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Development and Psychometric Properties of a Scale for Assessing Parents' Attitudes towards AAC for Children with Complex Communication Needs[1,2]

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Augmentative and Alternative Communication (AAC) encompasses a wide range of strategies and technologies designed to support individuals with complex communication needs. Although the effectiveness of AAC interventions has been well documented, parental attitudes and knowledge remain crucial factors in the successful implementation of these methods. The aim of this study is to develop and conduct an initial psychometric evaluation of the instrument designed to assess parental attitudes towards AAC in the local context. The study included 50 parents of children with complex communication needs. Data were analysed using Partial Least Squares Path Modelling (PLS-PM). The initial measurement model

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demonstrated satisfactory unidimensionality and internal consistency for the majority of constructs (DG rho> 0.70). Several items exhibited low factor loadings, while the construct "General Attitudes" showed marginally lower reliability. After removing problematic items, improvements were observed in reliability and convergent validity (increased DG rho and AVE), supporting the adequacy of the purification process. However, the HTMT analysis indicated limited discriminant validity, particularly for the constructs with a reduced number of remaining indicators, which is consistent with the known characteristics of the PLS-PM estimation in small samples. The structural model confirmed the importance of parental knowledge of AAC as a key predictor of readiness to implement the AAC strategies. The developed instrument represents a functional preliminary version of the scale for assessing parental attitudes towards AAC. Further validation on larger and more diverse samples, as well as the development of additional items aimed at strengthening construct validity, is recommended.

Key words: augmentative and alternative communication, complex communication needs, psychometric properties, scale development, parental attitudes

Introduction

Augmentative and Alternative Communication (AAC) encompasses a range of methods and technological solutions intended for individuals who, due to communication disorders, are unable to use speech as their primary mode of expression (Beukelman & Mirenda, 2013). AAC enables these individuals to express their wants and needs more effectively (Ganz & Simpson, 2004; Sigafoos et al., 2004), and in certain cases it may also contribute to the development of natural speech (Millar et al., 2006) and language (Brittlebank et al., 2024; Holyfield et al., 2025; Pope et al., 2024). AAC can be applied not only within the population of children and adolescents, but its development has also enabled its use among adults (Broomfield et al., 2024). In recent decades, the development of AAC methods has significantly improved communication opportunities. Their application has proven effective across various disorders and conditions in which communication impairments occur, such as cerebral palsy, developmental language disorder (Light & McNaughton, 2015), autism (Crank et al., 2021; Gevarter et al., 2021; Pope et al., 2024; Sandbank et al., 2020), as well as among children and adults with multiple disabilities (Brittlebank et al., 2024; Simacek et al., 2018; Stasolla & Perilli, 2015). Based on previous studies, it can be concluded that AAC offers considerable potential for improving communication and learning among children with complex communication needs (Desch et al., 2025; Dumitru et al., 2025; Drager et al., 2010; Morin et al., 2018; Resina et al., 2025; Srinivasan, 2022).

However, although the benefits of AAC have been demonstrated in a large number of scientific studies, the successful implementation of these methods largely depends on parents' attitudes and their willingness to accept

and support their use (Berenguer et al., 2022). The importance of parent education in the process of accepting and implementing AAC for children with complex communication needs has been particularly emphasized (Kim et al., 2021). Over the past two decades, a significant increase has been observed in research examining the effectiveness of AAC among children with intellectual and developmental disabilities (Crowe et al., 2022). In addition, studies examining parents' perceptions of various interventions indicate that factors such as program personalization, availability of support, and the reduction of logistical barriers influence parental engagement and their willingness to implement new approaches in the communication and education of their children (Butler et al., 2020).

Parents' expectations, fears, and perceived barriers regarding the use of AAC may significantly influence whether a child will successfully use AAC methods in communication (Johnson et al., 2006). In our region, there is a lack of validated instruments, or more precisely, comprehensive assessments of parental attitudes toward AAC, despite the existence of studies examining the attitudes of teaching staff (Jovanović Simić et al., 2022) and speech-language therapists toward AAC (Slavković & Vasić, 2023), as well as the self-assessed knowledge of teaching staff regarding AAC methods (Arsenić et al., 2022). In other words, there is an insufficient number of well-developed measurement instruments that would enable the assessment of specific dimensions of parental attitudes toward AAC.

In contemporary research in the fields of special education and rehabilitation, as well as speech-language pathology, validated measurement instruments represent the foundation for collecting reliable data. Psychometric measurements are essential for drawing informed conclusions about participants' perceptions, knowledge, and attitudes, particularly when investigating complex phenomena such as the implementation of AAC. Kline (2015) emphasizes that tests are key tools in applied disciplines, as they often represent the only objective means for assessment and decision-making, whereas poorly constructed instruments may lead to inaccurate conclusions and serious consequences in practice.

In Serbia, there is a limited body of empirical evidence on instruments for assessing attitudes, particularly in the field of AAC. This makes reliable data collection and interpretation more difficult and consequently limits the practical applicability of research findings, as well as the planning of individualized support for families of children with complex communication needs. Given the crucial role that parents play in the acceptance and implementation of AAC methods, there is a clear need to develop reliable instruments that would enable a systematic examination of their attitudes, perceived barriers, and readiness to implement these approaches. Within the specific social and professional context of Serbia, it is also important to note that the use of AAC is still developing and that data on its prevalence remain limited.

Vasić and Slavković (2023) examined speech-language therapists' attitudes toward the use of AAC. The authors developed a questionnaire consisting of 49 statements organized into five thematic domains: the usefulness and benefits of AAC, professional competencies, methods and goals of implementation, teamwork and transdisciplinarity, and limitations in practical application. Respondents answered the statements using a Likert-type scale. Future research could focus on further examining the psychometric properties of this instrument, which would strengthen its application in both practice and research.

One of the studies presenting results on parents' attitudes toward AAC and identifying factors that may influence the acceptance of AAC interventions is the study by Berenguer and colleagues (Berenguer et al., 2022). However, since this study is a meta-analysis, a standardized scale was not used; instead, a qualitative methodology was applied, with data collected through semi-structured interviews and analyzed using the constant comparative method. Although the qualitative approach enabled a deeper understanding of parents' attitudes and experiences, the lack of quantitative measurement instruments limits the possibility of generalizing the findings and comparing results across different groups of parents.

Cruz and colleagues (Cruz et al., 2011) developed an instrument for assessing the attitudes of parents of children with cerebral palsy toward AAC. In this study, the authors examined the attitudes of primary caregivers toward the use of augmentative and alternative communication systems (AACS) in children with cerebral palsy. A questionnaire inspired by the work of Udwin and Yule (1991) was used. The scale consisted of 15 Likert-type items rated from 1 to 5. The maximum possible score was 75 points and the minimum 15 points, indicating completely positive or completely negative attitudes. The psychometric properties of the scale demonstrated high internal consistency, with a Cronbach's alpha coefficient of .87 and an average inter-item correlation of .32. Based on these results, it can be concluded that the scale is well structured and demonstrates good psychometric properties.

The AATAAC-2 scale (Assessment of Attitudes Toward Augmentative/Alternative Communication) developed by Beck and colleagues (Beck et al., 2010) is designed to assess school-aged children's attitudes toward peers who use AAC. This questionnaire consists of 26 items divided into three key dimensions (cognitive, affective, and behavioral aspects of attitudes) and has been validated on a large sample of children. The reliability of the scale was confirmed by Cronbach's alpha coefficients ranging from .78 to .95, along with good test – retest reliability (r = 0.79), indicating a valid scale structure.

The systematic review and qualitative meta-analysis conducted by Berenguer and colleagues (Berenguer et al., 2022) identified a number of thematic domains that influence parents' attitudes toward AAC, including

the availability and quality of professional support, the complexity and adaptability of the technology, as well as the challenges of integrating AAC systems into daily family routines. The review of thematic patterns in the analyzed studies highlights the importance of dimensions such as perceived support, emotional barriers, technical readiness, and parents' general openness toward alternative forms of communication.

Similarly, previously developed scales, such as those by Beck and colleagues (Beck et al., 2010) and Cruz and colleagues (Cruz et al., 2017), also encompassed different aspects of parental attitudes, including barriers to the implementation of AAC. However, these scales were often context-specific (e.g., focused on a single type of AAC system or a specific sample of children), which limits their broader applicability.

The scale developed in this study builds on insights from the aforementioned sources and systematizes key domains into six interrelated constructs: general attitudes toward AAC, knowledge and awareness of AAC, willingness to use AAC, barriers to its use, emotional attitudes and fears, and perceived support and social acceptance. In this way, theoretical consistency is ensured, providing a foundation for the quantitative examination of parental attitudes within the local context.

The aim of this study is to develop an instrument in the Serbian language for assessing the attitudes of parents of children with complex communication needs toward AAC, as well as to examine its reliability and basic psychometric characteristics. Compared with previous studies, the scale developed in the present study represents an instrument specifically designed for parents of children with different forms of communication disorders and enables the quantitative measurement of various aspects of their attitudes toward AAC.

Method

Sample

The study included 50 parents of children with complex communication needs (N = 50), of whom 20% were male. The sample comprised parents from different age groups and educational levels. The mean age of the parents was M = 41.11 (SD = 6.37). Participants also differed in terms of educational attainment, with the largest proportion having higher education (48%) and secondary education (40%).

An analysis of the responses indicates that the children of the participating parents were most frequently diagnosed with autism (48%), followed by mixed developmental disorder (26%) and specific language impairment (16%). Regarding the use of AAC methods, 54% of parents reported that their children do not use AAC, 24% reported occasional use, and 22% reported regular use of AAC methods.

Data Collection Techniques

Data were collected using an online questionnaire created in Google Forms, which was distributed via email, social media, and specialized parent groups during October 2024. Participants took part in the study voluntarily, and prior to completing the questionnaire they were informed about the aim of the research, the method of data processing, and the anonymity of their responses. All participants provided informed consent to participate in the study.

In this study, a new scale designed to assess parents' attitudes toward AAC was developed and validated. The scale comprises six dimensions: general attitudes toward AAC, knowledge and awareness of AAC, willingness to use AAC, barriers to the use of AAC, emotional attitudes and fears, and perceived support and social acceptance of AAC. In addition to basic demographic questions, the scale contains a total of 31 items. A five-point Likert scale was used.

The development of the scale was based on insights from previous studies examining parents' attitudes toward AAC. In particular, findings from the systematic review and qualitative meta-analysis conducted by Berenguer and colleagues (Berenguer et al., 2022) were used as a conceptual basis. Themes identified in this meta-analysis – such as perceived support, emotional attitudes and fears, barriers to AAC use, and willingness to use AAC, served as the foundation for constructing the corresponding subscales in the present study.

Statistical Data Analysis

The data were analyzed using the Partial Least Squares Path Modeling (PLS-PM) approach in the R software environment (version 4.5.0), using the PLS-PM package. This method was selected due to the relatively small sample size (N = 50) and the theoretically specified model, as well as the robustness of the PLS-PM approach in situations involving a large number of latent constructs and indicators (Willaby et al., 2015).

The analysis was conducted in two steps. First on the full version of the instrument containing 31 items in order to examine the basic indicators of construct validity and reliability, and then on the refined version of the instrument, from which items with low factor loadings (<.40) and poor metric characteristics were removed. This procedure was applied to test the stability of the model and to compare improvements in metric indicators (Haji-Othman et al., 2024).

The evaluation of the measurement and structural model quality included the following criteria: internal consistency of constructs (Cronbach's α and DG rho), convergent and discriminant validity (AVE, HTMT), explained variance (R^2), and overall model fit (Goodness of Fit, GOF).

Results

Results of the PLS-PM Analysis

The analysis initially included six latent constructs and 31 variables. After the refinement of the instrument, an additional analysis was conducted on a reduced number of items (25) in order to examine the stability of the model and the validity of the measurement indicators. Items with factor loadings below .40 were removed.

Construct Unidimensionality

Construct unidimensionality was examined through indicators of internal consistency (Cronbach's α coefficient) and construct reliability (Dillon – Goldstein's ρ). By comparing Cronbach's α coefficients for all constructs before and after the removal of items with low loadings (Table 1), it was observed that most constructs demonstrated improved internal consistency, which supports the justification for refining the scale.

Table 1
Comparison of Cronbach's α coefficients before and after instrument purification

Construct	α (Before)	α (After)
General attitudes toward AAC	0.62	0.77
Knowledge and awareness of AAC	0.89	0.85
Willingness to use AAC	0.74	0.76
Barriers to AAC implementation	0.82	0.91
Emotional attitudes and fears	0.78	0.67
Perceived support and social acceptance of AAC	0.80	0.81

Table 2 presents additional indicators of construct unidimensionality, including the DG rho coefficients and the latent values (the first and second latent dimensions).

Table 2
DG rho coefficients and latent values (EV) for each construct before and after scale purification

Construct	DG rho (Before)	DG rho (After)	First EV (Before)	Second EV (Before)	First EV (After)	Second EV (After)
General attitudes toward AAC	0.77	0.86	2.46	1.17	2.44	0.80
Knowledge and awareness of AAC	0.92	0.89	3.48	0.58	3.57	0.99
Willingness to use AAC	0.83	0.84	2.51	1.27	2.63	1.25
Barriers to AAC implementation	0.89	0.94	3.26	1.01	2.56	0.34
Emotional attitudes and fears	0.86	0.82	2.86	1.06	1.86	0.81
Perceived support and social acceptance of AAC	0.86	0.87	2.81	0.77	2.80	0.77

After removing items with low loadings, most constructs show slight improvements in DG rho values and a more pronounced difference between the first and second latent dimensions, which further confirms the unidimensionality of the measurement scales.

Measurement Model (Indicator Validity)

Table 3 presents a comparison of the factor loadings of the items and their communalities before and after the removal of items with low loadings.

Table 3
Item loadings and communalities by construct before and after scale purification

Item	Subscale	Loading	Communality	Loading (After purification)	Communality (After purification)
Q1	General attitudes toward AAC	0.62	0.38	0.64	0.41
Q2	General attitudes toward AAC	0.85	0.73	0.87	0.76
Q3	General attitudes toward AAC	-0.20	0.04	/	/
Q4	General attitudes toward AAC	0.73	0.53	0.71	0.50
Q5	General attitudes toward AAC	0.87	0.76	0.87	0.76
Q6	Knowledge and awareness of AAC	0.78	0.60	0.78	0.61
Q7	Knowledge and awareness of AAC	0.74	0.55	0.74	0.55
Q8	Knowledge and awareness of AAC	0.84	0.71	0.85	0.72
Q9	Knowledge and awareness of AAC	0.93	0.87	0.94	0.88
Q10	Knowledge and awareness of AAC	0.80	0.64	0.81	0.65
Q11	Knowledge and awareness of AAC	0.40	0.16	0.42	0.18
Q12	Willingness to use AAC	0.57	0.33	0.58	0.34
Q13	Willingness to use AAC	0.85	0.73	0.86	0.73
Q14	Willingness to use AAC	0.63	0.40	0.66	0.40
Q15	Willingness to use AAC	0.77	0.60	0.77	0.60
Q16	Willingness to use AAC	0.74	0.55	0.74	0.55
Q17	Barriers to AAC implementation	0.90	0.82	0.90	0.81
Q18	Barriers to AAC implementation	0.87	0.77	0.90	0.81

Item	Subscale	Loading	Communality	Loading (After purification)	Communality (After purification)
Q19	Barriers to AAC implementation	0.95	0.90	0.96	0.93
Q20	Barriers to AAC implementation	0.08	0.00	/	/
Q21	Barriers to AAC implementation	0.35	0.12	/	/
Q22	Emotional attitudes and fears	0.22	0.04	/	/
Q23	Emotional attitudes and fears	0.58	0.33	0.64	0.41
Q24	Emotional attitudes and fears	0.24	0.06	/	/
Q25	Emotional attitudes and fears	0.42	0.17	0.47	0.22
Q26	Emotional attitudes and fears	0.91	0.84	0.92	0.85
Q27	Perceived support and social acceptance	0.71	0.50	0.80	0.63
Q28	Perceived support and social acceptance	0.84	0.70	0.89	0.79
Q29	Perceived support and social acceptance	0.74	0.56	0.74	0.55
Q30	Perceived support and social acceptance	0.61	0.38	0.64	0.41
Q31	Perceived support and social acceptance	-0.29	0.08	/	/

A slight increase in loadings was observed for most of the remaining items after scale purification, indicating improved convergent validity of the measurement model.

Structural Model

The structural model examined the relationships among the latent constructs. Table 4 presents the results of the analysis before and after scale purification, in order to assess the stability of the structural paths and identify potential changes in the significance and strength of the relationships among the constructs.

The relationship between the constructs knowledge and awareness of AAC and willingness to use AAC proved to be the strongest, indicating that parents who are better informed about AAC also demonstrate greater willingness to use it. In addition, parents' general attitudes significantly contribute to their level of knowledge and awareness, as well as to their perception of barriers.

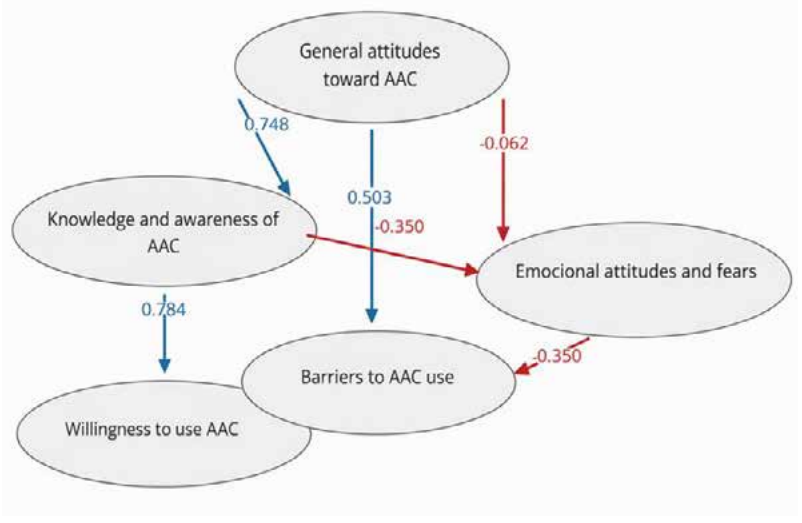
Table 4
Relationships among latent constructs before and after scale purification

Relationship	β (Before)	p-value (Before)	β (After)	p-value (After)
General attitudes → Knowledge and awareness of AAC	0.716	<.001	0.748	<.001
Knowledge and awareness of AAC → Willingness to use AAC	0.772	<.001	0.784	<.001
General attitudes → Barriers to AAC use	0.557	<.001	0.503	<.003
General attitudes → Emotional attitudes and fears	0.496	<.014	-0.062	0.760
Knowledge and awareness of AAC → Emotional attitudes	-0.510	<.011	-0.350	0.089

It is important to emphasize that the relationship between knowledge and awareness of AAC and emotional attitudes and fears is negative, indicating that parents with higher levels of knowledge about AAC exhibit fewer emotional barriers and fears. This finding is consistent with previous research highlighting the protective role of education and information (Johnson et al., 2006; Kent-Walsh & McNaughton, 2005). After scale purification, this relationship remained negative but lost statistical significance ($\beta = -0.350$, $p = .089$). Furthermore, the relationship between general attitudes and emotional attitudes and fears, although significant before purification ($\beta = 0.496$, $p = .014$), became non-significant after item removal ($\beta = -0.062$, $p = .760$).

The following figure presents the graphical model with standardized coefficients representing the relationships among the latent constructs.

Figure 1
Graphical representation of the structural model with standardized path coefficients between latent constructs



* Red arrows indicate negative relationships, while blue arrows indicate positive relationships

Table 5 presents the explained variance (R^2) for each of the dependent constructs before and after scale purification.

Table 5
Explained variance (R^2) of constructs before and after scale purification

Construct	R^2 (Before)	R^2 (After)
Willingness to use AAC	0.67	0.74
Knowledge and awareness of AAC	0.51	0.56
Barriers to AAC use	0.48	0.46
Emotional attitudes and fears	0.14	0.16
Perceived support and social acceptance	0.14	0.08
General attitudes	—	—

The value of the global model fit (GOF) before the removal of problematic items was 0.463, while after their removal the GOF increased to 0.492.

Assessment of Convergent and Discriminant Validity

Average Variance Extracted (AVE) values were calculated in order to assess the convergent validity of the constructs (Table 6). After scale purification, AVE increased for all constructs, indicating an improved explanation of variance by the common factor, particularly for the construct barriers to AAC use. The minimum acceptable value of AVE is 0.50. An AVE of 0.50 or higher indicates that the construct explains more than half of the variance of its indicators (Haji-Othman et al., 2024).

Table 6
Comparison of AVE values for latent constructs before and after instrument purification

Latent Variable	AVE (Before)	AVE (After)
General attitudes toward AAC	0.49	0.60
Knowledge and awareness of AAC	0.59	0.59
Willingness to use AAC	0.52	0.52
Barriers to AAC implementation	0.52	0.85
Emotional attitudes and fears	0.29	0.49
Perceived support and social acceptance	0.44	0.59

HTMT analysis was conducted to assess the discriminant validity of the constructs. The full set of values is presented in Table 7. In the initial version of the instrument, HTMT values were below the recommended threshold (HTMT <0.90), indicating satisfactory discriminant validity among the constructs (Henseler et al., 2015).

Table 7
Comparison of HTMT values before and after instrument purification

	General attitudes	Knowledge and awareness	Willingness to use	Barriers to AAC use	Emotional attitudes and fears	Perceived support and social acceptance
General attitudes	1	0.361	0.382	0.472	0.160	0.170
Knowledge and awareness	0.894	1	0.451	0.344	0.200	0.160
Willingness to use	0.885	1.003	1	0.344	0.210	0.160
Barriers to AAC use	0.818	0.762	1.016	1	0.220	0.240
Emotional attitudes and fears	0.358	0.427	0.549	0.345	1	0.302
Perceived support and social acceptance	0.358	0.333	0.377	0.375	1.027	1

*The upper part of the table presents HTMT values before scale purification, while the lower part presents HTMT values after the removal of items with low loadings.

After scale purification, HTMT coefficient values increased for certain pairs of constructs, indicating greater overlap among the latent dimensions. This finding suggests that item removal may reduce the differentiation between constructs, particularly when constructs remain with a smaller number of items.

Discussion

The aim of this study was to develop and conduct a preliminary psychometric evaluation of an instrument designed to assess the attitudes of parents of children with complex communication needs toward AAC. The obtained findings provide important insights into the initial measurement characteristics of the developed scale and indicate directions for its further improvement.

The analysis of the initial version of the measurement model showed that most indicators had satisfactory factor loadings (> 0.70), as well as good indicators of internal consistency and unidimensionality across most constructs. However, several items (Q3, Q20, Q21, Q22, Q24, Q31) exhibited low loadings (<0.40), while the construct *general attitudes* demonstrated somewhat lower internal consistency (α = 0.62). These findings indicated a weak fit of certain items within the latent structure and justified the need for instrument purification.

After removing items with unsatisfactory characteristics, an additional analysis of the purified version of the measurement model was conducted. The obtained results indicate a noticeable improvement in psychometric properties. For the construct *general attitudes*, Cronbach's α increased from 0.62 to 0.77, while DG rho increased from 0.77 to 0.86. Similarly, the construct *barriers to AAC implementation* showed an increase in the DG rho coefficient from 0.89 to 0.94, and the AVE value increased from 0.52 to 0.85. An increase in AVE values was also observed for other constructs, confirming improved convergent validity. Furthermore, the dominance of the first latent value over the second became more pronounced for most constructs, which further confirms their unidimensional nature in the purified version of the instrument.

Although the purification process contributed to strengthening internal consistency and convergent validity, the results of the HTMT analysis indicated challenges in the area of discriminant validity. Several pairs of constructs recorded HTMT values above the recommended threshold of 0.85, and some even above 1.00 (e.g., knowledge and awareness – willingness, willingness – barriers, emotional attitudes – perceived support), indicating increased overlap among constructs in the shorter version of the instrument. Elevated HTMT values following the removal of items with low loadings represent a common occurrence in PLS-SEM analysis, as the remaining indicators become conceptually more homogeneous and share a greater proportion of common variance with theoretically related constructs (Hair et al., 2017; Hair et al., 2019). This effect is further pronounced in smaller samples (N = 50) and when the bootstrapping procedure is used, since the PLS algorithm optimizes the explained variance of endogenous constructs, which may increase inter construct covariances (Henseler & Sarstedt, 2013; Rönkkö & Evermann, 2013).

It is important to emphasize that the elevated HTMT values are likely not the result of weaknesses in individual items, as all constructs satisfied the criteria for convergent validity and internal reliability (AVE> 0.50; DG rho> 0.70). Rather, they reflect a natural consequence of the high conceptual relatedness among the dimensions of attitudes toward AAC, as well as the reduced number of indicators in some constructs, which increases the proportion of shared relative to specific variance (Henseler et al., 2015; Henseler et al., 2016). In accordance with the recommendations of Hair and colleagues (Hair et al., 2014), further elimination of items with loadings between .40 and .70 was not methodologically justified, as it would compromise the content breadth of the constructs and reduce the number of indicators below the recommended minimum. Therefore, these findings do not indicate a model error but rather highlight the need for the development of additional items for each construct and the examination of the instrument's structure on larger and more diverse samples.

The analysis of the structural model revealed several stable relationships among the constructs, with the observed patterns remaining consistent even after scale purification. The most pronounced and statistically strongest finding refers to the relationship between the construct *knowledge and awareness of AAC* and *willingness to use AAC*, whereby better informed parents consistently demonstrate a higher readiness to implement AAC strategies in practice (β = 0.784, p <.001). This result is consistent with findings from previous studies indicating that understanding AAC approaches increases parents' openness to their use (Kent-Walsh & McNaughton, 2005). A similar pattern was observed in the relationship between *general attitudes* and *knowledge and awareness of AAC* (β = 0.748, p <.001), suggesting that parents who hold more positive general attitudes toward AAC also demonstrate greater knowledge and awareness of it. However, the influence of general attitudes on other constructs was weaker and partly unstable after scale purification, suggesting that this construct is conceptually broader and less specific compared to the other dimensions.

An important finding relates to the negative relationship between the constructs *knowledge and awareness* of AAC and *emotional attitudes and fears*. Prior to scale purification, this relationship was strong and statistically significant (β = – 0.510, p <.05), indicating that knowledge may have a protective role: parents who better understand AAC approaches are less likely to express uncertainty, discomfort, or concern regarding their implementation. Such findings are consistent with previous research emphasizing the importance of parent education and support when introducing AAC interventions (Johnson et al., 2006; Kent-Walsh & McNaughton, 2005). After scale purification, this relationship remained negative but lost statistical significance (β = –0.350, p = .089), which may be a consequence of the reduced number of items and the resulting decrease in construct variance. The influence of *general attitudes* on *barriers to AAC use* retained moderate strength (β = 0.503, p = .003), suggesting that more favorable parental attitudes contribute to a reduction in perceived barriers to the implementation of these methods. In contrast, the influence of *general attitudes* on emotional dimensions proved to be weak and unstable (β = –0.062, p = .760), suggesting that parents' emotional reactions do not depend directly on their general attitudes.

The analysis of the explained variance of the constructs (R^2) indicates that the model most successfully predicts the cognitive and motivational dimensions of attitudes. *Willingness to use AAC* and *knowledge and awareness of AAC* show an increase in R^2 values after scale purification (0.67-0.74 and 0.51-0.56), suggesting that the refined predictors more precisely explain these constructs. In contrast, the *emotional and social dimensions* (*emotional attitudes and fears* and *perceived support*) remain weakly explained, with minimal changes in R^2 values. This result is expected given their greater

complexity and their determination by factors that extend beyond the scope of the present model. The stability in explaining the construct *barriers to AAC use* (0.48 –0.46) further confirms that scale purification did not disrupt these relationships but primarily improved the precision of predictions for constructs more directly related to the cognitive aspects of parental attitudes.

In accordance with more recent recommendations in the methodological literature (Hair et al., 2017; Henseler & Sarstedt, 2013), the Goodness of Fit (GOF) index was not used as a primary measure of model adequacy. Instead, the evaluation was based on standard PLS-PM indicators such as AVE, HTMT, DG rho, factor loadings, and R^2 values, which allow for a more reliable assessment of the quality of both the measurement and structural models.

Overall, the results of this study suggest that the developed scale represents a valid foundation for further refinement, but that additional phases of instrument development should include the expansion of certain constructs, the development of new items, and empirical testing on larger and more diverse samples of parents. The practical implications of this research are also significant. Understanding parents' attitudes toward AAC may assist speech-language therapists and other professionals in planning individualized approaches when introducing these methods. Identifying barriers reported by parents, such as emotional discomfort, lack of confidence, or a perceived lack of support, may contribute to the development of targeted educational programs and interventions. Training programs that strengthen parents' knowledge and confidence in using AAC may potentially increase the acceptance and effectiveness of these methods within the family environment (Johnson et al., 2006; Kim et al., 2021).

Conclusion

The results of this study provide preliminary empirical evidence regarding the structure and psychometric properties of a scale designed to assess the attitudes of parents of children with complex communication needs toward AAC. The analysis of the measurement model showed that most constructs demonstrated satisfactory internal consistency and convergent validity, although several items exhibited low factor loadings, and the construct general attitudes showed a Cronbach's α value below the optimal threshold. The purification of the instrument by removing items with loadings below 0.40 led to a significant improvement in the reliability and convergent validity of most dimensions, but at the same time resulted in a decrease in discriminant validity, reflected in elevated HTMT values, including values above 1.00 for several pairs of constructs. This finding reflects the high conceptual relatedness among certain dimensions of parental attitudes toward AAC and represents an expected consequence of indicator homogenization in the early stages of scale development, particularly with a small sample (N = 50).

Findings from the structural model highlight the key role of parental knowledge about AAC as a predictor of their willingness to implement these methods and of the reduction of emotional barriers, which confirms the importance of educational programs and systematic support for families in the process of introducing AAC interventions.

Although the results are encouraging and suggest that the refined version of the scale may serve as a functional initial basis for further work, the instrument still does not meet all standard criteria of construct validity. To achieve a more robust and widely applicable scale, further development of additional items for each construct is required (particularly for dimensions currently containing three or four indicators), as well as empirical testing on substantially larger and more diverse samples of parents. Only after conducting confirmatory factor analysis (CFA), testing measurement invariance, and assessing test – retest reliability on larger samples will the scale be able to be considered fully valid and ready for routine use in research and clinical contexts.

Therefore, the developed instrument represents an important first step toward the systematic quantitative assessment of parental attitudes toward AAC within the local context, but it requires further refinement before its final implementation.

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Appendix

Instrument for Assessing Parents' Attitudes Toward AAC

Subscale	Item
General attitudes toward AAC	I believe that AAC should be part of educational and therapeutic support for children with communication disorders.
General attitudes toward AAC	The use of AAC methods is important for children with communication disorders.
General attitudes toward AAC	I believe that AAC can significantly improve communication of children with communication disorders.
General attitudes toward AAC	AAC is equally important as traditional speech-language therapy.
General attitudes toward AAC	I believe that AAC is useful only for children with severe communication disorders.
Knowledge and awareness of AAC	I believe that I need additional training or information in order to use AAC effectively.
Knowledge and awareness of AAC	I am familiar with different low-tech AAC methods (e.g., PECS).
Knowledge and awareness of AAC	I am familiar with high-tech AAC communication systems (software programs).
Knowledge and awareness of AAC	I know where I can find information about AAC methods.
Knowledge and awareness of AAC	I have enough information about how AAC works.
Knowledge and awareness of AAC	I am familiar with the ways AAC is used in the educational system.
Willingness to use AAC	I would be willing to participate in parent training on the use of AAC.
Willingness to use AAC	I am willing to use AAC at home to help my child communicate better.
Willingness to use AAC	Integrating AAC into daily activities would not be a problem for my family.
Willingness to use AAC	I would use AAC even if it required changes in family routines and additional time for adaptation.
Willingness to use AAC	I am willing for my child to use AAC in broader social environments (kindergarten, school, park).
Barriers to AAC use	Lack of time prevents me from further educating myself about AAC methods.
Barriers to AAC use	The use of AAC may require technical knowledge that I am not familiar with.
Barriers to AAC use	Using AAC would make everyday family activities more difficult.
Barriers to AAC use	I believe that using AAC would be complicated for my child.
Barriers to AAC use	I am not sure where to start when it comes to learning about AAC.
Emotional attitudes and fears	I am afraid that using AAC may interfere with my child's speech and language development.

Subscale	Item
Emotional attitudes and fears	I am concerned that my child might be stigmatized because of using AAC methods.
Emotional attitudes and fears	I have mixed feelings about using AAC with my child.
Emotional attitudes and fears	I am afraid that I would not know how to properly use AAC with my child.
Emotional attitudes and fears	I believe that my child might resist using AAC because it may make them feel different from others.
Perceived support and social acceptance of AAC	I believe that my child lives and is educated in an environment that supports the use of AAC.
Perceived support and social acceptance of AAC	I believe that schools and therapists sufficiently support the use of AAC in education and treatment for children with communication disorders.
Perceived support and social acceptance of AAC	I have support from family and friends when using AAC in communication with my child.
Perceived support and social acceptance of AAC	I believe that society sufficiently recognizes the importance of AAC for children with communication disorders.
Perceived support and social acceptance of AAC	I believe that my child's teacher and therapist would be open to using AAC in treatment and education.