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Developing and Validating an Attentional Literacy Model for Language Learners: A Fuzzy Delphi Study

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ABSTRACT

In a world with multifarious sources of disarrays, learners must be equipped with many literacies to handle their learning challenges. As a macroliteracy, attentional literacy refers to the learners' awareness of maintaining their attention on the information from the self, others, and the environment without being judgmental toward differing viewpoints and contexts. Assuming attention as not purely cognitive but social, cultural, affective, and technological, the researchers could not find any theoretical model underpinning different dimensions of attentional literacy in the literature. This study aims to develop a conceptual model of attentional literacy for English language learners. Using a Fuzzy Delphi Method, we surveyed the related literature to identify the factors of attentional literacy. We proposed an initial model with six factors and a list of measures which, after preliminary proofreading and piloting, was administered to a group of 20 experts in two rounds. The results of Fuzzy Delphi led to the conceptualization of a new attentional literacy model comprising two dimensions (internal and external), five factors (cognitive, socio-emotional, environmental, technological, and pedagogical), and 40 measures. The findings cast light on the theoretical foundations of attentional literacy and elucidate the dimensions, factors, and measures for language learners. Pedagogical contributions are discussed for researchers in language education.

KEYWORDS: Attentional literacy model; Fuzzy Delphi method; Cognitive factors; Socio-emotional factors; Twenty-first-century literacy

1. Introduction

The new millennium emerged with new complexities brought to the everyday life of the students which are the sources of many disarrays. The multiple sources of information have overwhelmed their personal and academic life which can easily hinder the learning process. The bulky literature delineated it to such factors as motivation (e.g., Dornyei, 2020; Dornyei & Ushida, 2021), willingness to communicate (e.g., Henry & MacIntyre, 2024; MacIntyre & Wang, 2021), learning style/strategies (e.g., Griffiths, 2018; Oxford, 2017), anxiety (e.g., Horwitz, 2010; Teimouri et al., 2019), etc. However, some studies have revealed that one factor which has remained overlooked and unaddressed is attention (e.g., Komorowska, 2021). It is further believed that inattention is among the major sources of students' deficiency in their academic performance (e.g., Arnold et al., 2020; Gray et al., 2017; Mohebbi, 2023). Some also affirmed that corrective feedback types embedded in negotiated interaction can help learners notice the erroneous language (Long, 1996, Ziaei & Dabaghi, 2023).

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The process of second language acquisition like other type of learning, entails factors which are both internal and external. Besides social, cultural, and political factors, there are some learner internal factors which deal with the processes enabling them to streamline their language learning. From a cognitive perspective in second language acquisition, the mental process of language learning entails "general approaches to learning adopted by the learners" and "specific … operations involved in different stages of acquisition" (p. 434) which Ellis (2008) referred to them as macro- and micro-processes respectively. Macro-processes like intentional/incidental learning or implicit/explicit learning have received considerable attention from scholars in SLA. However, the micro-processes like attention have not attracted the deserving attention of the studies. This might be due to the fact that the concept seems more of an interdisciplinary issue which is concerned with the fields like psychology, neurology, and physiology rather than solely pedagogy and education. Validating this model is essential as it enhances understanding of attentional dynamics—cognitive, social, and technological—impacting language learning process. By establishing a comprehensive framework, the study contributes to pedagogical strategies that foster effective learning environments in increasingly complex educational contexts. This study is also significant in that it primarily addresses attentional literacy as a new multidimensional concept through the prismatic lens of cognitive, psychological, ecological, pedagogical, and technological perspectives in language learning which has not been, to the humble knowledge of the researchers, probed yet. Moreover, following the recommendation of Sterling et al. (2023), this study adopted Delphi method which is limitedly used in applied linguistics and its "iterative process and community-driven nature of knowledge creation" (p. 9) can provide the field of applied linguistics "with additional validity arguments" (p. 9).

2. Literature review

There is no unanimous agreement among the scholars in education at large on the term attention. According to James (1890), attention is defined as "taking possession of the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought" (pp. 403-404). Later scholars defined it as the degree a person orients or channels his senses to an object, event, or information and ignores other stimulants in the environment (Ott, 1994). American Psychiatric Association (2013) defined behavioral inattention as a number of observable behaviors which indicate distractibility, challenges in organization, forgetfulness, and difficulties in following directions and attending to pertinent stimuli. These symptoms either mild or severe are very crucial in the process of learning. In recent years, Melo et al. (2024) defined it as "a cognitive process that allows selective concentration on one aspect of the environment while ignoring others" (p. 835). As can be inferred from all the above definitions, the factors of concentration, selection, and a single object or action to attract attention are all common in these propositions.

Attention plays a crucial role in second language (L2) learning as it influences the processing and acquisition of new linguistic information. The ability to effectively allocate attentional resources can significantly impact language learning outcomes. Historically, the concept of attention was represented in terms of consciousness. Unlike the behaviorists who took a positivistic approach claiming no integration of conscious awareness in their learning framework, cognitivists view attention as a conscious process in which working memory is involved. Many related theories were proposed by the proponents of cognitivism such as acquisition versus learning (Krashen, 1981), noticing hypothesis (Schmidt, 1994), controlled versus divided attention (Eysenck, 2001), theory of attention (Tomlin & Villa, 1994), input processing (VanPatten, 1996), and multiple-resources model (Robinson, 2003).

Besides the intrinsic factors like the role of attentional control, working memory capacity, and executive functions in shaping attention, extrinsic factors can also play a key role in maintaining and managing attention in the process of language learning which underlies the tenet of the sociocultural paradigm shaping the theoretical foundation of this study. Sociocultural perspectives on attention focus on the socio-cognitive and external factors that influence attentional processes. These perspectives consider how attention is shaped by the social and cultural contexts in which individuals are embedded. Factors such as cultural norms, social expectations, and environmental influences are believed to impact attention to a considerable extent (Schepers, 2007). According to Piaget's theory of sociocultural theory, learners actively construct knowledge through assimilation and accommodation. Attention is considered a vital component in this process as it enables learners to select and focus on relevant information, facilitating the integration of new knowledge with existing cognitive structures (Chapman, 1987). In the sociocultural paradigm, attention is viewed within the context of social interaction and cultural mediation. Vygotsky's sociocultural theory underlines the role of interaction in the development of cognition. Attention, in this framework, is seen as a socially mediated process that is influenced by the cultural tools and practices of a particular community (Vygotsky, 1994). According to Vygotsky, individuals acquire attentional skills through their interactions with more knowledgeable others, who provide guidance and scaffolding to support their learning. Learners notice and attend to specific aspects of the learning environment based on the guidance and support provided by more knowledgeable others. Through social interaction, learners develop the ability to notice and attend to culturally relevant information, which contributes to their cognitive development (Rogoff, 1990).

A question naturally arises here: Is it only a matter of *having* attention or *managing* it? With the turn of the century and the essential role of literacies in fulfilling the aims of everyday life, attention is viewed as a form of awareness that might foster mindful living. According to Pegrum and Palalas (2021), attentional literacy (AL) is a term that encompasses the ability to effectively manage and direct one's attention in an increasingly distracting world. In contemporary society, individuals are incessantly exposed to a constant influx of information from diverse sources, such as social media, television, and advertisements. This persistent influx of stimuli can often lead to attentional overload, making it challenging for individuals to focus on important tasks and make informed decisions. Therefore, AL plays a crucial role in enabling individuals to navigate this information-rich environment and make optimal use of their attentional resources.

In recent years, AL has gained significant attention from researchers and scholars in various fields, including psychology, neuroscience, and education. Several studies have explored the impact of attention on cognitive processes, such as learning, memory, and decision-making (Berger et al., 2023; Español-Martín et al., 2023; Miyadera, 2024; Nurmuhammad, 2023; Stewart & Swanson, 2024; Stevens et al., 2024). These studies have indirectly highlighted the importance of AL in enhancing these cognitive functions and improving overall performance. AL is a multidimensional construct that encompasses the ability to effectively manage and direct one's attention. It plays a critical role in various aspects of life, including education, cognitive processes, emotional well-being, and mental health. The growing body of research on AL highlights its significance in today's information-rich society (e.g., Palalas, et al., 2024).

In a world flooded with information, especially through digital media and exposure to countless sources, attention deficits or distractions are more prevalent than ever. In education, AL is investigated to be the source of educational/academic failure (Pegrum & Palalas, 2021) and challenges such as depression and anxiety, addictive behaviors, and prosocial attitudes (Bonnardel et al., 2018; Melo et al, 2020) which need further attention. Moreover, in the cognitive era, attention, or what they called attentional control theory (Eysenck & Derakshan, 2011), was traditionally seen as a unidimensional concept focusing on the quality of information processing from sensory input to short-term memory and finally to higher-level information processing. This narrows the concept of attention into only one of its subsections defining it solely within the realm of cognition. Literature is rich investigating attentional control theory in language learning environment (e.g., Dong & Li, 2020; Finneran et al., 2009; Martínez-Vicente et al., 2023; Taghavi-Nejad et al., 2024). In recent years, under the influence of sociocultural paradigm, attention is not seen as a single unidimensional system, but as a complex idea made up of different parts, called attentional systems (Issa & Morgan-Short, 2019). These include an external system that is affected by outside cues related to how we sense things and an internal system that is shaped by the information we create ourselves. This model has been applied quite recently to investigate the effect of variations of input enhancement in L2 learners' vocabulary (Liu et al., 2024). In the sociocultural paradigm, attention is viewed as a multidimensional concept (Yip, 2023; Yip et al, 2023) which entails psychological, affective, cultural, and ideological perspectives as well. Meager literature is available on this last issue. Furthermore, with the recent rise of attentional literacy, as a newly developed concept, it appears to be an underexplored area within the field of second language acquisition. A comprehensive framework that conceptualizes the underlying dimensions and factors is also lacking, one that considers it not merely as a cognitive concept but also as an emotional, social, cultural, or technological one. This conceptualization is the first step to developing a scale to measure one's level of attentional literacy. To this end, the reported study primarily aimed to identify the dimensions, factors, and measures of attentional literacy by adopting a fuzzy Delphi method and subsequently providing a conceptual framework.

2.1. The initial proposed model

Based on the thorough review of the literature adopting a phylogenetic approach and presenting the concept of attention from a historical, theoretical, and developmental perspective as briefly reported in the previous section, the researchers have attempted to conceptualize a new model of attentional literacy. The proposed model consists of six main factors: cognitive, mindfulness-related, technological, psychological, environmental (social & physical), and pedagogical.

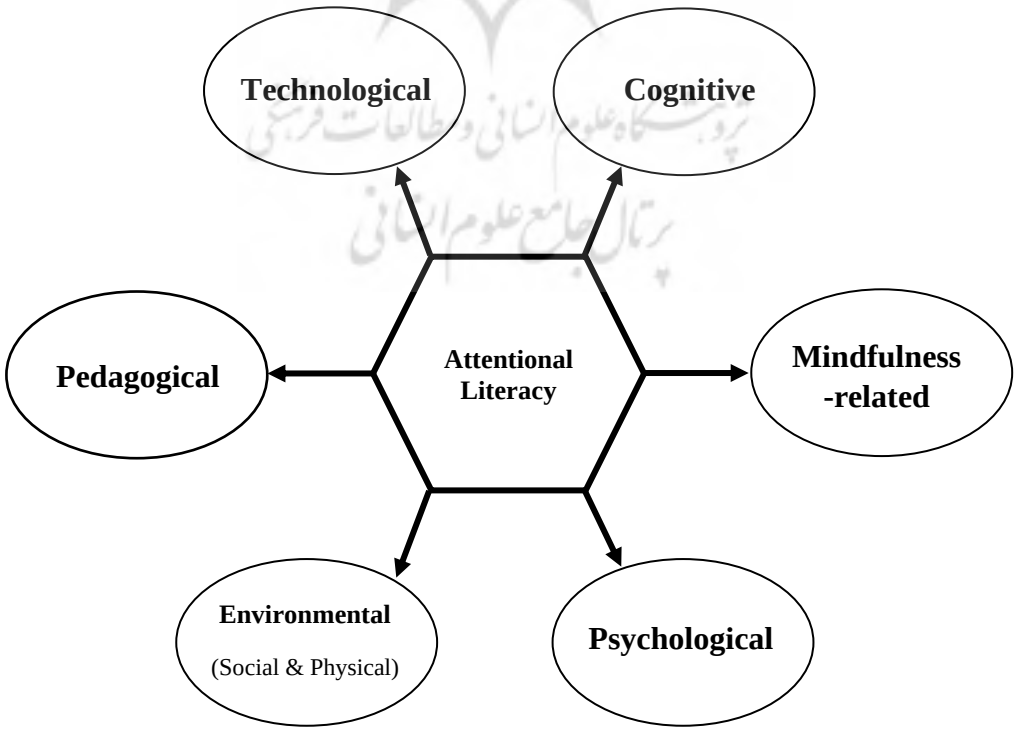

Figure 1. The initial attentional literacy conceptual model

2.2. Fuzzy Delphi method

The Fuzzy Delphi Method (FDM) is a research method which marries the Delphi method with fuzzy theory. The history of the Delphi Method dates back to the 1950s with RAND Corporation and was later presented by Dalkey and Helmer in 1963. In the Delphi Technique, the researcher seeks the consensus of a group of experts' opinions by systematic administration of a questionnaire to collect their judgment and justification. In many such situations, the experts' judgment cannot be understood in the form of definitive values or numbers. In other words, quantitative values and numbers fall short of accurately describing real-world systems due to the inherent ambiguity and uncertainty present in the judgments of those deciding within an expert panel. To overcome this problem, the theory of fuzzy sets or fuzzy theory presented by Zadeh (1965) can be used to deal with this ambiguity and uncertainty in the decision-making process. FDM is a kind of Delphi method that incorporates fuzzy theory to diminish the subjectivity of the results of the Delphi method by converting linguistic scale into fuzzy scale, item verification (fuzzification), and defuzzification. Like Delphi method which is used quite rarely in language education (e.g., Bulusan, 2024), the FDM has recently been adopted in studies with an exploratory nature within the field of language education (e.g., Ghani et al., 2024; Luo et al. 2024).

To fulfill the purpose of the study, the following questions were posed:

RQ1: What are the dimensions, factors, and measures of the attentional literacy conceptual model among language learners based on the expert agreement?

RQ2: What are their positions in the newly proposed model?

3. Methodology

3.1. Design

This is a multi-phase fuzzy Delphi study intended to validate the measures synthesized from the relevant literature. The study included two rounds of commenting from a panel of experts and analyzing the results by the researchers. It required two rounds to reach a final consensus about the dimensions, factors, and measures of the concept of attentional literacy. Attentional literacy was first raised in the conceptual research by Palalas and Pegrum (2021) who revised the term and reconceptualized the notion in 2021 and subsequently researched its application in online learning three years later (Palalas et al., 2024). Their definition of attentional literacy was a trigger to delve into the literature and survey its theoretical underpinnings along with the empirical research in the related fields.

3.2. Expert panel

The expert panel was comprised of 20 university professors teaching and researching in the sub-fields of applied linguistics, TESOL/TEFL, educational psychology, and distance education. Maximum variety in the panel members' expertise was observed to ensure the validity of the final model. They were selected based on the availability sampling method out of 35 scholars who were contacted and who opted in based on the letter of consent. Some did not reply despite their initial agreement. The inclusion criteria for the fuzzy Delphi panel members were extensive expertise in the field, being recognized in their areas of research interest, and over eight years of experience. The frequency of the panel members' professional expertise and areas of research is demonstrated in Table 1.

Table 1. List of experts involved in the Delphi technique and frequency

No.	Professional Expertise and Area of Interest	F
1	TEFL (Teaching English as a Foreign Language)/ TESOL	6
2	L2 Teacher Education	3
3	Pragmatics	1
4	Second Language Testing & Assessment	2
5	Discourse Analysis	2
6	Multiculturalism & Translation Studies	1
7	Technology-Assisted Learning / Distance Education	4
8	Psycholinguistics	1
9	Neurolinguistics	1
10	English for Academic/Specific Purposes	1
11	General/Educational Psychology	2
12	Sociolinguistics	1

There were 10 male and female panelists. They were both national and international scholars with the age between 39 to 74 within the age groups of 60-70 (%10), 50-60 (%55), 40-50 (%30), and 30-40 (%5). They were faculty members in 10 universities in Iran, Turkey, Canada, and Australia with the academic rank ranging from assistant professor (%30), associate

professor (%55), and professor (%15). They had an average of 23 years of teaching and research experience in their areas of research interest. Table 2 summarizes the demographic information of the panelists.

Table 2. Experts' demographic information

Demographic information	Details	Frequency	Percentage
Age	Below 40	1	5
	40-50	6	30
	51-60	11	55
	61-70	2	10
Gender	Male	10	50
	Female	10	50
Nationality	Iran	17	85
	Turkey	1	5
	Australia	1	5
	Canada	1	5
Academic rank	Assistant Professor	6	30
	Associate Professor	11	55
	Professor	3	15
Years of teaching/researching experience	Below 10	2	10
	10-20	6	30
	21-30	12	60

3.3. Procedure of data collection and analysis

The study entailed four major stages: literature review, expert assessment (round 1), expert assessment (round 2), and final analysis.

First, the researchers thoroughly and systematically reviewed the related literature until the point of saturation when there were no more theoretical frameworks or models available; hence, research in different disciplines was to be scrutinized to find appropriate dimensions and factors and develop the measures. Having completed the comprehensive review, six factors were identified and 64 measures were developed. The initial factors were cognitive, mindfulness-related, technological, psychological, environmental (social & physical), and pedagogical. To refine the factors and measures prior to the first fuzzy Delphi round, a pilot study was conducted. The factors and measures were consulted with four of the panel members, two of whom were the initiators of the concept of attentional literacy. After their review process, the issues were discussed through either online or face-to-face sessions with the researchers. The result of this pilot study was the revision and reclassification of the dimensions and factors into internal (cognitive, socio-emotional) and external (technological, pedagogical, environmental) factors and the deletion of 7 measures. The remaining five factors and 57 measures were converted to a digital questionnaire using Google Forms.

In the second stage, the refined questionnaire was then distributed to the members of the expert panel. They were given a two-week deadline which was then extended to four weeks to be able to accommodate their hectic schedules. The questionnaire consisted of three sections: demographic information survey, attentional literacy measures, and final comments. For the demographics, the panelists were asked to provide their full name, nationality, affiliation, age, years of experience, and areas of expertise. To raise the panelists' awareness of the attentional literacy concept, the AL measures section began with a brief background of the concept, alongside its theoretical definition of the concept of attentional literacy, and the direction to provide feedback on the measures. This section was added to the beginning of the questionnaire to raise the panelists' awareness regarding the concept and its background prior to reviewing and commenting on the measures. The panelists were supposed to give their assessment of the measures by ranking them based on a 7-point Likert scale (1= a strongly inappropriate measure, 2= an inappropriate measure, 3= a slightly inappropriate measure, 4= a slightly appropriate measure, 5= a moderately appropriate measure, 6= an appropriate measure, and 7= a strongly appropriate measure). After each measure, a comment box was included for the panelists' viewpoints and their response justification. Furthermore, at the end of the questionnaire, the experts were requested to add any additional missing factors and/or measures and their justification for them. After receiving the responses, the Microsoft Excel sheet was extracted and downloaded for analysis. Two sources of data were considered for the analysis: the written comments below each measure and in the final remarks section at the end of the questionnaire, and the panelists' responses to the quality of the measures based on a 7-point Likert scale. The comments below each measure (if there were any) were thoroughly read and discussed among the researchers. They varied from minor addition, deletion, or change of a word, and an item rewording, to complete inclusion or exclusion of an existing item, or adding a new item. Then, the researchers decided whether that comment was applicable or not. Peer review of at least two of the researchers was involved to guarantee the credibility of the data analysis. As for the responses of the panelists to the measures, a Fuzzy Delphi Method (FDM) procedure was adopted. It consisted of converting linguistic scale into fuzzy scale, item verification (fuzzification), and defuzzification which are reported in detail in the results section.

After conducting the FDM data analysis and item modifications, the newly revised questionnaire was sent to the expert panel for the second round of screening the items. The same procedure was conducted. The links to the modified questionnaire were sent via email to the members and a two-week deadline was announced. An Excel file including the aggregate results of all the panel members' responses to the items of the questionnaire in round 1 was also sent to the panelists to establish a consensus regarding the measures. When the responses were received, a similar data analysis procedure was conducted. The comments for the measures were discussed and decisions on any suggested modifications were made regarding the existing measures. Following that, the Excel sheet of the expert's opinion about the measures was downloaded and FDM analysis was done.

The fourth stage had no data collection. It mainly entailed the comparison of the results of FDM in the first and second rounds of collecting data from the experts. Based on the results of this comparison, the final factors and measures of the questionnaire were screened and verified. Figure 2 depicts the schematic representation of the procedures of data collection and analysis.

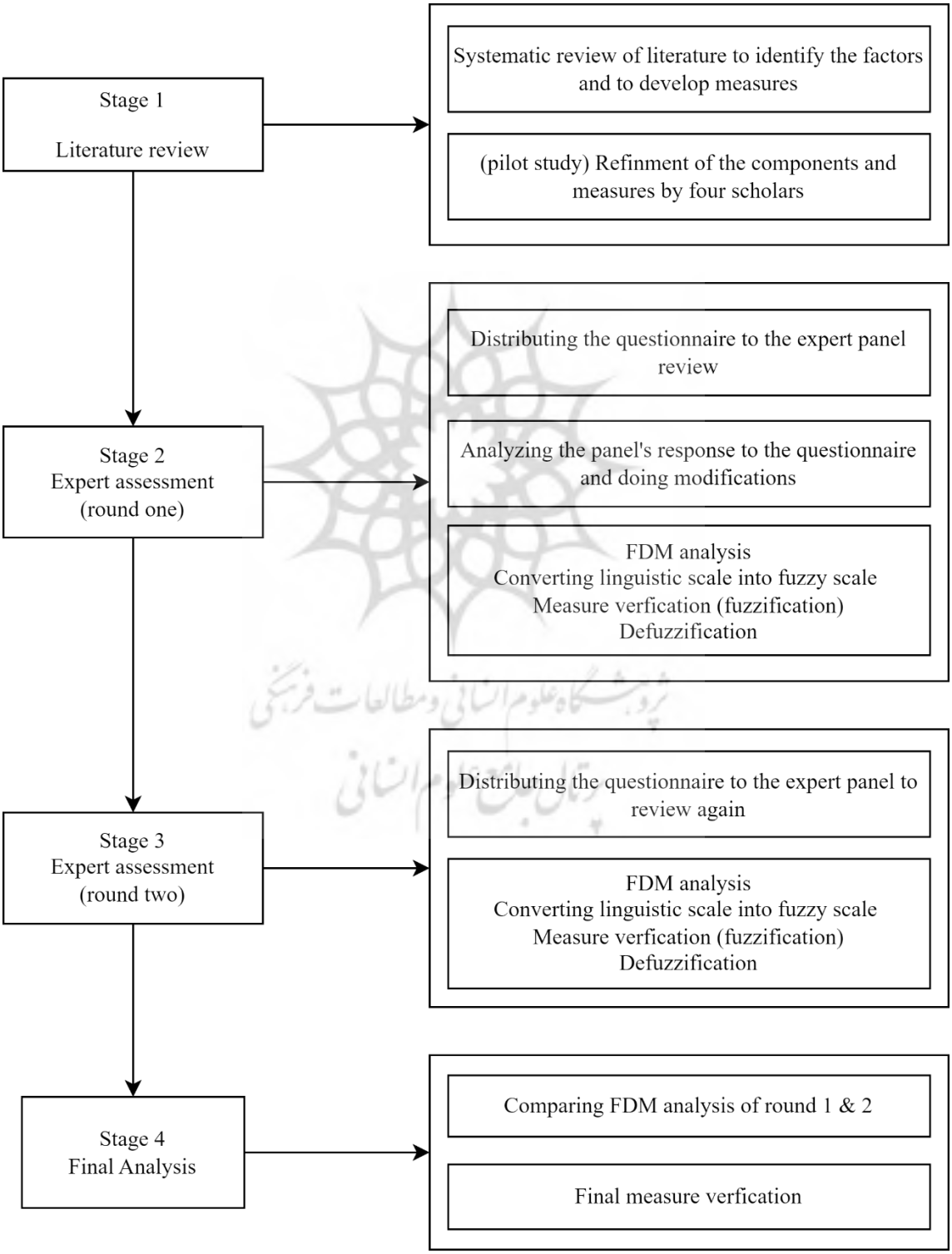

Figure 2. Data collection and analysis procedure

4. Results

In order to analyze the data in the FDM, the responses from the expert panelists were thoroughly analyzed adopting the steps suggested by Marlina et al. (2022) and Sensuse et al. (2018). These steps are used to analyze the FDM:

4.1. Converting the linguistic variables into fuzzy numbers

In this first phase, the Triangular Fuzzy Numbers (TFN), the combinations of three fuzzy numbers, were used to show the fuzziness of the expert opinion regarding the efficiency of the measures. Fuzzy numbers are the generalization of the human inexact use of real numbers in decision-making. It refers not to a sharp and crisp value but to a connected set of possible values, ranging between 0 to 1, which can help reach the utmost exactitude of the experts (Manakandan et al., 2017; Marlina et al., 2022). The expert opinions were translated into these three numbers. (Table 3)

Table 3. 7-point instrument scale

Instrument scale	Linguistic Variable	Triangular Fuzzy Numbers (m1, m2, m3)
7	Strongly Appropriate	(0.9, 1.0, 1.0)
6	Appropriate	(0.75, 0.9, 1.0)
5	Moderately Appropriate	(0.5, 0.75, 0.9)
4	Slightly Appropriate	(0.3, 0.5, 0.75)
3	Slightly Inappropriate	(0.1, 0.3, 0.5)
2	Inappropriate	(0.0, 0.1, 0.3)
1	Strongly Inappropriate	(0.0, 0.0, 0.1)

4.2. Items acceptability

In finding the acceptable items, the threshold value and the percentage of expert agreements were to be calculated. The former, threshold value, refers to the experts' acceptable level of agreement on a measure which was set to be < 0.2. A threshold value for all measures, following Al-Rikabi and Montazer (2024) was calculated by finding the difference between the fuzzy values average and the fuzzy numbers of the expert response based on the following formula:

$$\text{Threshold value } (m, n) = \sqrt{1/3\ [(m1 - n1)2 + (m2 - n2)2 + (m3 - n3)2]}$$

The latter, expert agreement, refers to the frequency of the experts' consensus. Any measure was accepted if the value was more than 75% (Chang et al., 2000); otherwise, the second round is needed to see if the measure is verified or not.

$$\text{expert agreement } (\%) = \frac{\text{the frequency of threshold values} \leq 0.2}{\text{Number of experts}}\ 100$$

4.3. Defuzzification

It includes converting the fuzzy values to a precise and crisp value considering the fuzzy set. In doing so, the following formula can be applied:

$$\text{Defuzzification value} = 1/3 * (m1 + m2 + m3)$$

Based on these steps, the data collected from 20 experts' responses to the measures of the attentional literacy scale in two rounds were analyzed. Table 4 summarizes the findings of the FDM analysis including triangular fuzzy numbers and experts' agreement of the first round.

Table 4. The results of round 1 on the proposed model

Measures	Triangular Fuzzy Numbers			Defuzzification Value	Expert agreement %	Measures	Triangular Fuzzy Numbers			Defuzzification Value	Expert agreement %
	m1	m2	m3				m1	m2	m3		
1	0.768	0.908	0.982	0.886	100	**30**	0.567	0.703	0.829	0.699	81
2	0.617	0.742	0.861	0.740	92	**31**	0.261	0.371	0.521	**0.384**	**56**
3	0.706	0.834	0.937	0.826	95	**32**	0.681	0.808	0.918	0.802	88
4	0.725	0.834	0.921	0.827	96	**33**	0.817	0.918	0.984	0.906	100
5	0.272	0.439	0.613	**0.442**	**35**	**34**	0.694	0.818	0.911	0.808	97
6	0.558	0.713	0.855	0.709	89	**35**	0.247	0.361	0.508	**0.372**	**51**
7	0.275	0.405	0.582	**0.421**	**42**	**36**	0.650	0.784	0.895	0.776	89
8	0.514	0.658	0.808	0.660	89	**37**	0.636	0.763	0.884	0.761	86
9	0.839	0.926	0.976	0.914	100	**38**	0.178	0.287	0.447	**0.304**	**37**
10	0.775	0.874	0.961	0.870	97	**39**	0.769	0.863	0.926	0.853	100
11	0.342	0.468	0.632	**0.481**	**59**	**40**	0.714	0.832	0.937	0.827	100
12	0.644	0.766	0.868	0.760	88	**41**	0.681	0.789	0.889	0.787	96
13	0.753	0.858	0.929	0.847	90	**42**	0.278	0.429	0.600	**0.436**	**61**
14	0.494	0.647	0.784	0.642	88	**43**	0.544	0.697	0.853	0.698	80
15	0.233	0.382	0.553	**0.389**	**60**	**44**	0.183	0.321	0.497	**0.334**	**46**
16	0.750	0.863	0.939	0.851	100	**45**	0.456	0.621	0.782	0.619	84
17	0.658	0.779	0.884	0.774	92	**46**	0.406	0.584	0.768	0.586	77
18	0.211	0.353	0.534	**0.366**	**36**	**47**	0.381	0.561	0.761	0.567	78
19	0.686	0.808	0.905	0.800	94	**48**	0.189	0.332	0.508	**0.343**	**35**
20	0.653	0.795	0.903	0.783	90	**49**	0.606	0.739	0.853	0.733	89
21	0.739	0.845	0.921	0.835	98	**50**	0.228	0.379	0.568	**0.392**	**28**
22	0.681	0.803	0.905	0.796	90	**51**	0.144	0.261	0.421	**0.275**	**25**
23	0.714	0.821	0.913	0.816	88	**52**	0.647	0.787	0.908	0.781	90
24	0.111	0.211	0.382	**0.234**	**31**	**53**	0.664	0.803	0.921	0.796	93
25	0.686	0.805	0.903	0.798	89	**54**	0.706	0.834	0.934	0.825	100
26	0.561	0.682	0.795	0.679	84	**55**	0.528	0.703	0.871	0.700	89
27	0.772	0.876	0.945	0.864	90	**56**	0.631	0.782	0.921	0.778	90
28	0.700	0.816	0.911	0.809	91	**57**	0.633	0.771	0.905	0.770	88
29	0.700	0.813	0.916	0.810	92						

For any item in FDM analysis to be accepted, any of these three conditions should be met: a) the threshold value ≤ 0.2, b) the expert consensus percentage $\geq 75\%$, and c) the defuzzification value ≥ 0.5. As can be depicted in Table 4, 14 items were rejected as they have defuzzification values smaller than 0.5 and the frequency of the expert agreement was below 75%. As a result, 43 measures under five factors were confirmed for the first round of the Delphi method. Except for the deletion of 14 items, a thorough review of the comments of the experts also led to a few modifications in other items such as minor additions, deletion, change of a word, an item rewording, or merging part of a deleted item in the existing item. With these changes in the remaining items and to have more refinement and confirmation of the existing results, the researchers decided to send the remaining factors (N=5) and measures (N=43) to the panel members again. It is noteworthy that an Excel file including the aggregate results of all the panel members' responses and comments to every individual item remaining from round 1 was also anonymously sent to the panelists to establish a new consensus regarding the existing items.

Table 5. The results of round 2 on the proposed model

Measures	Triangular Fuzzy Numbers			Defuzzi-fication Value	Threshold Value	Measures	Triangular Fuzzy Numbers			Defuzzi-fication Value	Threshold Value
	m1	m2	m3				m1	m2	m3		
1	0.792	0.929	0.995	0.905	0.02	**29**	0.736	0.845	0.942	0.841	0.03
2	0.644	0.774	0.897	0.772	0.03	**30**	0.642	0.808	0.939	0.846	0.15
3	0.722	0.855	0.961	0.846	0.02	**32**	0.775	0.887	0.971	0.878	0.08
4	0.742	0.855	0.945	0.847	0.02	**33**	0.861	0.945	0.995	0.934	0.03

6	0.628	0.784	0.905	0.772	0.06	**34**	0.711	0.839	0.934	0.828	0.02
8	0.536	0.682	0.829	0.682	0.02	**36**	0.747	0.876	0.974	0.893	0.12
9	0.878	0.955	0.995	0.943	0.03	**37**	0.744	0.868	0.966	0.878	0.12
10	0.811	0.908	0.982	0.900	0.03	**39**	0.833	0.929	0.984	0.915	0.06
12	0.650	0.776	0.879	0.768	0.01	**40**	0.811	0.908	0.982	0.900	0.07
13	0.758	0.868	0.939	0.855	0.01	**41**	0.686	0.800	0.900	0.795	0.01
14	0.506	0.658	0.797	0.654	0.01	**43**	0.642	0.795	0.929	0.840	0.14
16	0.825	0.913	0.968	0.902	0.05	**45**	0.489	0.655	0.816	0.653	0.03
17	0.767	0.882	0.971	0.887	0.10	**46**	0.742	0.874	0.968	0.861	**0.28**
19	0.778	0.889	0.966	0.878	0.08	**47**	0.689	0.829	0.947	0.822	**0.25**
20	0.744	0.876	0.963	0.861	0.08	**49**	0.878	0.955	0.995	0.943	**0.21**
21	0.761	0.868	0.942	0.857	0.02	**52**	0.683	0.821	0.929	0.811	0.03
22	0.753	0.868	0.953	0.858	0.06	**53**	0.711	0.850	0.950	0.837	0.04
23	0.819	0.913	0.982	0.905	0.09	**54**	0.706	0.834	0.934	0.825	0.00
25	0.775	0.895	0.968	0.879	0.08	**55**	0.539	0.716	0.879	0.711	0.01
26	0.578	0.703	0.818	0.700	0.02	**56**	0.653	0.808	0.937	0.799	0.02
27	0.808	0.908	0.971	0.896	0.03	**57**	0.683	0.813	0.932	0.809	0.04
28	0.731	0.855	0.947	0.844	0.04						

Table 6. Expert agreement consensus on the factors and measures – Round 2

Factors	**Measures**	**Expert**
Cognitive	1. I can focus on two or more different tasks simultaneously. (e.g., doing calculations while I am listening to a news broadcast).	95
Cognitive	2. I can switch my focus back and forth between tasks with different cognitive demands. (e.g., watching movies and helping my brother with homework).	92
Cognitive	3. I can focus on one specific task for a long time without being distracted.	97
Cognitive	4. When I work on a difficult project, I often make careless mistakes.	97
Cognitive	6. I have difficulty in planning and completing a detailed task that requires organization.	85
Cognitive	8. My thoughts (worriedness, fear of failure, daydreaming) distract my concentration.	96
Cognitive	9. I can return full attention to something after a short interruption.	91
Cognitive	10. I can concentrate even if I have little time to finish the task.	92
Cognitive	12. I can easily concentrate even if the subject matter is very complex or difficult.	98
Cognitive	13. When I have distracting thoughts, I step back without getting taken over by them.	100
Cognitive	14. I can focus on the present moment without my mind being preoccupied with the future or the past.	100
Cognitive	16. I tend to focus on one thing at a time rather than doing several things at once.	87
Cognitive	17. I increase my concentration by daily reflection on my actions.	78
Socio-emotional	19. I can concentrate since I often try to be relaxed.	80
Socio-emotional	20. If I am not sufficiently motivated or engaged in a task, I can manage to keep my attention.	79
Socio-emotional	21. I can control my attention by changing the way I think about the situation I'm in.	96
Socio-emotional	22. In stressful situations, I make myself think about it in a way that helps me stay calm.	85
Socio-emotional	23. I can effectively identify my emotions and thoughts as well as their impact on my actions.	80
Technological	25. I need to limit my screen time (e.g., use of mobile phone, tablet, internet, & social media) to enhance my attention.	81
Technological	26. My screen time (e.g., use of mobile phone, tablet, internet, & social media) does not distract my thoughts.	96
Technological	27. When using an application, having a reminder to close all other apps can help focus my attention on the task at hand.	92
Technological	28. I can keep a balanced attention between my daily activities/tasks and screen time.	90
Technological	29. I can manage any distracting challenges (e.g., receiving calls, messages, notifications, ...) caused by my screen use.	92

Technological	30. I find it difficult to concentrate in an online class.	77
Environmental	32. I am distracted by events or noise around me.	80
Environmental	33. Changes in my physical space (e.g., changing one's school) reduce my concentration.	90
Environmental	34. It distracts my attention if an examiner comes and stands near me while I am responding to the exam items.	97
Environmental	36. I cannot concentrate when I am cold/hot, hungry/thirsty, or sleepless.	78
Environmental	37. The physical space of the environment must be quiet for me to concentrate or study effectively.	79
Environmental	39. Studying in a group reduces my concentration.	88
Environmental	40. A safe learning environment in which I can trust the process and the learning community (e.g., teachers and classmates) helps me be more focused.	84
Environmental	41. Inappropriate classroom equipment affects the level of my attention.	100
Environmental	43. Family problems can affect my concentration.	76
Environmental	45. Economic problems can be a source of my inattentiveness in the classroom.	90
Socio-emotional	**46. Academic achievement is an important factor in increasing my attention in the classroom.**	**60**
Socio-emotional	**47. Overcoming distracting challenges of everyday academic life (e.g. test anxiety, time management, class workload, …) can enhance my focus.**	**66**
Environmental	**49. Being affected by friends or competing against them can be a source of my inattention.**	**70**
Pedagogical	52. I try to be more focused by following my teacher's effective feedback.	90
Pedagogical	53. Lack of variety in classroom activities cannot distract me.	88
Pedagogical	54. I need deadlines to be able to be more focused on my tasks.	100
Pedagogical	55. My concentration is not reduced when the teaching methods do not fit my learning style.	100
Pedagogical	56. I keep focused during my study even if the break time is insufficient.	96
Cognitive	57. Daily meditation before the class/studying time enhances my concentration.	88

Table 6 shows the results of FDM analysis based on the second round of responses. As can be seen in the table, all measures that have threshold values below 0.2 received the approval of the expert panel. However, measures 46, 47, and 49 have threshold values above 0.2 which have not met the condition and are rejected. As displayed in Table 4, the expert agreement on the measures is also indicative of the low consensus ($\leq 75\%$) on the above three measures. Hence, they can be deleted from the scale.

Table 7. Dimensions, factors, measures and expert agreement

Dimensions	Factors	No. of Measures	Expert Agreement
Internal	Cognitive	14	92.57
	Socio-emotional	5	84
External	Technological	6	88
	Environmental	10	86.2
	Pedagogical	5	94.8

To investigate the position of each dimension, factor, and measure in the model among the expert panel members, the results of aggregating the expert agreements on the dimensions of the attentional literacy scale in Table 7 indicate that experts have almost equal consensus on internal (88.28%) and external (89.66%) dimensions of the concept. Furthermore, pedagogical (94.8%) and cognitive (92.57%) factors are the most agreed factors while socio-emotional factor (84%) is the least agreed factor. Table 7 also shows the position of each measure in the model.

5. Discussion

This study was intended to develop an attentional literacy model for language learners. Using the Fuzzy Delphi technique, the researchers aimed to seek a level of consensus among the experts in the related fields regarding the dimensions, factors, and measures in this model. The results of two rounds of analysis led to the transformation of the initial proposed model. The revised attentional literacy model includes two dimensions, five factors, and 40 measures. There are two dimensions: internal and external. The internal dimension of the attentional literacy framework refers to resources that initiate from within an individual that can represent the level of attentional literacy in a person. It can help or hinder attention management. This dimension includes two factors: cognitive and socio-emotional. The cognitive factor entails executive functions which include top-down mental processes necessary to concentrate and pay attention. These functions are response inhibition, working memory, and flexible thinking. It also includes sustained attention which refers to the ability to maintain attentional focus over extended periods. The socio-emotional factors are those that influence a person to understand, experience, express, and manage emotions (emotional) and to develop meaningful relationships with others (social).

The external dimension refers to the resources which reside outside of a person either in the physical or social contexts of a person. They can reinforce or interfere with the attentional capacity of the learners. The external dimension is comprised of three factors technological, pedagogical, and environmental. Technological factor in our attentional literacy framework concerns the use of and effect of digital devices, such as individual screen time or attending virtual classes. The pedagogical factor entails those related to the instructional context of the classroom like teacher-related issues (teaching methods, types of feedback, …), instructional activities/tasks, and materials that can affect the level of attention. Environmental factors are those originating from the immediate surroundings such as space, location, shape, color, lighting, and sounds that can affect the attention.

Figure 3 shows the schematic representation of the final version of the attentional literacy model.

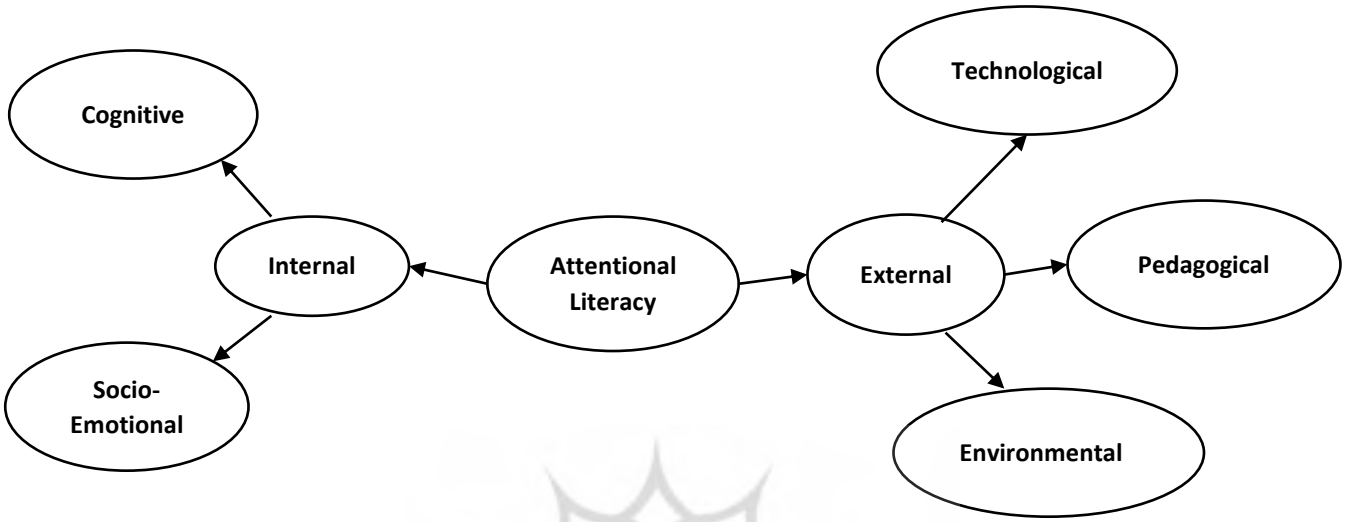

Figure 3. The final version of the attentional literacy conceptual model

The interrelatedness of the components in the model is a significant finding that underscores the complexity of attentional literacy. That is, these components do not stand alone within the external and internal dimensions. On the contrary, they are in a dynamic interplay and mutually influencing learners' attentional capacities. In other words, the students' cognitive ability to concentrate is the result of their emotional state as well as their teacher's pedagogical methods adopted in class. Similarly, the external technological environment like (not) having notifications and text messages on digital gadgets while studying can promote or impede cognitive and socio-emotional factors. This network of interconnection among the components of attentional literacy suggests that students, educators, and curriculum designers should employ a holistic approach to adopt and adapt strategies in language classes which encompasses both internal and external factors. On the whole, the findings of this study expand the theoretical foundations of the concept of attentional literacy by proposing a model and the underlying dimensions, factors, and measures. Literature lacks a multifaceted model for attentional literacy although a few studies have been conducted on some of the indicators of the present study. The findings of this study revealed that the pedagogical factor, among others, was the most agreed-upon factor in the attentional literacy model. This corroborates the findings of other studies which proposed that the practices of the teachers in classrooms have an impact on the students' attention (Dao et al., 2020; Hlas, et al., 2019; Wang, 2015) and reported strategies for teachers to develop learners' attentional literacy (Palalas et al., 2024). The role of other factors of the newly proposed model was also reported separately in the literature as pivotal in the learners' attentional literacy. Therefore, our findings are in line with studies by Schepers (2007) for the environmental influences, Yip (2023a) and Yip et al., (2023b) for the cognitive and emotional dimensions of attention, and Pegrum and Palalas (2021) and Palalas et al. (2024) for the learners' digital disarrays and hyperconnectivity which are effective in maintaining and directing the attention.

6. Conclusion

This study adopted the FDM to explore the dimensions, factors, and measures of the attentional literacy model. After examining the related literature, designing the factors and measures of an initial model, selecting the expert panel members, and administering the measures in two rounds, the data from the responses and the comments were analyzed. The results offer several contributions to the field. First, the use of FDM is not so prevalent in language education. Yet, when it is used in studies, like the current one, it proved to be efficient in orchestrating the conflicting views of the experts to achieve a desired consensus. The method also offers an effective methodological approach to develop and validate a theoretical model. The results of this study also contribute to the present literature by introducing a model to measure attentional literacy among TEFL students. The model has two internal and external dimensions with five factors and 40 measures which operationalize the notion of attentional literacy from cognitive, socio-emotional, environmental, pedagogical, and technological perspectives. Viewed through the lens of the sociocultural paradigm, the concept is multi-faceted thus selecting experts from different subdisciplines of Applied Linguistics and general education added to the value of the resulting multidisciplinary model. AL was seen as a cognitive and pedagogical issue with almost half of the measures falling into those categories which achieved a high level of agreement among the experts.

The other half spread among the technological, environmental, and socio-emotional issues for language learners which achieved even higher level of agreement. Interestingly enough, the pedagogical factor received the highest level of consensus among the experts indicating that effective teaching practices are paramount in promoting attentional literacy among language learners.

The insights from the study have certain implications. The principal theoretical implication of the study is that the concept of attentional literacy is multidimensional and many factors are involved to support the language learners' attentional capacity. This requires employing a holistic approach to address all factors contributing to the learners' attentional literacy. In terms of practical implication, all the stakeholders like educators, language school administrators, and policy-makers are suggested to foster environments in which the cognitive strategies are integrated in the classroom activities, socio-emotional skills are empowered, technological literacy is mindfully addressed, diverse pedagogical methods to cater for different learning styles are enhanced, and supportive learning environments are to be created.

Despite all the effort exerted to the meticulous implementation of the research, there are a few limitations that can impact the generalizability and accuracy of the results. As mentioned in the significance of the study, there was limited literature regarding the AL concept within the English language education which compelled the researchers to delve into the related literature within the field of general education. This can reduce the specificity of the concept. Also including more panel members could enhance the accuracy and generalizability of the model and more varied views could be proposed. Furthermore, the subjective nature of expert opinions might threaten the validity of the research findings. In this regard, we recommend testing the model with language learners to further improve its validity. Moreover, it is recommended that the current model be further reconceptualized in other educational settings to enhance its robustness and validity.

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