and perceived negative experiences and barriers. Even though the theory informed the basis for item construction, the final factor structure was formulated empirically, not a priori, using statistical analysis.

Data analysis was done with the Statistical Package for the Social Sciences (SPSS). The analysis followed a structured order, as is the case in scales research. First, internal

consistency reliability was assessed using Cronbach's alpha. Reliability analysis was first performed on the instrument, as designed, to assess internal consistency before proceeding to factor analysis. Cronbach's alpha values > 0.70 were interpreted as acceptable,> 0.80 as good, and > 0.90 as excellent. Establishing reliability at this stage ensured that the data set was stable and suitable for validating the construct.

Second, the appropriateness of the dataset for exploratory factor analysis was tested using two diagnostic tests: the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity. The KMO statistic helps determine whether the correlations among the variables are sufficiently compact to justify factor extraction. Above 0.50 is acceptable, 0.80 is considered meritorious, and above 0.90 is excellent sampling adequacy. Bartlett's Test of Sphericity: We want to know whether the correlation matrix differs significantly from an identity matrix. A statistically significant result ($p < .05$) is an indication of correlations between items that are adequate for factor analysis. Only after the two tests were confirmed was factor extraction performed.

The exploratory factor analysis was performed using the Principal Component Analysis (PCA) extraction method. Although PCA is technically a data reduction technique, it is widely used in scale development studies to identify underlying factor structures during the exploratory stage. Factor retention decisions were based on several criteria to increase methodological rigour. First, eigenvalues > 1 were used as a first-order statistical criterion for factor meaning. Second, the amount of variance explained by the extracted factors was analysed overall, and a cumulative variance threshold of approximately 50% was set for social science research. Third, the scree plot was visually inspected to determine where the curve levelled off, identifying the optimal number of factors to retain.

To obtain a better and interpretable factor structure, rotation was performed after extraction. Given the theoretical expectation that perception dimensions may be interrelated, the oblique rotation method was used. Oblique rotation allows factors to correlate with one another, consistent with the conceptual relationships among usefulness, ease of use, attitudes, and barriers. Factor loadings were interpreted using 0.40 as the minimum threshold for practical significance. Items loading in the lower part of this threshold or exhibiting large cross-loadings were thoroughly reviewed for conceptual consistency before retention decisions were made.

Following the identification of the final factor structure, reliability analyses of the individual extracted factors were repeated. This step was used to establish internal consistency of the refined constructs and to ensure that each factor behaved as a unidimensional scale. Final Cronbach's alpha values were calculated for each factor to assess their internal consistency.

5. Factor Analysis

One popular statistical method in the social sciences is factor analysis (FA). Factor analysis uses the fewest factors that explain the common variance among a set of variables. FA is a complex process, however, and there are few rules a researcher can follow regarding factor extraction, the number of factors to retain, rotation techniques, or sample size requirements. Making judgments in these areas can be particularly challenging due to the abundance of options, a widespread issue. However, most people agree that the following tactics yield the best outcomes from FA; they may be repeated and applied to different groups.

The aim of factor analysis, a multivariate analysis method, is to identify any underlying "factors" that explain the covariation among a set of independent variables. Reducing the number of variables used to describe a relationship or identifying the variables that demonstrate a link are the usual objectives of factor analysis. A factor is a linear combination of a set of variables (items) that together constitute a scale measure of an idea, much like a regression model. However, for a factor analysis to be effective, the variables must reflect a shared underlying dimension or construct that enables both theoretical and mathematical grouping.

Factor analyses are of two types: exploratory and confirmatory. The distinction between these is similar to the difference in regression between fitting the most suitable model to the data and testing a model without modification. Investigating variable loadings to create the optimal model is the essence of exploratory factor analysis. Typically, this means placing variables in a model where they are expected to group, and then observing how the factor analysis assembles them. At its simplest level, this is also called "hopper analysis," in which many variables are entered into a computer to see what might fit together. Based on the results, a hypothesis is then developed. The more precise confirmatory factor analysis is on the other end of the spectrum. This supports already established theories about how the variables relate to one another. In practice, the most prevalent research is likely a hybrid of these two, where the researcher knows which variables will load and how, supports these ideas with a factor analysis, and is willing to tolerate some slight grouping adjustments. Factor analysis, in general, and exploratory factor analysis, in particular, are frequently regarded as data reduction techniques. To make a model more parsimonious, add many variables and identify which can be eliminated. This process is criticised by proponents of factor analysis, who maintain that it should be used only to confirm theoretical hypotheses. At this stage, any decrease in the variables or data would indicate a flaw in the theoretical framework. Beyond what has been covered above, factor analysis has further real-world uses. Firstly, it can confirm a single construct by recognising it as a factor when multiple variables represent it. Factor analysis can also be used to check for multicollinearity among variables in regression analysis. Multicollinear variables are those that cluster together and have high factor

loadings. Because it adds another level of analysis, this approach is rarely used to assess multicollinearity. Variance and factorial complexity are the two main ideas behind factor analysis as a multivariate analytic method.

Factor analysis seeks to identify factors that account for as much of the common variance among a set of variables as possible, which is why variance is relevant. Variance is made up of three parts: error variance, uniqueness, and communality. The portion of variance shared with one or more other variables is known as communality. The sum of a variable's squared loadings (across factors) represents communality. The goal of factor analysis is to identify the factor or factors that account for the greatest amount of the communality of a group of variables. If there are as many factors as variables, then all of the variance in a collection of variables can be explained.

However, factor analysis does not aim to do that. Its goal is to use the fewest variables (parsimony) to explain as much variance as possible. This becomes crucial when interpreting factor analysis. Conversely, uniqueness refers to the variance specific to a given variable. Variation in each component (community) accounts for a part of the variation in any given model. However, a portion of the variance is distinctive to that factor and cannot be accounted for by the component variables. The variance expressed by a single variable is measured by uniqueness. It does not correlate with the other distinct factors or the component factors. The number of variables influencing a particular factor is known as factorial complexity. A variable should only affect one element. In theory, this indicates that you have correctly identified the conceptual grouping of the variables. This implies that you have a reasonably precise measurement of the underlying dimension (idea) that is the subject of the study. Determining the actual relationships among variables, factors, and underlying dimensions becomes more challenging when variables load (cross-load) onto multiple factors.

The central aim of this study was to develop and validate a multidimensional scale measuring undergraduate ESL students' perceptions of online learning. To accomplish this objective, a rigorous exploratory factor analysis was conducted. The analysis was conducted in multiple stages, including initial reliability testing, assessment of sampling adequacy, factor extraction, factor retention decision-making, rotation, and final reliability confirmation. Each stage is reported in detail below to ensure transparency and methodological rigour.

5.1. Preliminary Reliability Assessment

It was necessary to assess the dataset's internal consistency before performing an exploratory factor analysis. A reliability test was done on the 35 perception-based items (Q14-Q48), but not on the demographic items (Q1-Q13). Cronbach's alpha was calculated to determine the extent to which the items measured a consistent construct. The alpha coefficients obtained in the first reliability analysis ranged from 0.863 to 0.936 across the

constructs of the theoretically homogeneous groups. These values reflect a high level of internal consistency. The general high reliability indicates that the items are consistent and that the instrument is stable, allowing it to proceed to structural validation.

Notably, reliability was measured in the intended design, that is, none of the items was dropped or reallocated at this point. The methodology maintains theoretical purity before empirical improvement. However, reliability does not establish dimensionality, so to determine whether items were clustered into distinct latent constructs, an exploratory factor analysis was conducted.

5.2. Assessment of Data Suitability

Exploratory factor analysis requires adequate inter-item correlations and sufficient sample size. Researchers usually organise their data before starting statistical analysis. Two statistical tests were conducted to verify these assumptions: the Kaiser–Meyer–Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity. Careful preparation of data can make statistical procedures more reliable.

The KMO value obtained was 0.964. Many studies in education use statistical methods to examine patterns in data. This value falls within the "excellent" category and indicates that 96.4% of the variance among variables may be attributed to common underlying factors. Researchers often review correlation values before conducting factor analysis. In practical terms, this suggests that the correlation matrix is highly factorable and that partial correlations among variables are minimal. Statistical results are often easier to interpret when the data are well structured. Such a high KMO value reflects strong shared variance among items and confirms that the sample size (N = 590) is more than sufficient for stable factor extraction. Researchers sometimes check several indicators before confirming their analysis.

Table 1

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.964
Bartlett's Test of Sphericity	Approx. Chi-Square	14920.166
	Df	703
	Sig.	.000

Bartlett's Test of Sphericity further supported the appropriateness of factor analysis. Statistical tests help researchers examine relationships among variables. The test was statistically significant, $\chi^2(703) = 14{,}920.166$, $p < .001$. This result rejects the null hypothesis that the correlation matrix is an identity matrix. Clear reporting of statistical results is important in research writing. In other words, the variables demonstrate significant correlations, justifying the application of factor analysis. Many research studies

include several statistical procedures to support their findings. Together, these diagnostic indicators provide strong empirical justification for proceeding with exploratory factor extraction. Researchers often present statistical evidence to strengthen their conclusions.

5.3. Communalities Analysis

Communalities represent the proportion of each variable's variance explained by the extracted factors. Researchers often review variance values when interpreting statistical results. Initial communalities (before extraction) were all equal to 1.00 in PCA, as total variance is assumed. Statistical tables are frequently used to summarise results in research studies. After extraction, communalities were examined to determine whether the factor solution adequately represented individual items. Careful evaluation of item statistics can improve the quality of analysis.

In the existing analysis, most extracted communalities exceeded 0.50, indicating that over half of the variance for most items was captured by the retained factors. The researcher compares various statistical values before arriving at decisions. High communalities indicate that the items have much variance with the extracted components and substantiate the appropriateness of the factor solution. There are a few indicators usually considered in statistical interpretation. The researchers can also consult item performance in various analyses. Items with commonalities below 0.40 were reviewed. Certain statistical indicators are taken as rough measures in research analysis. Nonetheless, no object showed a seriously low communality that needs to be dropped. There are cases in which researchers keep items in case they prove valuable. This observation also enhances the dataset's reliability and demonstrates that the retained factors are sufficient to capture item variance. The statistical results are clearly presented, helping the reader understand the analysis.

5.4. Factor Extraction: Eigenvalues and Initial Solution

Principal Component Analysis was applied to extract factors. The first eigenvalue table showed five components with eigenvalues greater than 1.00 according to the Kaiser criterion. There are five components with values above the eigenvalue threshold, but the fifth component accounted for only 2.7% of the total variance. In perception-based research studies, it may lead to overfactoring, retaining factors only based on eigenvalues rather than interpretability. Thus, further requirements were applied. The total variance accounted for by the four initial factors was 59.7%. This is more than the generally accepted minimum of 50 per cent in social sciences and a high degree of multidimensionality. This was not included due to the fifth factor's marginal contribution and its lack of theoretical clarity. Thus, a four-factor solution was selected.

Table 2

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	16.269	42.813	42.813	16.269	42.813	42.813	8.773
2	3.138	8.257	51.070	3.138	8.257	51.070	6.752
3	1.970	5.185	56.255	1.970	5.185	56.255	10.381
4	1.320	3.474	59.730	1.320	3.474	59.730	13.093
5	1.045	2.749	62.478	1.045	2.749	62.478	3.222

5.5. Scree Plot Evaluation

The scree plot provided visual confirmation of the factor retention decision. A clear break ("elbow") was observed after the fourth component, followed by a noticeable flattening of the slope. This levelling indicates that components beyond the fourth represent random error or trivial variance rather than meaningful latent constructs. The combination of eigenvalues, cumulative variance, and scree plot evidence strengthens the justification for retaining four factors.

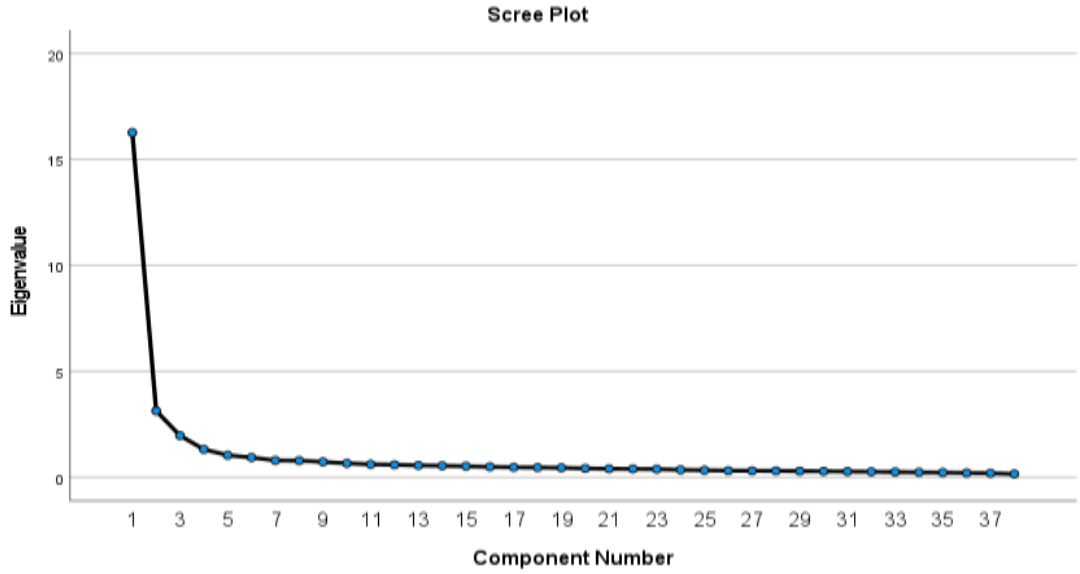

Figure 1: Scree Plot

5.6. Rotation Method and Rationale

After extraction, rotation was performed to obtain a more interpretable factor structure. Given the conceptual relationships among the theoretical constructs (usefulness, ease of use, attitudes, barriers), oblique rotation was chosen. Normalisation was performed using oblique rotation; the factors correlated, which is theoretically appropriate in research on perceptions. Indicatively, students who find online learning useful can also find it easy to use. Since these relationships are not orthogonal, imposing orthogonality would be an artificial constraint. After 23 rotation cycles, the rotation converged, and the solution was considered stable. The distribution of variance became more balanced after rotation.

Despite cumulative variance still standing at 59.7, redistribution increased interpretability and reduced the dominance of the first factor.

Table 3
Rotated Component Matrix

	Component				
	1	2	3	4	5
The instructions provided on the online platforms are clear and easy to follow.	.657			-.190	
I can quickly learn how to use new features on the online learning platform.	.627		.203	-.147	-.143
It is simple to access course materials and resources using online tools.	.609		.104	-.206	
Online learning tools require minimal effort to use effectively.	.584			-.197	
Institution-provided online learning tools are easy to use.	.573		.144	-.215	
I find it easy to participate in group discussions or activities in online ESL classes.	.572		.227		.112
I can easily find answers to my questions using online learning tools.	.565			-.162	
I rarely encounter technical difficulties while using online learning tools.	.430	-.129			.427
It is easy to communicate with instructors and peers using online tools.	.425			-.248	.306

The availability of recorded lessons makes it easier to review difficult language concepts.	.394			-.314	.129
I find it difficult to access course materials and resources through online learning tools.	.370	.742		.201	
Online learning tools have not helped me improve my English.		.731		-.120	
Online learning has not improved my English language skills.	-.155	.722		-.350	
Online learning is not a key to academic success.	-.143	.702		-.339	
Institution-provided online learning tools are difficult to use.	.424	.688		.133	
I do not prefer learning English online.	-.169	.608	.211		.294
Online learning is not a vital tool for learning English	-.107	.606		-.378	
Online ESL classes do not provide sufficient opportunities for practicing English language skills.		.582			.543
Online learning does not foster my confidence in using English in real-life situations.		.573			.434
Online ESL classes provide sufficient opportunities for practicing English language skills.			.796		

I prefer to opt online learning instead of traditional learning methods.		.786		
I prefer participating in online classes for my education.		.784		-.146
The online learning tools allow me to improve my English language skills effectively.		.766		
I prefer to learn the English language online.		.723		
Online learning fosters my confidence in using English in real-life situations.		.648		.205
Online learning has increased my motivation to study English outside of class.			-.766	
The interactive features of online learning tools make learning English more engaging.	.164		-.721	
Online classes make it simpler to handle my studies.	.137		-.717	
The online ESL classroom offers tools and resources that support my individual learning needs.			-.695	
Online learning tools allow me to learn English at my own pace.	.196		-.687	
Online learning is a key to academic success.		.187	-.644	

Online learning has improved my English language skills.		.255	-.635	
Online learning has helped me improve my overall proficiency in the English language.		.239	-.585	.120
Online ESL classes provide access to more diverse learning materials than traditional classes.	.110		-.582	.242
The feedback provided in online ESL classes is helpful for my learning progress.	.152	.141	-.569	
Online learning is a vital tool for learning English.		.278	-.562	
Online learning tools have made learning English easier for me.	.349	.170	-.472	
Online ESL classes are as effective as face-to-face classes in achieving language proficiency.		.196	-.307	.490

5.7. Interpretation of the Rotated Pattern Matrix

After the Oblimin rotation was applied, the pattern matrix was rotated and scrutinised to identify the extracted factors. Researchers frequently investigate rotated matrices to gain deeper insight into relationships among factors. The pattern matrix was used for interpretation rather than the structure matrix because, in oblique rotation, it reflects each item's contribution to each factor while accounting for correlations among factors. Factor rotation contributes to the researcher's explanation of the statistical patterns. The method will yield more accurate interpretations of the factor loadings. Exploratory analysis requires a clear interpretation of factor loadings. The adopted minimum level of practical significance was 0.40. Before interpreting factors, researchers tend to define loading thresholds. All loadings greater than 0.50 were considered strong, and all greater than 0.70 were very strong. Slightly different cutoff values are sometimes used in different studies. The dividing line aligns with the generally accepted norms in exploratory factor

analysis in social science studies. Statistical guidelines tend to help researchers maintain consistency in their analyses. The four-factor solution was identified in a clear and theoretically explicable form in the rotated solution. Factor solutions are judged by clarity and interpretability. All the factors showed conceptual consistency, high primary loadings and satisfactory discriminant characteristics. Researchers tend to investigate the presence of logical grouping of items in factors.

Factor 1: Perceived Usefulness of Online Learning

The first factor has emerged as a dominant and highly stable dimension in the dataset. Items (Q20-Q31) with good loading on this factor were 12 in number, with a loading value of between 0.639 and 0.834. These products reflected students' perceptions that online learning enhances their English language proficiency, academic achievement, and learning effectiveness, and that it positively influences educational achievement. Such a high level of clustering among these items indicates that respondents clearly differentiate the instrumental value of online learning. The fact that perceived usefulness has factor loadings greater than 0.70 on several items indicates that it is a strong latent construct in the measurement model. In independent analysis, this aspect accounted for 59.25 per cent of the variance in its connected items. The high variance explains the construct's unidimensionality. Further, the Cronbach's alpha for Perceived Usefulness was 0.939, indicating excellent internal consistency. Theoretically, this result is highly consistent with the Technology Acceptance Model, which posits that perceived usefulness is a key predictor of system acceptance. This factor is very strong, indicating that students' assessment of online learning is highly dependent on their perceptions of academic performance and skill improvement.

Factor 2: Perceived Ease of Use

The second one included 11 items (Q35-Q45) related to system usability, instruction comprehensibility, ease of navigation, resource availability, and overall user-friendliness of the online platforms. Factor loadings ranged from 0.514 to 0.836, indicating strong and consistent correlations. The presence of several items with loadings above 0.70 suggests that students viewed usability as a distinct dimension from usefulness. Whereas the usefulness is a measure of outcome-related evaluation, ease of use is a measure of process-related evaluation. The theoretical validity of TAM in this context is supported by the empirical difference between these two constructs. This factor accounted for 58.09 per cent of the variance when a single factor was used and showed high internal consistency ($a = 0.917$). Such findings affirm that perceived ease of use is a consistent and strong scale measure in the developed scale. Notably, oblique rotation showed a moderate correlation between Perceived Usefulness and Perceived Ease of Use, indicating that the constructs are empirically distinct yet associated. This tendency aligns with theoretical predictions that ease of use lacks conceptual overlap with perceived usefulness.

Factor 3: Negative Perceptions and Barriers

The third factor comprised six items (Q32-Q34 and Q46-Q48) that measured dissatisfaction, access issues, perceived inefficiency, and contextual constraints. The loadings ranged from 0.584 to 0.850, with some exceeding 0.75. This aspect of the emergence is especially significant in theoretical and contextual terms. Rather than being reverse-coded versions of positive-perception items, the items about barriers formed a distinct, coherent dimension. This implies that negative experiences are not merely the lack of positive beliefs but an autonomous evaluation domain. This factor accounted for 57.71 per cent of the variance and showed very good internal consistency (a = 0.886). The reliability value also shows that, although the construct may capture different challenges, the items function as a unitary dimension. In this context, this aspect depicts the realities of infrastructure and experience in online learning in South Punjab. The presence of a distinct dimension of barriers enhances construct validity by considering the multidimensionality of perception rather than reducing evaluation to a set of positive constructs.

Factor 4: Students' Attitudes Toward Online Learning

The fourth factor consisted of six items (Q11-Q16) that had general attitudes, preferences, and emotional responses towards online learning. The factor loadings ranged from 0.743 to 0.804, indicating very strong and consistent loadings. This factor, unlike Perceived Usefulness and Perceived Ease of Use, is an affective rather than a cognitive evaluation. It measures students' preferences for online study, their confidence in online classes, and their overall attitudes. This element accounted for 59.68 per cent of the independent variance and showed strong internal consistency (a = 0.864). The high reliability and high loadings substantiate that the attitudes are a stable and interpretable construct within the measurement model. The distinction between attitudes and usefulness also justifies the scale's theoretical framework. Cognitive beliefs (usefulness) and affective responses (attitudes) are phenomenologically different and yet empirically distinct.

Table 4

Reliability of the Online Learning Perception Scale and Its Factors

Scale / Factor	No. of Items	Cronbach's α
Overall Online Learning Perception Scale	35	.924
Factors of the Scale		
Perceived Usefulness of Online Learning	12	.939
Perceived Ease of Use	11	.917
Negative Perceptions and Barriers	6	.886
Students' Attitudes Toward Online Learning	6	.864

6. Conclusion

When researchers are uncertain about how variables interact due to limited knowledge of the underlying mechanisms of the target phenomenon, they employ exploratory factor analysis (EFA). To accurately replicate the complexity inherent in the observed data, researchers employ Exploratory Factor Analysis (EFA) to identify a set of unobserved latent factors. Essential form means that the factor solution extracted from an EFA should retain all important information available from the original data, between-individual variability, and the covariance between the construct under study and other related constructs. In contrast, unnecessary or redundant information, as well as issues arising from sampling or measurement errors, are removed. In other words, EFA is a tool created to help develop a new theory by exploring latent factors that best explain the differences and interactions between the manifest variables.

In EFA, researchers first need to generate a pool of items that are intended to assess the target construct. This initial pool should be expansive, including as many items as possible to avoid overlooking key aspects of the target construct and to maximise the face validity of the scale. Having redundant items that seem to measure the same factor at this stage causes little issue, while missing any related to the target construct can raise serious concerns. Items may be generated by sampling the relevant population for manifest behaviours or perceptions related to the target construct, or by researchers based on the construct's conceptualisation.

The main objective of the study was to design and test a multidimensional scale to measure undergraduate ESL students' perceptions of online learning in South Punjab. A systematic evaluation of the psychometric properties of the proposed instrument was conducted through reliability analysis and exploratory factor analysis. The findings confirm the hypothesis of non-unidimensionality of students' perceptions of online learning: it is not a single construct but a set of constructs that are connected yet distinct.

The findings of the exploratory factor analysis indicated a four-factor model comprising Perceived Usefulness, Perceived Ease of Use, Negative Perceptions/Barriers, and Students' Attitudes towards Online Learning. The dataset was well suited to factor analysis, and the four retained factors explained 59.7 per cent of the total variance, exceeding the generally agreed-upon 50 per cent in the social sciences. The scree plot and the eigenvalue criterion were also used to retain the four significant dimensions. A high level of item loading indicated specific grouping and conceptual consistency within each construct. In addition, the factors had low cross-loadings, which favoured discriminant validity.

Internal consistency in the last reliability test was also good across all four constructs, with Cronbach's alpha coefficients ranging from 0.864 to 0.939. These values show that the mature subscales are valid and reliable measurement dimensions. High

reliability, high communalities, a high Bartlett test result, and a high KMO result are good evidence of construct validity and internal consistency.

One can conclude from the results that the Technology Acceptance Model applies to online ESL learning. Perceived Ease of Use and Perceived Usefulness were strong cognitive dimensions that influenced students' perceptions of online learning. Meanwhile, the finding of a differentiated construct of Barriers indicates the significance of contextual and infrastructural factors in shaping learners' experiences. The presence of the attitudinal dimension also demonstrates that cognitive beliefs anchor affective responses. Taken together, these findings apply to the already-developed models of technology acceptance, incorporating the contextual realities of developing countries.

The research has also contributed to the methods literature by offering a highly validated tool for assessing BS English learners, particularly in South Punjab. The study observed a high level of validation procedures. It did not involve testing students without empirical validation of the instruments to demonstrate their effectiveness in measuring the dimensions of students' latency perceptions. This validity scale can be used in the future to explore the experience of online learning at a similar learning institution.

The sample consisted of BS English learners from two institutions and could not be generalised to other subjects or localities. The study used exploratory factor analysis; a confirmatory factor analysis (CFA) could be used to further confirm the model structure. Longitudinal studies are also applicable to analysing changes in students' perceptions as online learning systems evolve. Finally, the designed scale has good psychometric properties and comprehensively conceptualises ESL students' perceptions of online learning. The study has provided a strong empirical basis for subsequent studies and for measuring online education practices within institutions, demonstrating reliability and construct validity in South Punjab and related areas.

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