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ENHANCING MACRO CRITICAL THINKING THROUGH ICT: A STUDY OF PAKISTANI ESL LEARNERS

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Abstract
This paper investigates the role of Information and Communication Technology (ICT) in macro-level critical thinking skills of the undergraduate ESL students in Higher Education Institutions (HEIs) of Pakistan. This study employs Vygotsky's Socio-Cultural Theory, Bloom's Revised Taxonomy, and Gardner's motivational theories to examine how instrumental and integrative motivations can play an important role as a link to cognitive growth in digital learning environments. The research adopted mixed methods that include a questionnaire survey of 160 undergraduate BS English students to provide the baseline motivational orientations, and action research in the classroom with 30 participants (students and teachers). The data were gathered using the validated motivational questionnaire and structured classroom observation, as well as a 26-item pre-test and post-test instrument for analytical, evaluative, and creative thinking. Results show that a strong initial motivation facilitates in-depth analytical interaction with ICT tools. The results of quantitative analysis showed that the use of ICT in the classroom achieved a statistically significant increase in post-test critical thinking scores, and there is a good positive correlation between the frequency of using ICT in the classroom and the results of critical thinking ($r = 0.74$, $p < 0.01$). Moreover, there was a significant relationship with perceived usefulness of ICT and analytical engagement ($\rho = 0.69$, $p < 0.01$). These findings were supported by qualitative observations showing greater pupil engagement and active thinking where teacher scaffolding was used. Finally, the findings show that when ICT is used as a pedagogical tool, it can transform the learning process with the help of pedagogical guidance and with the motivation of learners. This article focuses on the instrumental and integrative motivation of learners in the ESL classroom and the use of keywords in developing their macro critical thinking skills in the context of mixed methods.

Keywords: *ICT, macro critical thinking, instrumental and integrative motivation, ESL classroom, mixed methods, Bloom's Taxonomy, Socio-Cultural theory.*

Introduction

Information and Communication Technology (ICT) has become a key enabler for the changing nature of teaching and learning in all disciplinary areas in today's educational environment. In a general sense, ICTs can be understood as a wide array of digital technologies, including hardware, software, and communications that enable the delivery, access, and sharing of information (Unsworth & Mills, 2020). From an educational point of view, ICT is not only an extra tool but also a basis to provide a knowledge delivery system where teachers can provide an interactive, multimedia, and intellectually stimulating environment. The use of ICT in higher education has changed teachers' roles from information providers to facilitators of digital and analytical learning experiences, as pointed out by Zhiyong et al. (2020).

The use of ICT tools and platforms has had a major impact on the field of English language teaching (ELT). English is used as the main medium of communication, academic work, and professional engagement, and thus in non-native countries, such as Pakistan, the effective learning of English is very important (Khamkhien, 2012). The use of digital technologies has given English language learners access to a wider range of resources that can be used to engage them in learning beyond the traditional classroom, such as access to authentic

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materials, interactive platforms, and collaborative tools. In this context, the current study analyzes the unique association between the integration of ICT and the achievement of macro-level critical thinking abilities of undergraduate ESL students in Pakistani universities.

Critical thinking, especially macro-level thinking, requires higher-order cognitive processes like analysis, synthesis, evaluation, and reflective thinking (Nawaila et al., 2020). Although many scholars have established the importance of critical thinking in higher education, macro-level critical thinking is still an uncharted territory in many universities in Pakistan, where teaching strategies are still focused on rote memorization, content reproduction, and lack an analytical approach (Rashid & Rana, 2019). This research, therefore, aims at developing an evidence-based understanding of closing this pedagogical gap with purposefully integrated ICT tools to benefit the development of higher-order thinking competencies among ESL learners.

Undergraduate Teaching and Learning

Undergraduate English teaching in Pakistan involves much more than just teaching grammar and vocabulary. The role of Universities is to equip students with the skills to cope with the demands of life as a professional in a globalized and technology-mediated environment. In this context, the development of critical thinking, problem-solving, and communicative competence has become necessary (Milal et al., 2020). But one of the most prevalent issues in many universities in Pakistan is that many of them still have teacher-centred teaching with content as the focus, which does not encourage higher-order thinking. In such settings, students are likely to be taught to, and think about, information passively, and therefore not to learn to think critically about information, which is what is required in modern academic and professional settings.

The research findings in various fields strongly support that the training of critical thinking skills during undergraduate study has an impact on measurable outcomes such as increasing academic achievement, decision-making ability, and adaptability to complex problems in the real world (Nurhidayah, 2020). Critical thinking is also associated with critically interacting with information in texts, making well-informed arguments, and assessing the credibility of information that is presented to them in digital and print media in the ESL context. Pakistan's universities, thus, are challenged with two problems: Both at the same time, they have to modernize their teaching and learning environment by embracing ICT and develop the pedagogy to make use of ICT for significant cognitive growth.

Critical Thinking

Critical thinking is an aspect of higher-order thinking skills and involves the systematic ability to examine information, detect patterns or relationships, evaluate evidence, and make reasoned conclusions. It is a multi-dimensional phenomenon that involves both the capacity to break down a problem into its parts and the reflective attitude to challenge assumptions, consider alternative points of view, and modify judgements based on new information (Entika & Ying, 2019). At school, the promotion of critical thinking helps students in the academic environment to go beyond the superficial understanding of the content of disciplines to reach a deeper level of interaction and build their own independent and critical perspectives.

The theoretical underpinning of understanding for critical thinking in the learning context is very much based on Bloom's Revised Taxonomy, which is hierarchical from lower level (remembering, understanding) to higher level (analysis, evaluating, creating) (Putri et al., 2021). As defined in this study, macro-level critical thinking is associated with the higher-order levels of this taxonomy. It includes the ability to combine information from different sources, identify logical gaps, formulate a coherent argument, and create original ideas. These skills do not just happen naturally, but rather need to be taught; the task needs to be meaningful, and practice needs to be sustained in cognitively challenging learning contexts.

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Statement of the Problem

The integration of ICTs in higher education is still not uniform, and very few institutions and universities have used these tools beyond administrative and/or replacing the conventional lectures, where they are used as tools for developing higher-order thinking (Rozmatovna, 2020). The difference between the presence of ICTs and their meaningful use for teaching-learning is a major problem for the development of analytical skills of ESL learners. Additionally, prior studies have tended to treat the phenomena of the integration of ICT and the development of critical thinking as parallel phenomena rather than intersectional phenomena, and the ways in which ICTs can systematically foster critical thinking at the macro level have not been extensively studied.

The present study has attempted to fill this gap by exploring the direct link between the use of ICT in ESL and the macro-level critical thinking skills of undergraduate students of Faisalabad, Pakistan. The independent variable is ICT integration (operationalized into structured use of digital tools, platforms, and resources in teaching ESL), and the dependent variable is the macro-level critical thinking abilities of learners using validated pre-test and post-test instruments. Moderating variables, such as the quality of teacher guidance and students' ICT competence, that might affect the strength of this relationship are also examined. Additionally, although the cognitive outcomes of using ICTs have been extensively documented, the motivational factors that are needed for the use of these digital tools tend to be neglected. Students need continuous instrumental and integrative motivation to use ICT in complex cognitive tasks. To fill this gap, this study examines the underlying motivations of learners in learning English and how such motivations can motivate them to interact with ICT to create macro-level critical thinking.

Research Questions

1. How does the use of ICT in the ESL classroom impact students' macro-level critical thinking development?
2. How do instrumental and integrative motivations influence undergraduate ESL learners' engagement with ICT tools?
3. In what ways does learner motivation serve as a bridge to developing analytical and critical thinking skills in an ICT-integrated environment?

Significance of the Study

This study helps to add to the body of studies in the field of technology-enhanced language learning, as it offers empirical evidence of the link between integration of ICT and higher-order cognitive development in the context of Pakistan's ESL. The results have practical implications for university administrators, curriculum designers, and language teachers who want to use digital technologies to make meaningful pedagogical implications. The research findings offer a basis for evidence-based policy recommendations for the investment of ICT infrastructure and teacher professional development in Pakistani higher education, by revealing the clear correlational and causal relationships between ICT use and the development of critical thinking. In addition, this research gives a theoretical contribution by locating the use of ICT in the framework of the two theories of learning, which are cognitive and sociocultural theories.

Review of Literature

The potential of critical thinking skills development with the integration of ICT in ESL has been the focus of much research over the last two decades. However, research in this field is not yet fully consolidated; the evidence strongly suggests a transformative potential of digital technologies when it comes to critical thinking skills development in pedagogically oriented instructional frameworks. This review is an integration of pertinent literature from three interrelated fields: conceptions and theoretical frameworks of using information and communication technology (ICT) in education, the use of digital tools to foster critical thinking

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and analytical engagement, and the problems and opportunities faced in Pakistani higher education (HE) settings.

Theoretical Background

The conceptual scaffolding for the present study is twofold – Bloom's Revised Taxonomy of Educational Objectives and Vygotsky's Socio-Cultural Theory of cognitive development. Bloom's Revised Taxonomy, which Anderson and Krathwohl (2001) reformulated, classifies cognitive learning objectives into a hierarchical continuum that starts from lower-order skills (remember, understand, and apply) and moves on to higher-order skills (analyze, evaluate, and create) (Putri et al., 2021). Macro-level critical thinking operationalised in this study resonates with the higher levels of this framework, in which learners are expected to analyze information from different perspectives, assess the soundness of arguments, identify fallacious arguments, and formulate their own critical response. Through access to a variety of sources of information that are authentic and multimodal, ICTs can provide conditions that are conducive to engagement at these higher cognitive levels.

The Socio-Cultural Theory, one of the theoretical lenses on which this research is based, gives another perspective on understanding how ICT supports cognitive development through the central concepts of the Zone of Proximal Development (ZPD) and scaffolded instruction. Vygotskian theory has suggested that learning should take place in the social environment, where more able participants (whether adults or children) offer support to help learners do things they could not do in isolation (Nawaila et al., 2020). Digital platforms and collaborative ICTs can allow this scaffolding process to be extended through the use of asynchronous peer interaction, immediate access to content generated by experts, and adaptive feedback systems that cater to the needs and progress level of the individual learner. These frameworks combined indicate that ICT integration, if appropriately planned to meet the needs of learners at the top of Bloom's Taxonomy and carried out within Vygotskian scaffolding, can be a tool that can really make a difference in critical thinking at the macro level.

It is important to realize that progress from the lower levels of Bloom's Taxonomy (remembering and understanding) to the higher, more cognitively challenging ones (analyzing, evaluating, and creating) demands considerable cognitive effort and learner will. Digital platforms and collaborative ICTs create the scaffolded environment (ZPD). Still, the motivation to learn and engage for a long enough period to master the critical thinking skills at the macro level is the drive from within. Therefore, theoretical models of the cognitive development of ESL students must align with models of language learning motivation.

Information and Communication Technology in Education

ICT is an umbrella term for technology, tools, and systems that can be used to create, store, retrieve, and communicate information. For educational institutions, ICT refers to the hardware (e.g., computers, tablets, smartphones), software (e.g., learning management systems, digital libraries, collaboration tools), and connectivity infrastructure (e.g., internet, LAN, mobile broadband) (Sathya, 2017). The UNESCO model of integration of ICT in education postulates five levels of integration in the field of education: acquisition, deepening and creation, as well as pedagogical sophistication and cognitive engagement of the learner. The present study places the use of ICT in the deepening phase, where digital tools are not only used to provide content, but to involve the learner in analysing and problem-solving to develop transferable skills.

E-learning is one of the key modes of education using ICTs. It is defined as an education system that uses electronic networks, such as the internet, intranet, and extranet, to provide, manage, and monitor learning activities. Digital platforms are especially found to be effective in promoting learner autonomy, enabling learners to move at their own pace through the instructional material and providing instant and personalised feedback (Shahzad et al., 2020).

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Blended learning is a pedagogical approach that has been gaining more popularity in higher education settings in Pakistan, where it blends traditional face-to-face instruction with online and digital learning experiences, thereby allowing the retention of the benefits of the face-to-face learning model in terms of relationships and motivation while providing the flexibility and resources of digital learning.

Previous Studies on ICT and Critical Thinking in ESL Settings

There is a wealth of empirical evidence to suggest that there are positive relations between the use of ICT in language learning contexts and the acquisition of analytical and critical thinking skills. The study by Khamkhien (2012) highlighted the importance of critical thinking in a technology-enhanced ESL classroom, showing that the experimental group (ICT-integrated group) exhibited clearly more growth in critical reasoning tasks compared to the control group (no ICT group), confirming that the use of technology in learning promotes questioning, analysing, and evaluating information (Khamkhien, 2012). Likewise, the study about the integration of ICT in the EFL classroom in Indonesia showed that the students in the EFL classroom with digitally enriched learning environments had higher scores in the analytical aspects of engagement with textual materials, both in performance-based assessment and in the self-report measure of critical thinking disposition (Radfar & Lengkanawati, 2020).

The relationship between the use of ICT and the development of critical thinking has also been examined from a motivational point of view. Within the realm of Gardner's (1985) Socio-Educational Model, integrative and instrumental motivations have been consistently associated with learners' use of digital tools in ESL contexts (Rozmatovna, 2020; Al-Ta, 2018; Vakilifard, 2021). The integrative motivation, which is the desire to interact with the L2 community and its culture, is positively correlated with the voluntary, sustained use of the digital platform for learning L2, which is conducive to the development of higher-order thinking skills such as extended reading, writing, and interaction (Ahmadi, 2011; Kirkgöz, 2005). Instrumental motivation, which entails a utilitarian approach to language learning to serve pragmatic needs such as getting a job or enrolling in a university, is also linked to the conscious use of ICT tools to acquire skills and knowledge (Hong & Ganapathy, 2017; Daif-Allah & Aljumah, 2020).

The study by Entika and Ying (2019) also showed the significance of giving constructive, immediate feedback using ICT in students' instrumental motivation and analytical engagement in the speaking activity. Kalkoul and Hamitouche (2021) also reported that the use of ICTs in learning resulted in integrative and instrumental motivation in EFL learners, which had a positive impact on vocabulary learning and analytical reading skills. From all of these findings, it is evident that the link between ICT, motivation, and critical thinking is not unidirectional but is interwoven through various factors that reinforce each other, in which using ICT contributes to the motivation, which in turn contributes to higher-level thinking skills.

Despite the overall positive evidence, there have also been a number of studies that have highlighted the problems of using ICTs in an ESL context. Milal et al. (2020) reported that the efficacy of using ICT to promote critical thinking depends on teachers' training and the critical thinking instructional design; otherwise, the use of ICT can be used as a passive information delivery tool and not as a cognitive engagement tool. Similarly, Rashid and Rana (2019) explained that a teacher who is not sufficiently digitally literate and has no flexibility in integrating ICT into their pedagogy to make meaningful use of it in the learning process is not likely to achieve the maximum cognitive development benefits of the integration of ICT. Taber (2018) reaffirmed the importance of reliability validation in the instruments used in research to measure the outcomes of critical thinking and highlighted the methodological rigor that is needed to generate evidence of the impact of ICT.

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Against all these findings, it is clear that the relationship between ICT, motivation, and Critical Thinking is not one-way but integrated and reinforced in each other. The higher-order levels of Bloom's Revised Taxonomy (analytical and evaluative) place a cognitive strain on a passive learner that they are unlikely to be able to achieve. Learners, however, with high integrative motivation (wanting to interact with the target culture) and instrumental motivation (wanting career and academic success) demonstrate the perseverance required to attempt complex linguistic tasks. ICT serves as an effective catalyst that can provide these authentic, multimodal settings that elicit these deeper motivations to learn and, in turn, prompt the learner to continually engage in the higher-order critical thinking activities required for the advanced levels of ESL proficiency.

Research Methodology

According to the study's research design, a mixed methods approach was used, which combines both quantitative and qualitative methodological strands to create a comprehensive and triangulated understanding of the relationship between the macro-level critical thinking development of undergraduate ESL learners and their integration of ICT. Given the research objectives, a mixed methods approach was chosen to benefit from the statistical accuracy of quantitative measurement to draw correlational and causal patterns, and to gain the interpretative depth that qualitative analysis brings to understanding the context and experience of ICT-mediated learning. The independent variable for this study is the use of ICTs in ESL instruction, which is defined as the organized and sustained use of digital tools, platforms, and digital resources to support teaching in the classroom. The dependent variable is learners' macro-level critical thinking ability, which is manifested in their performance on a pre-test and a post-test instrument designed to measure this ability and validated according to the top levels of Bloom's Revised Taxonomy. Moderating factors are teacher quality in instructional guidance and learner proficiency level in using the ICTs, which are explored as potential mediators in the relationship between the main factors and critical thinking outcomes.

Methodological Framework

The quantitative aspect of the research design is based on a quasi-experimental action research approach that employs pre-test and post-test data to determine the level of change in the macro-level critical thinking skills of the learners after going through a period of structured instruction with the use of ICT. With this design, it is possible to compare pre-instruction and post-instruction performance, and causal inference can be drawn about the impact of integrating with ICT on the development of critical thinking skills (with the known limitations of a non-randomised sample). The qualitative strand uses structured classroom observation data, which is analysed using thematic analysis with a contextually sensitive approach, to examine how ICT-mediated instruction impacts on learners' engagement and analytical cognition. Integration of the two strands is in the form of a concurrent triangulation design, which involves the simultaneous collection of both quantitative and qualitative data, with the synthesis of the data happening at the interpretation stage, thereby resulting in a more complete and nuanced description of the research phenomena than either strand could provide alone.

Participants of the Study

The research was carried out in the different English departments of public, private, and semi-government universities of Faisalabad, Pakistan. Two different participant samples were formed that reflected the mixed-methods design. The first sample consisted of 160 undergraduate students of the BS English program who took part in the questionnaire part of the research. The sample was used to explore learners' perceptions and attitudes, motivational patterns, and the level of use of ICTs in ESL classrooms, and to collect baseline data on the use of ICTs and their perceived impact on analytical engagement. The second group consisted of 30 subjects, 24 undergraduate students and 6 teachers, who were chosen for the action research

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in the classroom. Pre-test, post-test, and classroom observation data were used to investigate the direct effects of teaching with the use of ICT on the critical thinking macro level of the subjects of this sample.

Data Collection Instruments

Three major instruments were used to collect data. The first one is a 26-item pre-test and post-test to measure the critical thinking skills of the learners on a macro level in line with the three cognitive levels of Bloom's Revised Taxonomy (analytical, evaluative, and creative). Items were designed to elicit longer analytical answers rather than just factual data and were used in a way that was related to the macro-level cognitive construct being studied. The second one was a questionnaire consisting of 18 items adapted from Gardner's (2004) Attitude/Motivation Test Battery. This baseline motivational assessment is included because higher-order cognitive engagement (critical thinking) is related to the level of learner volition. This study quantifies instrumental and integrative motivations (e.g., need for global career opportunities and need for intercultural communication) and thus sets the motivational ground that enables learners to immerse themselves in challenging, ICT-based analytical tasks. The third instrument was structured observation protocols for recording classroom interaction patterns, students' engagement behaviour, and the quality of analytical discourse produced during the ICT-integrated instructional sessions.

A Cronbach's Alpha was used to determine the reliability of the questionnaire, and it was found to be 0.935, which is a high coefficient of internal consistency (Taber, 2018). The expert review of three applied language and education technology specialists was used to establish content validity. Before data collection, the data were pre-processed to eliminate incomplete responses and to correct response inconsistencies, thus ensuring the accuracy and reliability of the analytical data set.

Data Analysis Procedures

Data were analysed quantitatively with SPSS and MS Excel, which allowed the calculation of descriptive statistics, paired-sample comparisons, and inferential statistical significance tests. Pearson product-moment correlation analysis was used to investigate the linear relationship between learners' use frequency of ICT (quantitative) and their critical thinking scores (post-test), and Spearman's rank-order correlation (ρ) was used to examine the association between learners' perceived usefulness of ICT (ordinal) and their self-reported analytical engagements. A paired samples t-test was used to test the statistical significance of the difference in pre-test and post-test critical thinking scores. Qualitative data collected from the classroom observations were analyzed using thematic analysis (Braun & Clarke, 2006) in two ways: first, deductively, according to the conceptual framework of the study; and second, inductively, based on the patterns of emerging data.

RESULTS AND DISCUSSION

The results of this study offer converging evidence, both quantitative and qualitative, that the use of ICT-based instruction has a significant positive effect on the development of macro-level critical thinking skills of undergraduate students learning ESL. The results are structured around the three research questions and presented in an integrated fashion that establishes links between statistical results, observations, and the theoretical and empirical literature more generally.

Questionnaire Results (n = 160)

The questionnaire results indicated that there was a great level of agreement (70%–90% of the respondents) with the positively worded items, indicating that the majority of respondents had positive perceptions of ICT integration in ESL learning environments. Table 1 presents a cumulative summary of the findings across the key thematic domains of the questionnaire.

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Table 1

Cumulative Summary of ICT Impact on ESL Learners' Perceptions (n = 160)

Statement Theme	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Interpretation
ICT improves motivation in learning English	48%	42%	6%	4%	Strong motivational impact
ICT increases engagement in classroom activities	45%	43%	7%	5%	High classroom participation
ICT helps in understanding English content better	50%	40%	6%	4%	Improved comprehension
ICT supports the development of critical thinking	38%	47%	10%	5%	Moderate-to-strong cognitive impact
ICT provides access to global learning resources	55%	37%	5%	3%	Strong global exposure effect
ICT encourages independent learning	42%	44%	9%	5%	Learners show autonomy development
ICT makes learning English more interesting	52%	38%	6%	4%	High positive perception

Note. Percentages reflect combined Strongly Agree and Agree responses; remaining percentages account for Neutral and Disagree positions.

As seen from the data presented in Table 1, there is an overall pattern in the perceptions of the learners that is highly positive across all seven thematic areas, ranging from 85% (ICT supports the development of critical thinking) to 92% (ICT provides access to global learning resources). This is similar to the results found by Shahzad et al. (2020) and Nawaila et al. (2020), who also reported that, in technology-rich classrooms, students' engagement and motivation have been observed to be high. The moderately reduced agreement rate for the item that measured critical thinking development (85% combined) compared with the items that measured motivation and engagement (87%–92%) is of interest because it indicates that learners feel that the use of ICT is beneficial in supporting their motivation, but may not be so aware of its role in supporting their critical thinking development – further supporting the need for teacher-mediated and intentional design in ICT use for learning to promote critical thinking development.

Questionnaire Figures

The following figures (Figs. 1–8) present the questionnaire results in graphical form, illustrating participants' motivational orientations toward ICT-integrated English language learning. Each figure corresponds to a specific questionnaire item and depicts the distribution of responses across the participant sample (n = 160). Taken together, the figures reveal a consistent pattern of positive motivational orientation, with the majority of respondents expressing agreement with statements linking ICT use to English language learning motivation, career opportunity, and intercultural engagement.

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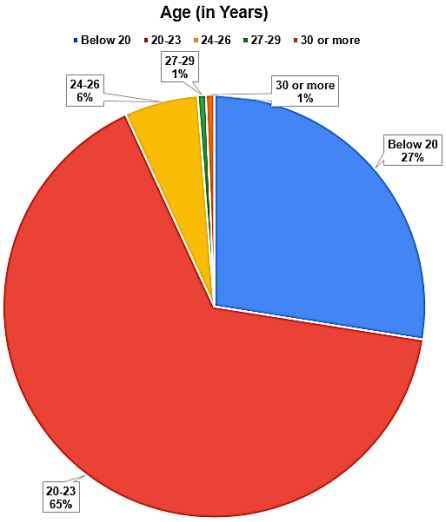

Fig. 1: Respondents' Age Group

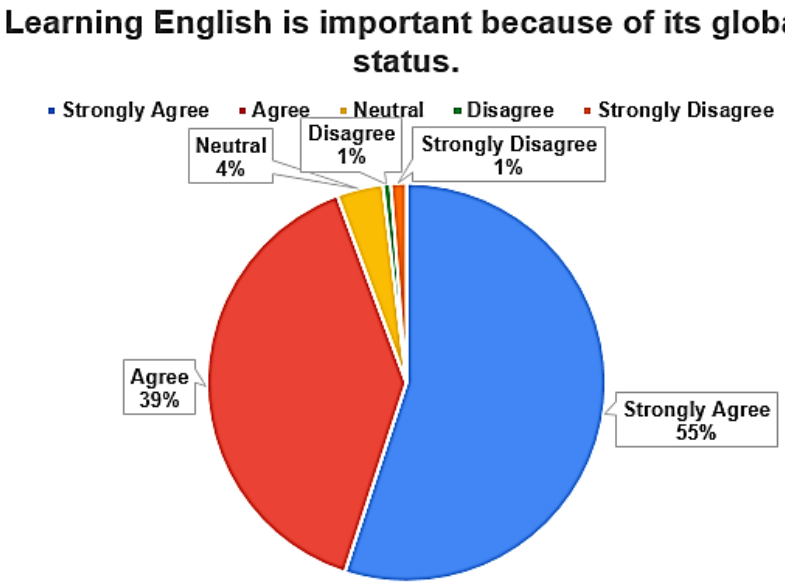

Fig. 2: Global Status of English as a Motivation

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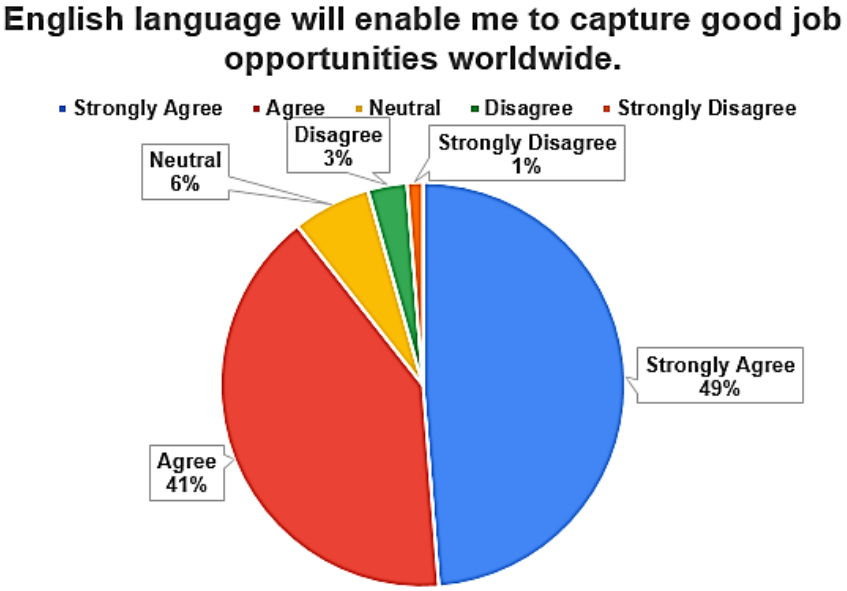

Fig. 3: Worldwide Job Opportunities as Motivation

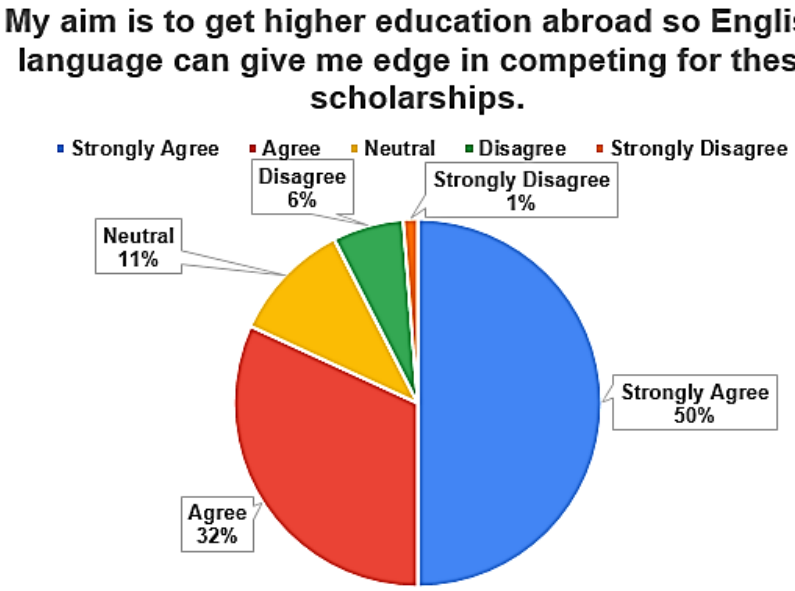

Fig. 4: Foreign Scholarships as Motivation

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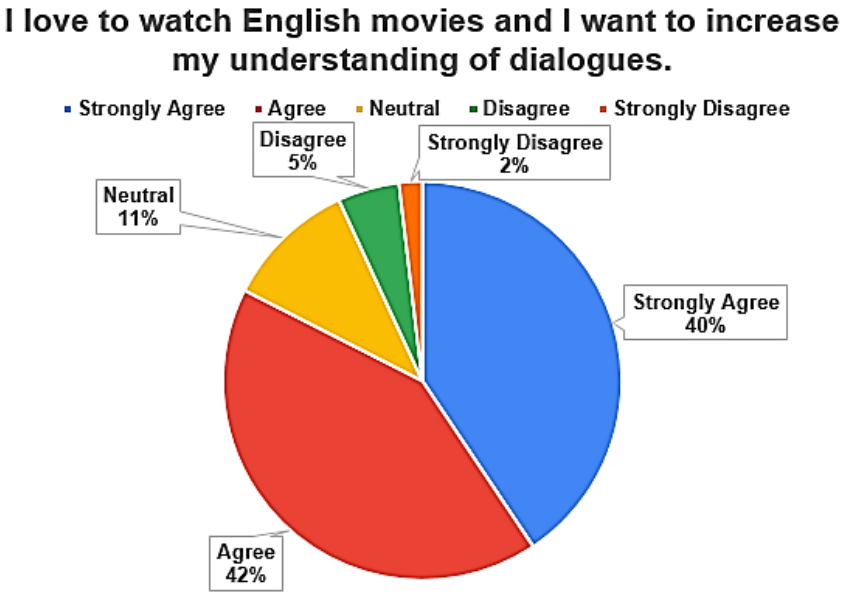

Fig. 5: Motivation for Understanding Movie Dialogues

Fig. 6: Video Tutorials and Online Lectures

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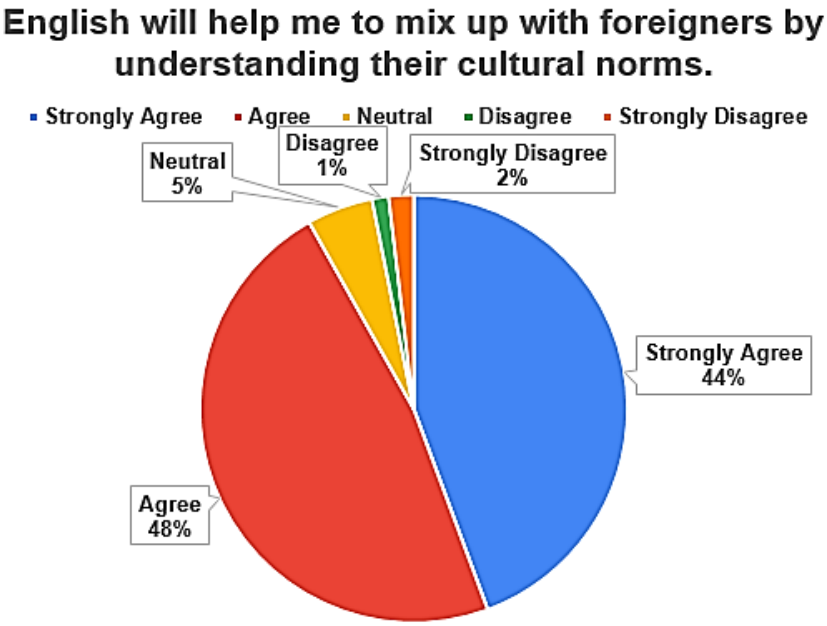

Fig. 7: Importance of Understanding the Cultures of Foreigners to Learn English

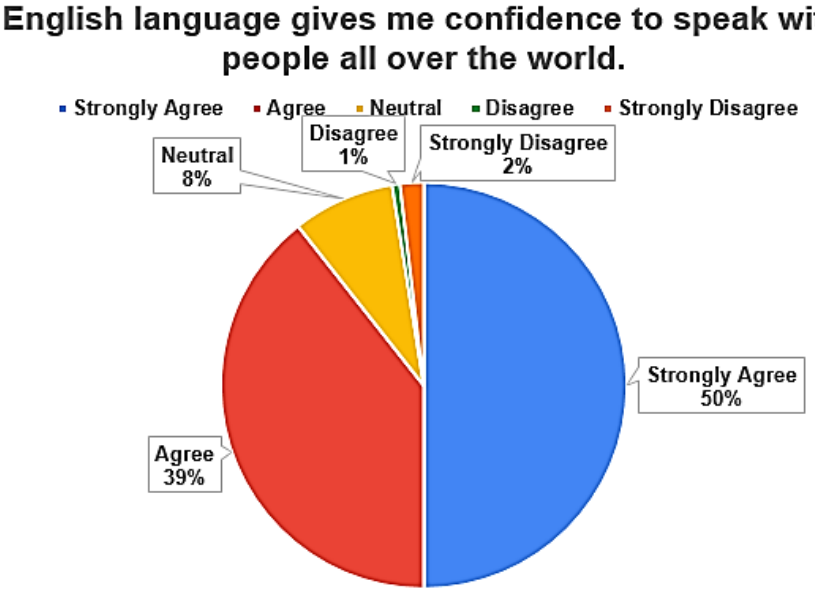

Fig. 8: Increasing Motivation for Using English with Confidence

From the robust instrumental and integrative motivations shown in Figures 1-8, it is clear that these undergraduate learners already have a desire to learn English for their global, academic, and professional integration. This basic motivation is important in the context of introducing more complex pedagogical interventions. As shown in Table 1, the high motivation is manifested in the high engagement of learners in the classroom and in their high autonomy when using ICTs, when it is directed through ICT integration. Thus, the general interest in learning English (as expressed in the survey) becomes engine fuel that helps students to engage in more difficult, higher-order thinking tasks with the support of digital tools. This motivational scaffolding directly preps them for the analytical tasks that are measured in the ensuing action research phase.

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Action Research Results: Pre-test & Post-test Analysis (n = 30)

Table 2

Participant Demographics for Action Research Component (n = 30)

Parameter	Description
Total Participants	30 (24 students, 6 teachers)
Level of Education	Undergraduate BS English (students); MA/MS (teachers)
Gender Distribution	Mixed (male and female)
Age Group	18–22 years (students); 25–40 years (teachers)
Teaching Experience (Teachers)	3–15 years

The pre- and post-test results indicated that the learners' macro-level critical thinking scores were statistically significantly different after the instructional intervention of the integration of the ICT. The mean pre-test scores were significantly lower than the mean post-test scores, and the paired-samples comparison showed that the difference was statistically significant ($p < 0.01$), meaning that this difference was not due to chance. This enhancement and the high reliability coefficient ($\alpha = 0.935$) of the assessment instrument offer strong evidence that the integrated teaching method using ICT obtained measurable and replicable improvements in macro-level critical thinking skills of action research subjects.

Correlational Analysis: ICT Use and Critical Thinking

Pearson product-moment correlation analysis was performed to investigate the nature and strength of the relationship between the integration of ICT and the critical thinking development at the macro-level based on the results of the post-test and the measurement of the frequency of using ICT. The results showed that there is a highly significant correlation between the use of ICT and the critical thinking scores ($r = 0.74$; $p < 0.01$), which means that the higher the level of ICT use, the better the critical thinking scores. This discovery is in line with the theoretical predictions of Bloom's Revised Taxonomy, which suggests that the chance to undertake analytical, evaluative, and creative tasks through the extensive information resources and interactive features of digital environments will foster development at the higher cognitive levels.

Spearman's rank order correlation was also performed to determine the relationship between learners' perceptions of the usefulness of the use of ICT (rated on a Likert scale) and the analytical engagement learners reported during the activities where they used ICT. The result indicated a medium to strong positive correlation ($\rho = 0.69$, $p < 0.01$), which means that the greater the educational value learners perceived in the use of the ICT tools, the more likely they were to engage analytically with the content that these provided. This relationship is consistent with the motivational frameworks of Rozmatovna (2020) and Vakilifard (2021), which state that the perceived instrumental value is a crucial factor in motivating students to use the resources of ICTs in ESL learning contexts in order to be engaged with them in a sustained and analytically productive manner.

Qualitative Findings: Classroom Observation Analysis

Thematic analysis of the classroom observation data resulted in three main themes that summarised the effects of the use of ICT in teaching and learning in relation to classroom engagement and analytical behaviour of learners. The first theme, Active Cognitive Engagement, is a consistent pattern wherein learners engaged in the use of ICT showed significantly more evidence of question posing, seeking evidence, and discussion of analysis

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than the learners who participated in the sessions without the use of ICT. Students were seen evaluating the credibility of online sources, comparing and contrasting information from different digital sources, and discussing with peers, with the need to articulate and defend an analytical point of view. The second theme, Motivational Intensification, reflects higher levels of task engagement and voluntary participation seen in the process of doing some of the activities using ICT. Learners were seen to be constantly engaged and interested in the learning, especially when engaged in activities that required them to use multimedia materials, documentary clips, interactive simulations, and collaborative digital writing platforms. The third theme, Teacher-Mediated Scaffolding, emphasizes the important role of the teacher's scaffolding in guiding ICT engagement to be not just informational, but analytical as well. The depth and quality of critical thinking that learners could show were consistently found to be significantly greater in the sessions when teachers actively frame tasks to prompt analysis and evaluation than in the sessions when teachers leave tasks to learners to explore on the computer.

Discussion and Connection with Literature

The quantitative and qualitative findings in this study converge to jointly confirm that the use of ICT, as a holistic pedagogical approach with a clear purpose, has a positive impact on the development of macro-level critical thinking skills in undergraduate ESL learners. The finding of a strong correlational relationship between the use of ICT and the performance of critical thinking ($r = 0.74$) supports the results of Khamkhien (2012) and Radfar and Lengkanawati (2020), who found a positive correlation between critical thinking and the engagement of digital tools in an ESL environment. The teacher's support for the students' use of ICTs as a key mediating variable in the observation is aligned with the caution given by Milal et al. (2020) and Rashid and Rana (2019) about the dangers of uncontrolled ICT use.

The motivational aspects of the engagement with ICTs, highlighted by the correlational analysis of perceived usefulness of ICTs and analytical engagement ($\rho = 0.69$), are compatible with the motivational aspects of Rozmatovna (2020), Al-Ta (2018), Hong and Ganapathy (2017), and Ahmadi (2011). Overall, these studies point to a significant mediation between the use of ICTs and the development of critical thinking, with motivational processes playing a pivotal role: the use of ICTs initially increases the learners' interest and engagement, and serves as a trigger to develop the analytical and sustained learning behaviour that is instrumental for obtaining critical thinking. This mediated model explains the connection between ICT and critical thinking in a more nuanced way than direct-effect models and has instructional design implications: It indicates that the use of ICT in ways that clearly relate to, and strengthen, learners' motivational orientations is likely the best way to ensure that the cognitive benefits of its use are realized.

CONCLUSION

The results show that the underlying instrumental and integrative motives give the learners the drive to meaningfully interact with the digital platforms and, as a result, actively develop their higher-order analytical skills. This study presents empirical and theoretical evidence that the intentionally used ICT in ESL classrooms has a significant and positive impact on developing macro-level critical thinking skills of undergraduate students in Pakistani universities. The results, based on Bloom's Revised Taxonomy and Vygotsky's Socio-Cultural Theory, indicate that using ICTs in learning environments can facilitate the higher-order cognitive skills of analysis, evaluation, and synthesis if adequate pedagogical planning and guidance are provided in the learning environments. The strong positive correlation between the use of ICT and the critical thinking performance ($r = 0.74$), the statistically significant difference in the post-test scores, and the qualitative evidence of an increase in analytical

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engagement during the session with the use of ICT in the instructional process stand together as evidence of the transformative potential of digital tools as critical thinking instruments.

Critically, however, the study also highlights the importance of the fact that this potential is not inherent in the technologies themselves, but rather in the theoretically-based instructional frameworks in which they are used that afford opportunities for analytical engagement. The role of ICT in learning is therefore critical, only to be led by the teacher who is responsible for designing the learning experience and how ICT will be used; otherwise, ICT becomes a passive medium to deliver information instead of being a medium for cognitive development. It has implications for curriculum designers, administration of universities, and teacher educators, because if the investment for the infrastructure of ICTs is made, it requires ongoing professional development in the field of technology-integrated and critical thinking-based learning.

Limitations and Directions for Future Research

The present study has several limitations, which should be taken into consideration while interpreting the findings. The sample of the participants was limited to the English departments of Faisalabad, which limited the geographical and institutional representativeness of the results. The quasi-experimental design is suitable for classroom action research, but is not as causally certain as a fully randomised controlled trial. Future studies should attempt to replicate and extend these findings by using larger and more geographically varied samples, and should use a randomised experimental design, if ethically and practically possible. Sustained impact of combining ICT with instruction on the development of critical thinking in the long-term (several semesters) would also be valuable to the evidence base. Furthermore, future studies could successfully explore the differential impact of different categories of ICT tools, such as collaborative tools, adaptive learning systems, and multimedia resources, on different dimensions of critical thinking at the macro level, which would pave the way for more specific and evidence-based suggestions for teaching and learning.

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