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## Toward Postulating a Critical Digital Pedagogy Scale: Development and Validation of a Meta-Connective Attitude Questionnaire for the Online Classrooms

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### ABSTRACT

Although digital technology and democracy through digital learning environments are gaining attention in applied linguistics, the lack of a measurement scale with robust psychometric properties hinders progress towards education quality and learning opportunities. To address this gap, this study is a report on designing, constructing, and validating the practicality of critical digital pedagogy (CDP) scale. To undertake the study, a quantitative research following a survey design was adopted to (a) develop and validate the scale, and (b) to screen English as a foreign language (EFL) teachers' perceptions. To gauge teachers' perspectives, this study aimed to conceptualize the construct of CDP through the development and validation of a scale specifically designed for use in online classrooms. Utilizing both data-driven and theoretical approaches among 412 EFL teachers has resulted in the development of a 27-item CDP scale. Notably, the findings indicated a high level of internal consistency and satisfactory construct validity of the of the newly developed scale. Such scale can bridge the gap between critical pedagogy and digital instruction.

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**Keywords:** Critical digital pedagogy; Digital learning environments; EFL teachers; Validation

## 1. Introduction

In recent years, the landscape of education has been significantly transformed by the widespread adoption of online learning environments. Over the past ten years, technology has made significant strides in various educational fields. It has been demonstrated that these advancements (e.g., virtual reality, AI system, augmented reality, ChatGPT), whether directly or indirectly, impact and shape educational environments (İpek et al., 2023). The connection between technology and education has garnered significant interest from researchers because of its benefits to students and its impact on the entire teaching process (Athanasopoulos et al., 2023). Technology has revolutionized traditional classrooms, transforming them into dynamic and interactive spaces. Digital tools such as interactive whiteboards, educational apps, and multimedia presentations enable real-time feedback and collaboration, thereby enhancing the teaching and learning experience. This transformation allows educators to implement more inclusive and diverse teaching methods, catering to various learning styles. Overall, advancements in educational technology have reshaped the educational landscape, making it more inclusive, engaging, and effective. These technologies not only improve access to educational resources but also promote essential 21st-century skills like digital literacy, critical thinking, and problem-solving (Athanasopoulos et al., 2023; Carvalho & Ivanov, 2024; Karakose et al., 2023). Recent research claims that the proliferation of digital technologies has revolutionized the way knowledge is disseminated and acquired, presenting both opportunities and challenges for educators and learners alike (Carvalho & Ivanov, 2024; Timotheou et al., 2023; Singh et al., 2023; Baako & Abroampa, 2023). Amidst this digital revolution, the concept of critical digital pedagogy (CDP) has emerged as a vital framework for navigating the complexities of online education. Vijayaratnam et al., (2023) study explores various factors influencing students' enjoyment of learning English in higher education. It specifically investigates instructional quality, material relevance, challenge level, social context, and personal traits, aiming to shed light on how these elements shape students online learning environment. CDP encompasses a multifaceted approach to teaching and learning

in digital spaces, emphasizing critical inquiry, social justice, and equitable access to knowledge. Rooted in critical pedagogy and informed by digital literacy theories, it seeks to empower learners to engage critically with digital technologies, interrogate power structures inherent in online spaces, and cultivate meaningful connections in virtual learning environments (Masood & Haque, 2021). Barjesteh (2019) condensed the primary goal of a critical pedagogical classroom into five fundamental principles: (a) Social realities are inherently intertwined with various values such as social, political, cultural, and aesthetic values, (b) The connection between a concept and an object is always subject to change, (c) Dialogue plays a crucial role in both conscious and unconscious understanding, (d) Knowledge is shaped by linguistic relationships that are socially and historically constructed, (e) Certain groups in society hold unfair advantages over others. These principles demonstrate that critical pedagogy leads to a shift in learning, aiming to foster the development of engaged learners by constructing and reorganizing cognitive structures and enhancing connectivity (Coles, 2024; Fovet, 2023; Luna-Thomas & Romero-Hall, 2023). CDP promotes the need to reimagine a fairer global structure encompassing various cultures and political entities. It proposes that education can foster a civil society that transcends the negative impacts of competition between nation-states, which can lead to detrimental outcomes like environmental degradation (Efremova & Huseynova, 2023). The reason for integrating critical inquiry into digital technology in English Language Teaching (ELT) is the philosophical transition towards reconstructionism. Reconstructionism, influenced by Dewey's ideas, emphasizes the significance of social change (Crookes, 2010). Reconstructionism has been advocated for in educational settings, including English language classrooms, to address concerns about education primarily focusing on knowledge transmission without context, values, or critical engagement (Freire, 1996). Reconstructionists support teaching methods that encourage citizenship and a critical approach to understanding presented ideas. Recent significant events like the Covid-19 pandemic, wars, and socioeconomic factors, along with advancements in digital education, have underscored the need for integrating critical pedagogy (CP)

with digital technology in ELT (Williamson et al., 2020). This suggests that fields such as psychology, linguistics, and philosophy align with the principles of CP in digital education. While the idea of promoting democracy through digital learning environments may seem ambitious and challenging, it remains a worthwhile goal. Traditional educational institutions often lack democratic principles. Teachers usually take an authoritative role to maintain discipline. Despite the initial challenges, the idea of promoting democracy through digital learning environments is worth pursuing. Various advantages of technology-enhanced language learning have already been recognized in the educational literature, such as promoting students' language skills (Karakose et al., 2023), facilitating access to information (İpek et al., 2023; Athanasopoulos et al., 2023); opening the way for the language learner to discover the nuances of language and develop human communication (Carvalho & Ivanov, 2024). However, concerns have also been raised about the use of technology and its impact on teaching within the principles of critical language pedagogy (Barjesteh, 2019). Although CP is a well-established concept, its application in developing a meter for network environments is a new approach.

Despite the growing importance of CDP, there remains a notable gap in the literature regarding the assessment and measurement of its implementation within online learning contexts (Efremova & Huseynova, 2023; Vataaja et al., 2021). There is no clear principle and teaching strategy on CDP. In response to this gap, this research article presents the development of a CDP scale designed to assess the integration of critical pedagogical principles within online learning environments. Through a rigorous process of scale development and validation, this study aims to provide educators, researchers, and educational institutions with a valuable tool for evaluating the efficacy of their digital pedagogical practices. By focusing specifically on online learning environments, this research contributes to a deeper understanding of the intersection between CP and digital technologies, offering insights into how educators can effectively foster critical thinking, social awareness, and digital citizenship among their students in virtual spaces. Through the implementation of the CDPS, this study seeks to advance the scholarship on CDP and inform the design of more inclusive and transformative online learning experiences. This study addresses the following research questions:

### **Research questions**

RQ1: What is the underlying structure of the Critical Digital Pedagogy scale?

RQ2: Is the new version of the CDP scale reliable and valid?

## **2. Literature review**

### **2.1 Theoretical framework**

With the emergence of the constructivist approach in education, teaching has adopted a critical and socio-political perspective. Essentially, this research is grounded in the principles of critical pedagogy theory. Critical pedagogy embodies a philosophy of education that seeks to bring about change through the elimination of oppression (Freire, 1996), eliminating social inequality that enables and catalyzes the metamorphosis of individuals using ethical considerations and values for making decisions (Crookes, 2010). Critical theorists in the field of education demonstrate a willingness to move toward constructive social change that promotes democracy and social justice (Morris & Stommel, 2018, Wink, 2000). With the development of technology, the possibility of implementing CP in online teaching/learning has been proposed (Williamson et al., 2020). Therefore, education adopts a meta-connective teaching approach through the use of digital tools, which mirrors the transformative characteristics of the digitally interconnected world (Dreamson, 2021). This study combines the theoretical framework of critical pedagogy with technology-enhanced language learning. Consequently, it introduces a technology-infused approach to critical pedagogy. The theoretical premise of this possibility is that current global trends, technologies, innovations and advances of the fourth industrial revolution are already affecting all aspects of human life, work and relationships. This effect is expected to continue as this development expands. With globalization and the rise of cyber communication, the use of technology in teaching English has become essential for effective communication and collaboration anywhere in the world. Therefore, technology enhanced language learning has become an increasingly important determinant of quality educational provision (Barjesteh & Frouzandehfar, 2022). The educational system is not exempt from the influence of the trends and technologies of the fourth industrial revolution. The interface between CP and technology is that

both strive for transformation (Gao et al., 2020). Both have the power to change and empower culture (McLaren, 1995). With the development of the social networks, professional and social interactions have changed significantly, leading to the formation of an online network culture (Carvalho & Ivanov, 2024). The contribution of technology in many fields, including education, is significant (Gao et al., 2020). Thus, CDP as a hybrid pedagogy is a methodological approach to language teaching and learning that employs a participatory approach to bridge the gap between teachers and students and between classrooms and the world in an online environment (Morris & Stommel, 2018).

## 2.2 Critical digital pedagogy

Scholars, researchers, policymakers, and program administrators are increasingly utilizing mobile technologies to assist marginalized or underprivileged communities in enhancing their learning experiences in a more effective and suitable manner (Dreamson, 2021). Such technologies can assist students and educators in navigating the challenges and opportunities presented by our complex, interconnected world, fostering greater cultural and ethical awareness at the intersection of education, research, and technology (Baako & Abroampa, 2023). Through the use of digital tools, education adopts a *meta-connective teaching approach* that mirrors the transformative nature of the digitally connected environment (Dreamson, 2021). Delving into the realm of *meta-connective learning* introduces various novel ideas such as digital identity development, emerging communities, collaborative learning, interdisciplinary and transdisciplinary knowledge creation, teacher perspectives on the link between learning and technology, student engagement and online interaction, transformative digital literacy, analysis of technology integration frameworks, strategies for authentic digital participation, and meta-connective ethics (Dreamson, 2021). Such concepts formulate the principles of CDP. The theoretical underpinning of CDP deeply rooted in CP. Coles (2024) describes CP as an innovative educational method that goes beyond traditional teaching methods focused on the teacher imparting fixed knowledge to students. This participatory and empowering pedagogy aims to create classrooms that provide opportunities for growth. Students are motivated to analyze their surroundings and cultivate the necessary qualities to be mindful, politically informed, and socially

accountable. It is a teaching and learning method focused on fostering independence and empowering students (Barjesteh, 2019). According to Morris and Stommel (2018), students become more proficient in using technology when they critically analyze its nature and impact. They outlined the key characteristics of CDP as: (a) focuses on community and working together; (b) needs to embrace diverse, global perspectives, leading to the need for innovation in how communication and collaboration occur across cultural and political divides; (c) cannot be limited to one perspective but should encompass a variety of voices; and (d) should be applicable beyond traditional educational settings. CDP challenges the traditional method of teachers simply imparting knowledge to students, often referred to as *banking education*. In this approach, teachers are seen as oppressive figures who deposit information into students who are viewed as passive recipients. More specifically, the teacher is seen as an active agent, while students are viewed as "objects" reliant on the teacher for knowledge about the world (Freire, 1969). Banking education hinders communication and social reflection, critical thinking, and action on shared issues (Galloway, 2019). This lack of interaction with others and the world leads to students having a limited awareness of their surroundings. They possess a simplistic or distorted understanding that hinders their grasp of the true nature of a repressive society, thus limiting their ability to take action and effect change (Coles, 2024). CDP focuses on the notion that a classroom environment should empower students to engage their own intellectual capabilities, rather than prompting discussion around predetermined issues, thereby fostering dialogue between teachers and students (Gonye & Moyo, 2023; Timotheou, et al., 2023; Vataaja, 2021). In Freire's (1969) words, teaching is a collaborative process where individuals learn from each other through the guidance of a teacher. One way to enhance student learning and facilitate knowledge construction is through the effective use of dialogue and the active involvement of both teachers and students. Both teachers and students play a dual role where students are actively engaged, and teachers assist students in expressing their thoughts and sharing authority with them.

### *Works done*

Boczar and Jordan (2022) examines the integration of CDP in virtual instruction for special collections during the COVID-19 pandemic. Amidst pandemic-induced challenges,

the University of South Florida Libraries swiftly adapted to online instruction, ensuring continued access to materials. This study highlights the importance of critical digital pedagogy in overcoming pandemic obstacles and showcases innovative virtual instruction methods, enriching student experiences and broadening access to library resources. Masood and Haque (2021) also investigated the evolution of CP into critical digital pedagogy (CDP) and proposes a prospective model for its implementation in EFL classrooms. Today, CDP has become widely recognized and utilized as a pedagogical approach. CP is characterized as a context-specific pedagogy and a platform for community engagement, facilitating knowledge exchange among learners from diverse backgrounds (Pouwels, 2023). It challenges traditional teaching methods, which have been criticized for stifling student potential. Paulo Freire, a seminal figure in the CP movement, advocated for problem-posing education as an alternative to traditional teaching paradigms (Coles, 2024). Despite its conceptual popularity, there remains ambiguity regarding the precise definition and practical implementation of CP in traditional EFL learning contexts. Masood and Haque's (2021) study delves into the core concepts of CP and addresses the challenges associated with implementing CDP in EFL classrooms. By proposing a model for its implementation, the study aims to provide clarity and guidance for educators seeking to integrate CDP principles into their teaching practices. In today's educational landscape, characterized by the widespread adoption of blended learning approaches, CDP offers a flexible and transformative alternative to traditional teaching methods, promising to reshape the dynamics of learning in EFL classrooms. Smith (2021) underscores the potential of CP to transform teaching practices in higher education, particularly in the realm of digitalization of informal education. By addressing gaps in existing literature and proposing innovative assessment strategies, the study advocates for the widespread adoption of CDP principles in higher education settings. Smith (2021) traces the historical development of CP literature, noting its increasing prominence in academic discourse over the years.

Recently, Bendraou and Sakale (2023) explores the impact of CP on value-based education and its influence on social thinking, education based on values, and intercultural understanding. CP, viewed as a transformational approach, questions the purpose of providing students with information

and emphasizes the development of self-awareness regarding social realities. The researchers advocate for CP as an inclusive approach that enables teachers to tailor their instruction to meet students' needs and foster creativity. The study's findings indicate a significant impact of CP on value-based education, suggesting the implementation of critical literature to further enhance CDP for educational outcomes. Bendraou and Sakale (2023) propose that such pedagogical approaches are instrumental in developing the diverse skill set required for 21st-century students. They recommend further research, particularly focusing on teacher training to align with the demands of the new digital era, thereby ensuring the continued efficacy of CP in education. Köseoğlu et al., (2022) examine the application of CP in higher education, particularly in response to the challenges posed by digitalization and the COVID-19 pandemic. The researchers highlight criticisms of formal education, noting its inflexibility and failure to foster students' potential. This dissatisfaction led to a comparison with higher education, where CP has been utilized despite budgetary constraints and reliance on digital technologies provided by external sources. Köseoğlu et al., (2022) argue that CDP is relevant not only for educators but also for anyone involved in higher education. It fosters self-understanding and emphasizes the importance of human connection in learning. Learning through digitalized CP begins with social experiences and emphasizes democratic teaching practices that resist authoritarianism.

### **3. Methods**

#### **3.1 Participants**

In the present study, a sample of 422 EFL teachers participated in two phases: (a) the construct definition and instrument validation phase, and (b) the practicality phase. For the validation phase, ten associate professors in the field of applied linguistics were selected through convenience sampling to give their opinions on the item pools. They were four males and six females, with varying levels of teaching experience, spanning from a minimum of 17 years to a maximum of 28 years. Their ages ranged from 42-55. Second, to have a more inclusive sample, a total of 412 EFL instructors from different contexts and from a wide range of teaching experience participated in the study. They had the experience of teaching in different working contexts at

language institutes, state/private high schools, or colleges. Specifically, they were private EFL teachers ( $n = 259$ ), assistant professor ( $n = 116$ ), and associate professor ( $n = 37$ ) who were selected through snow ball sampling procedure. The participants aged between 42 and 55 ( $M = 46.04$ ,  $SD = 4.73$ ). Among them, there were 214 male teachers (52%) and 198 female teachers (48%). Varying in teaching experience ranged from 10 to 25 years.

A detailed account of the participants can be found in **Table 1**.

### 3.2 Data collection

With the absence of a reliable and valid CDP scale, this study aims to develop a technology-laden CP in order to implement the principles in the EFL classrooms. Accordingly, a quantitative method was adopted to collect the data. Initially, the researchers drew on the L2 professional literature as a springboard to develop an item pool. It aimed to elicit participants' awareness of the CDP aspect of language. To develop a CDP principles, the L2 professional literature was extensively searched with the hope of finding a model within the framework of CDP that could be implemented in the EFL context. After a long and extensive search, the researcher became convinced of the necessity of developing the required scale. In this phase, a CDP scale was introduced through extensive literature review. After proposing the CDP scale, the following steps were taken to examine the validity of the scale. Specifically, an item pool ( $n = 35$ ) was extracted based on the elicited themes in the earliest draft of the CDP scale. Next, some preliminary validation (e.g., finalizing item wording, checking the content validity, and the scale format) was taken for developing the scale. Notably, the researcher and three experts in the field discussed and reviewed the item pool carefully. To assure an acceptable level of content validity, a panel of ten associate professors were inquired to provide feedback on, comprehensibility, readability, specificity, fairness, and relevance. After collecting their notes and feedback on the first draft, 5 items were removed, and some items were reworded or rephrased to increase their clarity. Accordingly, 30 items in 7 domains was proposed. Finally, seven EFL teachers were inquired in a think-aloud session to read the scale and elaborate on its clarity with the hope to understand all the items. The retained items were subsequently validated in a separate sample of professional

experts, providing strong evidence for its structural validity and reliability. Notably, to check the reliability, researcher distributed the CDP via the Porsline platform among private EFL teachers.

### 3.3 Instruments

The relevant literature for the content of the CDP scale consisted of CP, critical thinking, dialogic pedagogy and digital education in ELT. One of the most influential and widely recognized works on this subject is *Linguistic imperialism* by Robert Phillipson, published in 1992. Additionally, scholars such as Canagarajah (2005), Pennycook (2006), and Kumaravadivelu (2006) have also made significant contributions to this field. Due to the emergence of digital education and certain significant global events, it appears that digital transformative education is bound to occur. As a result, the concept of democracy in digital learning environments has been introduced in professional literature. Several notable studies have been conducted in this area. For instance, Köseoğlu et al., (2023) made significant contributions to the field with their work on CDP in higher education. Fovet (2023) explored the impact of neo-liberalism on digital higher education, shedding light on this important topic. Gonye and Moyo (2023) delved into the intersection of CDP and indigenous knowledge, offering valuable insights. Luna-Thomas and Romero-Hall (2023) focused their research on culturally relevant pedagogy in digital praxis, making noteworthy contributions to the field. These are just a few examples of the commendable studies conducted in this area. The writings of these works consistently centered around enhancing the importance of democracy through the utilization of digital learning environments. As a result, this central theme became the foundation of the CDP scale. Significantly, approximately 500 lines were extracted and subsequently condensed as the fundamental substance (referred to as elicited themes), which were then further refined and transformed into items. This collection of items was considered as a starting point to evoke themes using a 5-point Likert CDP scale.

#### *CDP Scale*

The CDP Scale was designed in the first phase of the study to uncover extent to which EFL professional experts endorse the developed scale. The scale comprised 27 items with a 5-point Likert-type scale. It covered different com-

**Table 1.** Participants' Demographic Information.

Private EFL Teachers	Academic degree		Gender		Age	Teaching experience
	Assistant professor	Associate professor	Male	Female		
-	-	-	-	-	42-55	17-28
259	116	37	214	198	42-55	10-25
62.8%	28%	8%	52%	48%		
Total 412			50.67%	49.32%		

ponents, each having three to five relevant principles. After undergoing some steps to ensure its preliminary and final validation, which are explained in detail in the procedure section, the final draft of the CDP scale (**Appendix A**) was driven in seven domains as follows: Native-speakerism (1-5); monoculturalism (principle 6-10); learning outcomes/objectives (11-16); learning skills (principle 17-21); digital resources (22-24); assessment and evaluation (25-27); and the role of teachers and learners (28-30). The overall internal consistency of the scale calculated through Cronbach's alpha was 0.89

### 3.4 Data analysis

This research is a quantitative study utilizing a survey method for data collection (Creswell, 1998). To develop the scale, both preliminary and final validations were performed. The preliminary credibility was run for the content validity, and the final validation was implemented to test the reliability and confirmatory factor analysis. At this stage, some statistical measures (i.e., the Cronbach's alpha, Kaiser-Meyer-Olkin, Bartlett's Test, principal component analysis, exploratory and confirmatory factor analysis) were employed using the SPSS and AMOS software to check the internal consistency and construct validity. Specifically, Pearson correlation matrix and the Promax rotation test were used to confirm the appropriateness of the CDP. Afterwards, a SEM approach was used to examine the external validity of the newly developed scale. In so doing, chi-square and goodness-of-fit index (GFI), and approximation errors with the following classifications were employed: the root mean square error (RMSEA), the Tucker-Lewis index (TLI), and the comparative fit index (CFI).

## 4. Results

### 4.1 Analysis of the first research question

Following the theoretical and research bases, the items of the CDP were proposed. Next, some preliminary validation (e.g., content validity ratio and content validity index) were conducted by a panel of 10 experts. Then, the adequacy of the correlation matrix was initially checked. Specifically, Bartlett's test of Sphericity and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy were conducted to screen the suitability of the data for the factor analysis (See **Table 2**).

**Table 2.** KMO Measure of Sampling Adequacy and Bartlett's Test of Sphericity.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.912
Bartlett's Test of Sphericity	22366.013
Df	435
Sig.	0.000

As shown in **Table 2**, the Bartlett test of Sphericity is significant ( $\chi^2(435) = 22366.013, p < 0.000$ ) and the KMO result ( $KMO = 0.912$ ) is higher than 0.80, indicating that the data are suitable for factor analysis. (Field, 2013). Therefore, the correlation matrix is sufficient for exploratory analysis. **Table 3** illustrates the initial eigenvalue data and the amount of variance account for after rotation.

The preliminary factors were decided by parallel analysis. In particular, items loading  $\geq |0.30|$  on a component were considered in the respective factor. Thus, seven factors were confirmed in the parallel analysis. The obtained value indices of the components explained 94.60% of the total CDP variance. Notably, the post-rotation data indicates that seven components meet Kaiser's criterion. Besides, the principal component analysis (PCA) with an oblique rotation (Promax) was performed on the 30-item CDP due to the correlation of the items in the scale. The results of the Promax rotation enjoyed the best fit with the logical model and theoretical foundations (**Table 4**).

**Table 3.** Total Variance Explained with Principal Component Analysis.

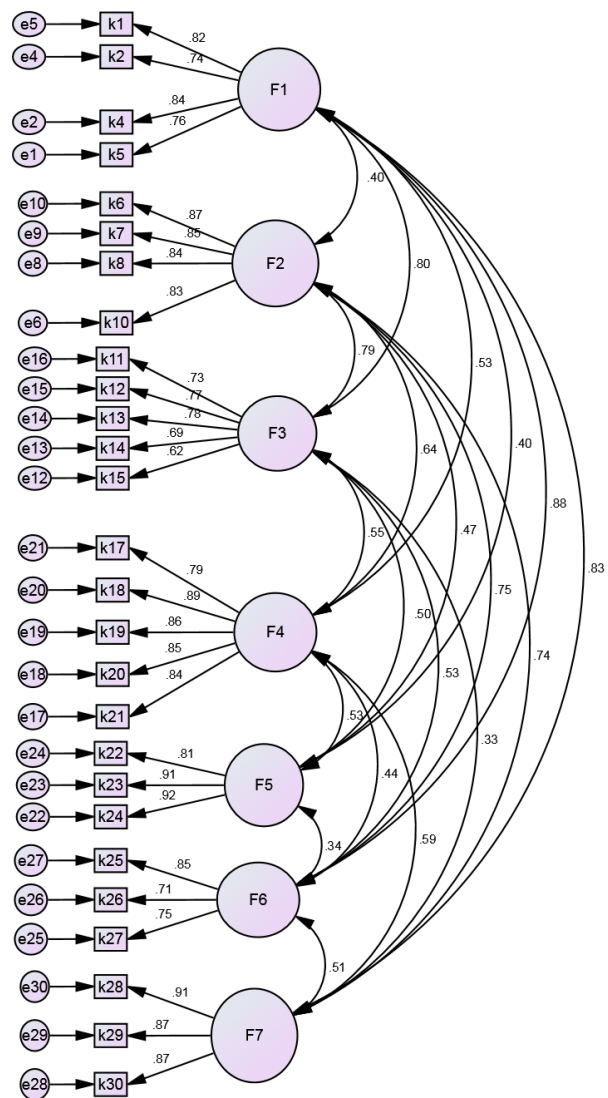
Component	Initial eigenvalues			Rotation sums of squared loadings*
	Total	% of variance	Cumulative %	Total
NS	32.383	94.609	64.609	55.083
MNS	28.373	77.909	72.519	46.214
LO	22.537	55.123	77.642	31.750
LS	15.034	39.446	81.088	23.069
DR	11.892	32.974	84.062	18.348
AE	7.641	22.136	86.198	12.571
RTL	4.597	11.992	94.190	7.758

Note: NS = Native-Speakerism; MNS = Monoculturalism Native-Speakerism; LO = Learning outcomes/objectives; LS = Learning Skills; DR = Digital resources; AE = Assessment and evaluation; RTL = Role of Teachers and learners.

**Table 4.** Matrix of Factor Indices After Promax Rotation.

Item	1	2	3	4	5	6	7
1	0.880						
2	0.929						
3	<b>0.254</b>						
4	0.874						
5	0.967						
6		0.897					
7		0.809					
8		0.843					
9		<b>0.177</b>					
10		0.811					
11			0.852				
12			0.863				
13			0.891				
14			0.892				
15			0.953				
16			<b>0.132</b>				
17				0.956			
18				0.889			
19				0.813			
20				0.848			
21				0.791			
22					0.806		
23					0.854		
24					0.855		
25						0.923	
26						0.911	
27						0.929	
28							0.896
29							0.955
30							0.921

It should be noted that items with loading factors below 0.3 were removed. This led to the decision to remove three items (i.e., item 3, 9 and 16 of the first, second and the third components respectively) due to low factor loading. **Figure 1** indicates construct validity model along with standardized prediction statistics.



**Figure 1.** Tested construct validity model along with standardized prediction statistics.

As three items appeared to be problematic in assigning to their factors, the Promax rotation test was used to test the



factor structure of the CDP. Through this process, 27 items indicated high cross-loadings, representing the conceptualization of CDP in the present study.

**Analysis of the second research question**

To test the external validity of the newly developed questionnaire, the interplays among the constructs were examined using an SEM model. **Table 5** shows the fit indices of the constructs after modification.

**Table 5.** The Model Fit Statistics of the SEM Model after two Steps of Correction.

	$\chi^2$	$\chi^2/df$	GFI	NFI	CFI	RMSEA
CDP	2.460	86	0.999	0.999	0.999	0.037

RMSEA = Root mean square error of approximation; GFI = goodness-of-fit test; NFI = Standardized Fit Index; CFI = Comparative Fit Index.

As shown in the **Table 5**, the model fit indices for the CDP are acceptable ( $\chi^2 = 2.460$ ,  $df = 86$ ,  $CFI = 0.999$ ,  $GFI = 0.999$ ,  $NFI = 0.999$ ,  $RMSEA = 0.037$ ). Specifically, the value of RMSEA is equal to .037 ( $RMSEA = 0.037$ ,  $p < 0.001$ ) which indicates that the mean of the squared errors of the model is suitable and the model is acceptable. Also, the chi-square value of the degree of freedom (2.460) is between 1 and 3, and the GFI, CFI, and NFI indices are almost equal and greater than  $\geq 0.9$  indicating that the research variable measurement model is appropriate. Furthermore, this study examined the reliability of the newly developed questionnaire using the Cronbach’s alpha.

As shown in the **Table 6**, the Cronbach’s alphas of the seven components of the CDP reveal high internal consistency. All the subscales met above the optimal criterion limit ( $\alpha \geq 0.05$ ). To test the external validity of the questionnaire, it was concurrently correlated with a critical pedagogy questionnaire (CPQ) developed by (Atai & Moradi, 2016). **Table 7** and **Table 8** illustrate the descriptive statistics and the correlation values among the main components, respectively.

**Table 6.** Cronbach’s alpha reliability analysis.

No	Component	$\alpha \geq 0.05$
1	NS	0.872
2	MNS	0.935
3	LO	0.881
4	LS	0.939
5	DR	0.912
6	AE	0.827
7	RTL	0.911
Total		0.981

The skewness and kurtosis of all variables are within the range between  $-2$  and  $+2$  and between  $-7$  and  $7$ , respectively, representing that the subscales are normally distributed (Kim, 2013). **Table 8** indicate the results of Pearson correlation coefficients between the developed CDP and the CPQ.

As indicated in the **Table 8**, the subscales of CDP and its total score show significant positive correlations. Notably, the seven components of CDP exhibit substantial positive relationships: (NS,  $r = 0.933$ ,  $p < 0.001$ , MNS:  $r = 0.929$ ,  $p < 0.001$ , LO:  $r = 0.961$ ,  $p < 0.001$ , LS:  $r = 0.895$ ,  $p < 0.001$ , DR:  $r = 0.894$ ,  $p < 0.001$ , AE:  $r = 0.848$ ,  $p < .001$ , RTL:  $r = -0.855$ ,  $p < 0.001$ ). Besides, CDP was concurrently correlated with the CPQ. The results showed that the components and the total score of CDP exhibited substantial positive relationships with a CPQ ( $r = 0.433$ ,  $p < 0.001$ ), indicating confirmation of concurrent validity.

**5. Discussion**

In light of several momentous events (e.g., pandemic Covid 19, War, socioeconomic status, and etc.) that have left a lasting impact, and the recent advancement in the digital education in transforming knowledge, this study aims to report on developing and implementing the practicality of CDP scale in the EFL context. Developing the significance of democracy through digital learning environments may be perceived as a noble and unattainable objective, yet it is a goal worth pursuing. Higher education institutions, schools, and colleges are typically not characterized by democratic principles (Barjesteh, 2019; Gonye & Moyo, 2023), as the teachers assume the role of the authority figure to uphold discipline and order within such environments. The notion of enhancing democracy through digital learning environments may initially appear ambitious and unattainable. There is no a clear principle and teaching strategy on CDP. The primary goal of this study was to develop and validate a new CDP scale with robust psychometric properties based on the principles of CP and digital education (Canagarajah, 2005; Fovet, 2023; Luna-Thomas & Romero-Hall, 2023; Pennycook, 2006). To achieve this, a sample of 412 EFL teachers participated in two phases (i.e., validation & implementation). A new 27-item CDP scale with seven components was established, and its reliability and validity were confirmed.

**Table 7.** Descriptive statistics of the components of critical digital pedagogy.

Variable	Mean	Std. deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. error	Statistic	Std. error
NS	13.1650	4.22678	-0.097	0.120	-1.051	0.240
MNS	13.9587	4.41913	-0.343	0.120	-1.029	0.240
LO	15.8034	5.17176	-0.207	0.120	-0.815	0.240
LS	17.6869	5.31870	-0.188	0.120	-1.177	0.240
DR	9.3495	3.53077	-0.254	0.120	-1.065	0.240
AE	10.0850	3.08360	-0.347	0.120	-0.684	0.240
RTL	10.5995	3.29230	-0.249	0.120	-1.039	0.240
TOTAL	90.6481	26.36779	-0.190	0.120	-0.933	0.240

**Table 8.** Matrix of Pearson Correlation Coefficients between the Components with CDP in Concurrent Validity of Divergent Type.

Variable Correlation	1	2	3	4	5	6	7	8	9	
NS	Pearson	1	0.926**	0.878**	0.736**	0.727**	0.819**	0.830**	0.933**	0.401**
MNS	Pearson	0.926**	1	0.845**	0.779**	0.750**	0.755**	0.809**	0.929**	0.433**
LO	Pearson	0.878**	0.845**	1	0.875**	0.931**	0.783**	0.722**	0.961**	0.406**
LS	Pearson	0.736**	0.779**	0.875**	1	0.902**	0.605**	0.656**	0.895**	0.399**
DR	Pearson	0.727**	0.750**	0.931**	0.902**	1	0.646**	0.627**	0.894**	0.386**
AE	Pearson	0.819**	0.755**	0.783**	0.605**	0.646**	1	0.886**	0.848**	0.328**
RTL	Pearson	0.830**	0.809**	0.722**	0.656**	0.627**	0.886**	1	0.855**	0.367**
Total	Pearson	0.933**	0.929**	0.961**	0.895**	0.894**	0.848**	0.855**	1	0.433**
Critical Pedagogy	Pearson	0.401**	0.433**	0.406**	0.399**	0.386**	0.328**	0.367**	0.433**	1
	Sig. (1-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
	N	412	412	412	412	412	412	412	412	412

Note:\*\*. Correlation is significant at the 0.01 level (1-tailed).

To test the external validity, this study concurrently probed the interplay among the dimensions of the CDP with a CPQ.

The first research question concentrated on the fundamental framework of the CDP. The preliminary analysis using CFA among target participants revealed a poor fit of the measurement model to the data. This resulted in the resolution to eliminate some items due to their propensity to cause misconceptions of the components, consequently distorting the factor structure and psychometric properties (Krosnick, 2018). This decision was further influenced by our aim to offer a concise, streamlined version of the scale to enhance its practicality and usefulness (Wieland et al., 2017). The measurement model after the removal indicated a near-fitting measurement model. Considering that the remaining 30 items seemed to be problematic in assigning to their factors, PCA was employed to scrutinize the factorial structure of the CDP scale. This permitted the items to autonomously load onto their corresponding factors, without any pre-assigned determinations. It also enabled the possibility for the items to have the cross-loading. In the course of this procedure, three elements exhibiting minimal factor loading were duly eliminated. The items that were

kept accurately embody the conceptual interpretation of CDP within the scope of this present research. In addition, the remaining items refocus on the native-speakerism, monoculturalism, learning outcomes/objectives, learning skills, digital resources, assessment and evaluation, and the role of teachers and learners. To sum up, utilizing both data-driven and theoretical approaches has resulted in the development of a 27-item CDP scale. The secondary objective of the study was to evaluate the reliability and validity of the developed 27-item CDP, employing a novel set of EFL instructors in a two-tier procedure. During the initial phase, the reliability and validity of the CDP were scrutinized, confirming that the developed scale displayed elevated level of dependability and validity. Phase II further confirmed the concurrent validity of the CDP among the same EFL teachers with a different questionnaire, establishing its generalizability. Overall, the results affirmed the credibility and accuracy of the new version of the CDP scale.

The finding of this study support the previous claim by Wink (2000) stating that learning is not just grounded in the prepared syllabus and the prescribed curriculum. Similarly, the finding supported Barjesteh (2019) who proposed

that teaching through CP help learners go beyond the course content and reconstruct the subject knowledge through dialogical interaction, negotiation and reflection. The results also echo Ipek et al., (2023) who acknowledged the integration of technology to the educational environment. Ipek et al., believe that Performing high level cognitive skills such as the production, analysis, and synthesis of information through technological means has created a new paradigm in education. Developing and validating a technology-laden CP based release enlightening issues regarding the applicability of CDP in EFL teacher education. The findings have theoretical and pedagogical implication for the educational setting. The rapid advancement of technology and globalization is presenting us with novel difficulties and a significant transformation. The extensive integration of global trends, innovations, technologies, and advancements with CP have transformed the standard of education. The impact of this integration is so extensive that it permeates all aspects and institutions of education. Despite its novelty, complexity, uncertainty, and ambiguity, we can be certain that it will result in swift, significant, and far-reaching transformations in many areas, particularly EFL teacher education. As a result, our reaction to this integration must be comprehensive and unified, involving all stakeholders across the educational community. The findings have implication for the EFL teachers and the curriculum planners to incorporate the principles of CDP extracted in the present study. Similarly, teachers and language practitioners as well as the educators may transform the current status of the system with a technology-laden CP-based framework. Considering the scale developed and validated among the target participants using a meta-connective attitude questionnaire for the online classrooms, such principles can be implemented in the EFL/ESL classrooms to examine the practicality of the CDP scale in the classroom. Besides, similar study can be conducted to unveil both teachers and learners attitudes with different instruments such as reflective journal, journal diary, or observation using the ground theory.

## 6. Conclusion

This study developed, validated and implemented a new 27-item CDP in two quantitative and qualitative phases. Initially, a rigorous validation was taken to obtain the CDP

adequate content, construct and convergent validity. This has confirmed the applicability, and stability of the CDP, laying the foundation for the later use of this scale. The findings further confirmed the external validity of the questionnaire by revealing positive interplay with the CPQ. The model considers digital technology, reflection and democracy as a cycle of reflection and online learning by embracing learners' needs, and cultivating their personal growth in their social, cultural and political aspects. The scale proposed that digital materials should inspire learners to develop their critical literacy skills and to reflect on their learning experiences by establishing a connection between knowledge and real-life scenarios. The CDP suggests that language teaching should co-built around customizing instructional resources for learners' local culture and ideologies and valuing learners' mother tongue as well as non-native teachers. There were some limitations in this study that should be considered when interpreting the results. First, due to certain limitations, the researcher could not select participants from a larger population and had to rely on existing teachers using a non-random convenience sampling method. The teachers who participated in the study were mostly private EFL teachers. Variation in different academic degrees in different positions may change the result. Therefore, care must be taken in extrapolating the results of the study to a wider educational context. Second, research is still in its early stages and further validation may be needed before the CDP scale can be widely used. The research focuses on EFL teachers, so the generalizability of the results to other disciplines may be limited. Focusing on a specific population and the possibility of bias in the selection of participants weakens generalizability. Therefore, some other studies can be conducted with other population groups, such as ESP and ESL teachers, to test the practicality of the CDP scale.

## Author Contributions

Conceptualization, methodology, formal analysis, Hamed Barjestesh and Mehdi Manoochehrzadeh; writing—original draft preparation, Hamed Barjestesh; writing—review and editing, Subashini K Rajanthran and Maya Shakiyeva. visualization, Mehdi Manoochehrzadeh; supervision, Hamed Barjestesh and Subashini K Rajanthran project administration, Mehdi Manoochehrzadeh; funding acqui-

sition, Subashini K Rajantran and Maya Shakiyeva. All authors have read and agreed to the published version of the manuscript.

## Conflicts of Interest

The authors declare no conflict of interest.

## Data Availability Statement

The CDP scale and the data are accessible through email, or Whats-app of the corresponding author. (habar77@yahoo.com).

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## Appendix A. Critical digital pedagogy scale

Components	Principles
1. Native-Speakerism	P1. Digital materials created by native speakers possess an equal level of reliability as those developed by non-native speakers P2. Digital materials should assist non-native teachers in creating customized instructional resources for their local context *P3. It is not fair to hold students accountable for pronouncing English words like a native speaker P4. To acquire genuine proficiency in English, it is advisable not to rely exclusively on English digital resources created by native English speakers P5. Teaching English can be facilitated using a combination of the English language itself and the learners’ mother tongue.

<b>Components</b>	<b>Principles</b>
2. Monoculturalism	<p>P6. Digital books should demonstrate that local culture is just as valuable as Western culture</p> <p>P7. Digital resources can serve as powerful instruments to advocate for local ideologies rather than Western ideologies</p> <p>P8. Participants should engage in discussions on cultural and political topics of significant importance when utilizing digital materials</p> <p>*P9. Third-World nations ought to develop their own English Language Teaching resources for reasons rooted in politics and ideology</p> <p>P10. Teachers must exercise caution in avoiding the endorsement of Western customs and traditions within digital materials</p>
3. Learning outcomes/objectives	<p>P11. Digital resources should serve as a source of inspiration for students to reflect on their learning experiences by establishing a connection between knowledge and real-life scenarios.</p> <p>P12. Digital resources encourage learners to prioritize the process of constructing meaning by incorporating their sociopolitical background</p> <p>P13. Digital material should allocate a significant amount of time and effort towards engaging in reflective tasks</p> <p>P14. Digital materials ought to encompass a harmonious blend of fostering social development and enhancing language skills</p> <p>P15. Teaching English can be effectively conducted using both the native language and the target language</p> <p>*P16. Digital resources should progress from prior knowledge into the new context, gradually introducing learners to the hidden curriculum</p>
4. Learning Skills	<p>P17. Digital resources should engage students in meaningful dialogic interaction that enhances their understanding of the world</p> <p>P18. Digital materials should strengthen specific worldviews through meaningful engagement between teacher and learners</p> <p>P19. Materials should help learners' develop self-directed learning skills by incorporating real-life situations and sharing students' experience in all skills</p> <p>P20. Digital material is to assist learners in developing their critical literacy skills when it comes to generating and formulating problems</p> <p>P21. Digital resources should gradually cultivate learners' personal growth in their social, cultural and political aspects.</p>
5. Digital resources	<p>P22. Digital resources should offer learners multiple chances to extract information from genuine materials in no fixed curriculum (i.e., flexible)</p> <p>P23. Students and teachers work together with various media (e.g., MOOCs, blogging) to develop adjustable curriculum through dialogic exchanges</p> <p>P24. Social media platforms (Facebook and twitter) should be used to provides learners with an international audience to voice their stance against social injustices</p>
6. Assessment and evaluation	<p>P. 25 Alternative assessments should be used to evaluate both students' critical language awareness and their linguistic skills</p> <p>P26. Teachers help students to self-assess themselves in determining the learning outcomes</p> <p>P27. Students ought to be provided with implicit feedback, and reflect upon their progress till the last day</p>
7. Role of Teachers and learners	<p>P28. When developing Digital resources, it is crucial to consider the role of the teacher as a co-learner, coordinator, and problem poser</p> <p>P29 Classmates are dynamic individuals who evaluate each other's' performance through peer discussions and peer feedback</p> <p>P30 The CDP-oriented classroom is student-centered and a social justice movement concentrates its content on social critique and political action</p>

\*Three items (i.e., item 3, 9 and 16) were removed due to low factor loading.