






Face-to-face and virtual vocabulary learning for individuals with intellectual disabilities

Alba Ayuso-Lanchares , Inés Ruiz-Requies  and Rosa Belén Santiago-Pardo 

Department of Pedagogy, University of Valladolid, Valladolid, Spain

ABSTRACT

People with mild intellectual disabilities (ID) often have difficulties understanding and expressing advanced linguistic concepts. Prior to the arrival of COVID-19, there were no research-backed models to guide virtual interventions with this population. The research presented here pursues three objectives: to determine if the vocabulary of people with mild ID improves following face-to-face and virtual learning interventions, to understand the differences between these two interventions, and to assess participants' perceptions of both modalities. The sample consists of 10 adults with mild ID who participated in 10 face-to-face learning sessions and 10 virtual learning sessions. An ad hoc designed vocabulary assessment instrument and semi-structured interviews are used, in addition to statistical software SPSS and Atlas.ti. The results show improvements in vocabulary in both modalities, although no significant differences were found, suggesting that both in-person and virtual modalities are effective for vocabulary learning in people with ID. However, there were exceptions in some categories such as gardening and baking. Likewise, participants expressed satisfaction and enthusiasm toward both interventions, but showed a preference for face-to-face sessions.

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Introduction

Individuals with mild intellectual disabilities (ID) face challenges in understanding, assimilating, and retaining advanced linguistic concepts and academic skills. These challenges often arise during the individual's developmental process. However, it is important to note that the majority of individuals with mild ID are able to master essential activities related to self-care, household life, and practical tasks (Asociación Americana de Psiquiatría 2014; World Health Organization 2018). Language represents one of the intellectual functions that tends to be more affected in individuals with intellectual disabilities, resulting in increased communicative barriers (Navas, Verdugo, and Gómez 2008). According to Ríos and Ayllón (2017), some characteristics of the language of individuals with ID include a lack of uniform progress in their linguistic development, with language dimensions (such as semantics) not evolving simultaneously or following conventional patterns. Morphosyntactic difficulties are the primary linguistic challenge for children with intellectual disabilities, a difficulty that extends and is also influenced during adolescence

(Katsarou and Andreou 2022), and even into adulthood (Altman et al. 2022). Syntactic skills involves organizing words to produce phrases (Croft 2022). These morphosyntactic difficulties, coupled with challenges in semantics (Katsarou and Andreou 2017), can impact language comprehension on various occasions.

Additionally, there are notable disparities in linguistic development among individuals with ID, even when they present similar cognitive levels, complicating data and results generalization. The context of this article focuses on the semantic dimension of language, which involves the development of word meanings and refers to a higher form of verbal communication and depends on the level of intelligence (Golubović 1997; Bojanin 1985). In general, the semantic network of individuals with ID is less structured (Nilsson et al. 2021), and there are also issues with semantic fluency (Danielsson et al. 2012; Henry 2010). At times, individuals with ID may distort language due to their limited understanding of one or two words in a sentence or the similarity of sounds between words. Many studies focus on vocabulary development in early childhood because this learning

CONTACT Alba Ayuso-Lanchares  alba.ayuso@uva.es 

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is associated with this vital period (Clark and Casillas 2015; Hansen and Broekhuizen 2021). However, it is known that these difficulties persist into adolescence because the quality and quantity of linguistic input are different from adolescents without intellectual disabilities (Nilsson et al. 2021). It is also known that these difficulties continue into adulthood, as people with intellectual disabilities produce fewer total words and a smaller number of different words during conversation and narration (Altman et al. 2022; Chapman et al. 1998). Additionally, it is known that these communication difficulties in adults are associated with their level of intellectual disability, a low level of social relationships, behavioral problems, and the diagnosis of Down Syndrome (Smith et al. 2020).

Online and face-to-face adult learning

Adult education and literacy programs refer to the learning undertaken by adults with intellectual disabilities after they leave school, focusing on acquiring new skills to obtain employment or help them become more independent (Ross-Gordon and Procknow 2020). These programs encompass courses, classes, and workshops aimed at fostering this learning (Mirfin-Veitch 2003). Generally, this type of education has always been conducted in person (Di Giovanni and Cronin-Gilmore 2024). Before 2020, there was a lack of research-backed models to guide educators in providing virtual interventions or remote environments for individuals with ID and developmental disabilities (Brewer et al. 2022; White et al. 2021). However, research in this area began to emerge from that moment onwards. Murphy et al. (2020) found that individuals with ID who participated in virtual activities and conducted meetings *via* video conferencing during the COVID-19 crisis had a positive effect. Other studies such as those by Jeste et al. (2020) and Oudshoorn et al. (2023) focused on virtual therapy in individuals with ID during the COVID-19 crisis and concluded that it was not only beneficial for them but could also be continued after the COVID-19 crisis passed. However, only one program has been identified that evaluates speech intervention in both face-to-face and virtual modalities with adults with ID, and it is a program focused on dialogic reading (Ayuso-Lanchares and Santiago-Pardo 2022). But no programs have been found that evaluate technical word learning in individuals with mild ID, much less using a virtual intervention. Therefore, it can be confirmed that there is scarce research in virtual environments (Hernández and Ortega 2016).

However, it is advisable to conduct these types of studies since it has been noted that communication difficulties experienced by individuals with ID are exacerbated in digital environments (Pedro-Viejo 2020). These difficulties, coupled with the fact that a very low percentage of individuals with ID typically use virtual tools (Bonilla-del-Río and Calero 2022), make it challenging for them to engage in programs with video conferencing, making it interesting to assess their effectiveness in this population. Additionally, research has delved into the digital aptitude of individuals with ID, focusing on their interaction with technology and its implications for communication and digital competence (Delgado-Vázquez et al. 2019).

Intervention programs for vocabulary learning in children have been found in face-to-face settings. Bryant et al. (2003) review found six articles covering the period from 1978 to 2003 that conducted vocabulary interventions, and these articles could be categorized into computer-assisted instruction; that is, they used the computer in face-to-face interventions; vocabulary practice activities to develop fluency and mnemonic strategy instruction and concept instruction and learning. Overall, positive results were found for all research in the participating children. After 2003, studies have been found that worked on vocabulary, but with the aim of improving other types of skills such as narrative skills (Hettiarachchi 2016) or reading comprehension (Gómez-Taibo et al. 2017). Terol et al. (2023) study has evaluated virtual counseling programs for families with children who have intellectual disabilities, and like the previous study, they explain that families have a positive opinion about these programs. It is noteworthy that this type of research has been conducted regarding vocabulary instruction, mainly in children with ID, but no such studies have been found in adults (Burt, Graham, and Hoang 2022). Furthermore, all preceding studies have focused on children rather than adults, in contrast to the research presented here, thus rendering this article pioneering and contributing novel insights to the scientific realm. Studying adult programs for individuals with intellectual disabilities (ID) is critical because their language and communication needs persist and evolve beyond childhood and adolescence (Altman et al. 2022; Chapman et al. 1998; Nilsson et al. 2021). While considerable research has focused on children with ID vocabulary acquisition (Garrels 2019; Laher and Dada 2023; Kokol et al. 2020; Vandereet et al. 2011), the challenges faced by adults with ID in acquiring vocabulary remain underexplored. It is

beneficial for adults with ID to attend programs where they have learning opportunities (Ross-Gordon and Procknow 2020), and it is always necessary to have scientific evidence supporting the educational programs implemented (Pring and Thomas 2004). By investigating vocabulary learning in adults with mild ID, this study aims to address a significant gap in the literature and provide evidence-based strategies that can improve the quality of adult education programs. Additionally, understanding how virtual and face-to-face interventions impact adult learners with ID can inform the development of more effective educational tools and resources tailored to their unique needs, ultimately promoting greater social inclusion and quality of life for this population.

This research pursues three objectives: the first is to determine whether the vocabulary of adults with mild ID improves as a result of face-to-face intervention focused on technical concept instruction and learning and/or virtual intervention focused on technical concept instruction and learning. The second objective is to understand the differences between face-to-face and virtual intervention focused on concept instruction and learning. And the third objective is to assess participants' perceptions of both face-to-face and virtual programs.

Method

This comparative descriptive pretest-posttest study employs an embedded mixed-method design (Cresswell 2014) that aims to understand the experimental results by incorporating participants' perspectives.

Participants

The participants consist of 10 adults with ID, aged between 18 and 43 years ($M = 30.30$, $SD = 8.82$). Of these 10 individuals, 6 are male and 4 are female. All participants are active members of the Fidel Ramos Center in Palencia (Spain), which is part of the San Cebrián Foundation, for a continuous period of over 7 years.

Various group activities are conducted at the center, including speech therapy, psychotherapy, physiotherapy, cognitive stimulation, and practical workshops. They share the space with another 30 individuals who also have ID. Participant selection was based on the following inclusion criteria:

- Diagnosis of mild intellectual disability.
- At least a high school diploma.

- Regular attendance at the day center where the research was conducted.

Exclusion criteria were as follows:

- Behavioral difficulties affecting interpersonal relationships.
- Presence of other disabilities or problems.

Additionally, all 10 participants provided voluntary consent and signed the Informed Consent form before participating in the study. To facilitate the activities, participants were divided into two groups of 5 individuals each, as it was considered that working in small groups would facilitate the process. These groups were assigned randomly, with the only condition being gender parity in each group (two women and three men in each group). All participants completed 10 sessions of Virtual Learning (VLE) and 10 sessions of Face-to-Face Learning (FFL).

Data collection techniques and instruments

The data collection instruments used in this study are two-fold: an ad hoc designed instrument for vocabulary assessment, and a semi-structured interview to understand participants' perceptions.

Vocabulary Assessment Instrument: An ad hoc instrument, specifically tailored for this study, was designed to evaluate participants' vocabulary before and after each of the interventions: VLE and FFL. Since the aim is to assess whether participants are capable of learning these words during the teaching process, a standardized test measuring participants' semantic level was not opted for, as such a test would not allow us to determine whether they have learned these words, which are the focus of this research. The evaluation process involves presenting 200 specific words that will be studied (100 words in VLE and 100 in FFL). Four possible definitions are provided for each word presented to each participant: one correct definition and three distractor definitions. The distractors were chosen from words in the same category and also included in the instrument's selected words. Their task is to select the definition they consider correct among the provided options. Participants are awarded 1 point if they know the definition, or 0 points if they do not know the meaning of the word.

Each stage comprises a set of 100 different nouns, adjectives, and verbs. The 200 words are related to baking (e.g. meringue, glaze, sprinkle, truffle, tasting,

fondant, rustic, ferment), gardening (e.g. prune, horticulture, pesticide, fertilizer, transplant); leisure and free time workshop (accommodation, camping, fauna, inn, ecotourism, geography), and handicrafts workshop (innovative, skill, creativity, weaving, mosaic, calligraphy). The internal consistency of this instrument specifically tailored for this study, was evaluated using Cronbach's Alpha coefficient, yielding a value of 0.804 in pretest measures and a value of 0.932 in posttest measures, indicating high internal consistency. This high internal consistency supports the instrument's validity and reliability. Furthermore, the design of the instrument, with distractor definitions chosen from the same category, helps to reduce the possibility of random guessing during the assessment process. The selection of vocabulary words was informed by collaboration between the speech therapist and classroom tutors, ensuring relevance to participants' daily activities. This process contributes to the ecological validity of the instrument and enhances its utility in assessing real-world language acquisition.

Semi-Structured Interview: The second instrument used was the semi-structured interview (Ballestín and Fàbregues 2018). The interview was designed to deeply understand participants' perceptions of both intervention modalities: VLE and FFL. A total of 20 interviews were conducted, two interviews per participant: one about VLE and another about FFL.

The interviews were conducted orally by the educator during the workshops, who recorded the responses immediately after completing the 10 sessions of VLE or FFL, as appropriate (Left column of [Supplementary Material 1](#)). Once the 20 intervention sessions were completed, the questions from [Supplementary Material 1](#) (right column) were formulated in the same manner. Specifically, these questions sought to understand how participants felt during the sessions, any specific experiences they encountered, aspects they found enjoyable or challenging, and their overall preferences between VLE and FFL. Through these interviews, insights into participants' learning experiences, preferences, and challenges emerged, contributing valuable qualitative data to complement the quantitative findings of the study.

Additionally, participants were given the opportunity to share any suggestions or comments they considered relevant regarding the study and interventions.

Procedure

The intervention is divided into two modalities: virtual and face-to-face sessions. As depicted in [Figure 1](#),

all participants first undergo virtual sessions (10 sessions of 45 min each) followed by face-to-face sessions (10 sessions of 45 min each). Both modalities include teaching 10 words per day, 25 words from each category (baking, gardening, tourism, and handicrafts), integrating 100 words for each modality (total of 200 words). The activities in both modalities are playful and involve presenting clear definitions of each word and attempting to connect the meaning with the signifier.

Both sessions (both VLE and FFL sessions) were divided as follows: a welcome segment (participants greet each other and engage in brief conversation for about 5 min), followed by memory activities (5 min), bingo (5 min), card activities (5 min), crosswords (5 min), the game of the goose (5 min), storytelling with words (10 min), and 5 min at the end to discuss plans for the following day. The games and activities remain the same; the difference lies in the learning modality.

In the VLE sessions: the Teams platform is utilized. The speech therapist initiates the video call from her home, and she shares her screen, while on-site staff assist in setting up the session and ensuring everything runs smoothly, before leaving the room, leaving the participants alone to engage in the session. If technical issues arise, on-site staff are available to provide support. Participants are grouped together in the same room to facilitate interaction and engagement. Interactive PowerPoint software and some platforms like Wordwall are used to conduct the activities.

In the FFL sessions: all participants and the speech therapist are in the same classroom. Tables are arranged in proximity, allowing participants to see each other's faces and interact easily. Laminated sheets, photocopies, and manipulative materials are utilized, and no technological resources are used for the activities described previously. The activities are the same in both modalities.

Data analysis

Once the data collection was completed, the data analysis was conducted, which was divided into quantitative and qualitative analyses. For the quantitative analysis, SPSS 29.0 statistical software was used to perform statistics. Firstly, to ascertain the differences between the scores obtained in the pretest and posttest of VLE and FFL. This involved conducting descriptive statistical analysis (mean and standard deviation) of the variables and the Wilcoxon signed-rank test for related samples were conducted.

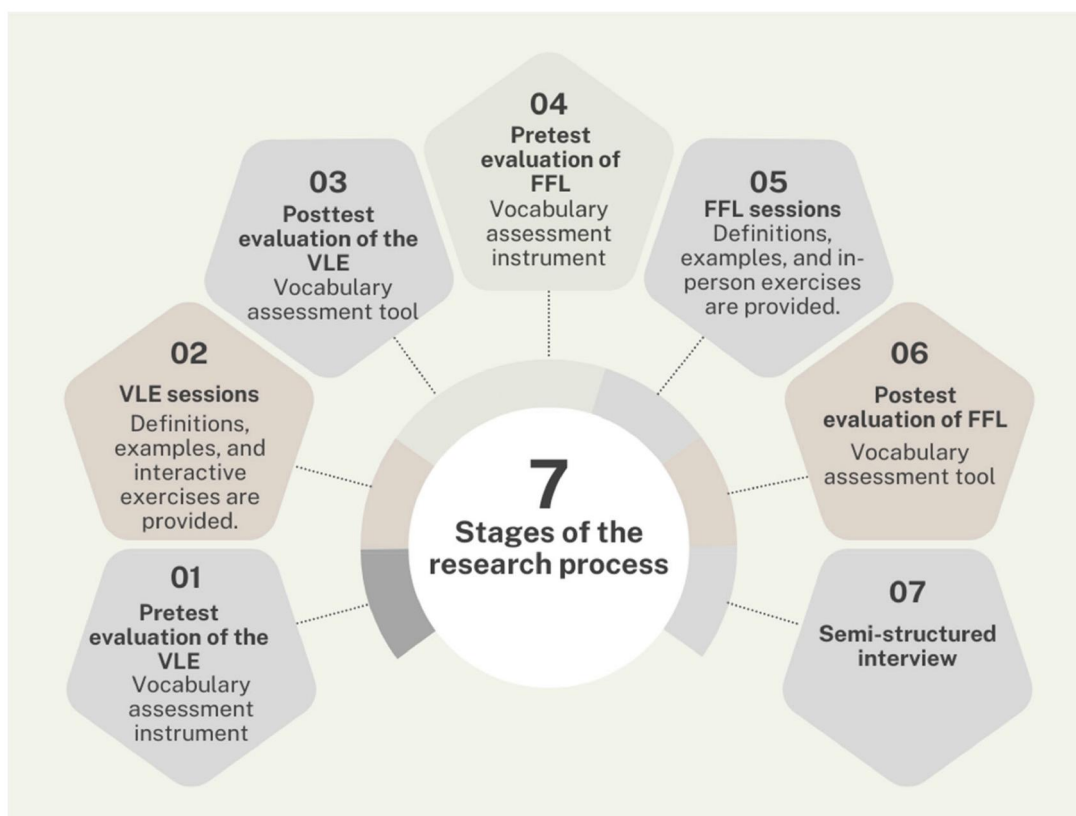


Figure 1. Flowchart depicting the phases of the procedure.
Source: Self-made

Additionally, Spearman's rank correlation coefficient was calculated. Secondly, to compare the two intervention contexts: VLE and FFL, the Mann-Whitney U test and the Kruskal-Wallis test were used. These statistical methods were chosen for their robustness in analyzing non-parametric data and their suitability for comparing differences between intervention modalities.

For the qualitative analysis, Atlas.ti 23 software was used. To address the research question, a process of selective coding (Hernández-Samperi and Mendoza-Torres 2018) was followed based on the information gathered from the interviews (Corona-Lisboa and Maldonado-Julio 2018). When developing the codes, it was taken into account that the satisfaction of a program is crucially influenced by the feelings it generates (Tassinari 2016), the experiences each participant has had (Spurgeon, Clarke, and Sackley 2015), and the benefits and challenges of completing the program (Theodoros 2011); in addition to the need to understand the differences they found between the two programs (Little et al. 2023).

The three experts reviewed the participants' responses and generated the 10 codes used, which are presented in Table 1.

Table 1. Codes, definitions, and frequency of categorization.

Code	Definition	N
Positive Feeling VLE	Encompass responses indicating a positive emotional experience during virtual or in-person sessions.	6
Positive Feeling FFL		8
Specific Experience VLE	Contain responses describing specific experiences during virtual or in-person sessions.	6
Specific Experience FFL		9
Beneficial Aspects VLE	Include responses pointing out enjoyable or useful aspects of virtual or in-person sessions.	5
Beneficial Aspects FFL		8
Challenges or Difficulties VLE	Encompass responses mentioning challenging or difficult moments during virtual or in-person sessions.	8
Challenges or Difficulties FFL		4
Learning Differences	Responses highlighting differences in learning between virtual and in-person sessions.	7
Preferred Modality	Responses expressing a preference for a learning modality (virtual or in-person) and the reasons behind that preference.	6

VLE: Virtual Learning; FFL: Faceto-Face Learning.

Following this, two researchers independently categorized the participants' responses, achieving a 94.6% agreement. Subsequently, a third researcher conducted a thorough review of the categorization, addressing

any minor discrepancies, resulting in the findings outlined in Table 1.

Results

To address the objectives of this study, this section presents the obtained results. Firstly, Table 2 shows a descriptive analysis of the variables before (pretest) and after (posttest) the intervention modalities: VLE and FFL. The pretest results show that the average scores in the semantic categories of gardening, baking, crafts, and tourism ranged from 19.80 to 23.70, while in the posttest of the VLE intervention, the scores significantly increased, with an average of 10.30 to 23.20 in gardening, 14.30 to 23.20 in baking, 10.30 to 18.90 in crafts, and 12.10 to 21.10 in tourism. In FFL, the results also showed an increase in scores, with an average of 12.80 to 22.80 in gardening, 9.40 to 20.20 in baking, 9.50 to 20.30 in crafts, and 11.40 to 18.50 in tourism. This means that the total vocabulary learned increased from 46.20 to 82.40 in VLE and from 43.10 to 81.80 in FFL. These findings indicate significant improvements in vocabulary knowledge in both intervention modalities.

Table 3 presents the results of the Wilcoxon signed-rank test for related samples, applied to analyze the differences between pretest and posttest scores for interventions in various vocabulary

categories. The *z* value values in the second column indicate the magnitude of the differences between pretest and posttest scores for each category. The *p* value in the third column represents the probability associated with the observed difference, with all *p* value being 0.005, indicating a significant difference in all observed differences. Additionally, Spearman's rank correlation coefficient is provided to assess the strength and direction of the relationship between pretest and posttest scores within each teaching modality. The correlation coefficient values range from -1 to 1 , where values closer to 1 indicate a strong positive correlation, values closer to -1 indicate a strong negative correlation, and values close to 0 indicate a weak or null correlation. For VLE correlations between pretest and posttest scores vary across different categories. Gardening and baking show weak and non-significant correlations (-0.140 and -0.327 , respectively), while crafts and tourism exhibit moderate and significant correlations (0.414 and 0.452 , respectively), suggesting a positive impact of virtual learning in these areas. In contrast, for FFL, moderate and significant correlations are observed in gardening and crafts (0.477 and 0.502 , respectively), indicating a positive influence of face-to-face teaching in these domains. However, correlations for baking and tourism are weak and non-significant (-0.381 and 0.333 , respectively), suggesting no clear relationship with face-to-face teaching.

The results presented in Table 4 reflect the data from the Mann-Whitney U and Kruskal-Wallis tests, conducted to compare performance between VLE and FFL in various variables. In the analysis of the Mann-Whitney U test, it is observed that the Asymptotic Significance (Sig.) value in the pretest is greater than 0.05 in most variables, indicating no significant differences between VLE and FFL before the intervention. However, an exception is recorded in the baking variable, where a statistically significant difference in pretest results between VLE and FFL is identified. This

Table 2. Descriptive analysis of each of the variables studied.

		Results pretest		Results posttest	
		Mean	SD	Mean	SD
Virtual Learning (VL)	Gardening	10.50	1.509	19.20	2.573
	Baking	14.30	2.497	23.20	2.044
	Crafts	10.30	2.627	18.90	1.792
	Tourism	12.10	2.025	21.10	2.331
	Total	46.20	6.763	82.40	5.777
In-Person Learning (IL)	Gardening	12.80	2.486	22.80	1.619
	Baking	9.40	1.776	20.20	3.553
	Crafts	9.50	.707	20.30	1.947
	Tourism	11.40	2.171	18.50	2.953
	Total	43.10	4.630	81.80	8.284

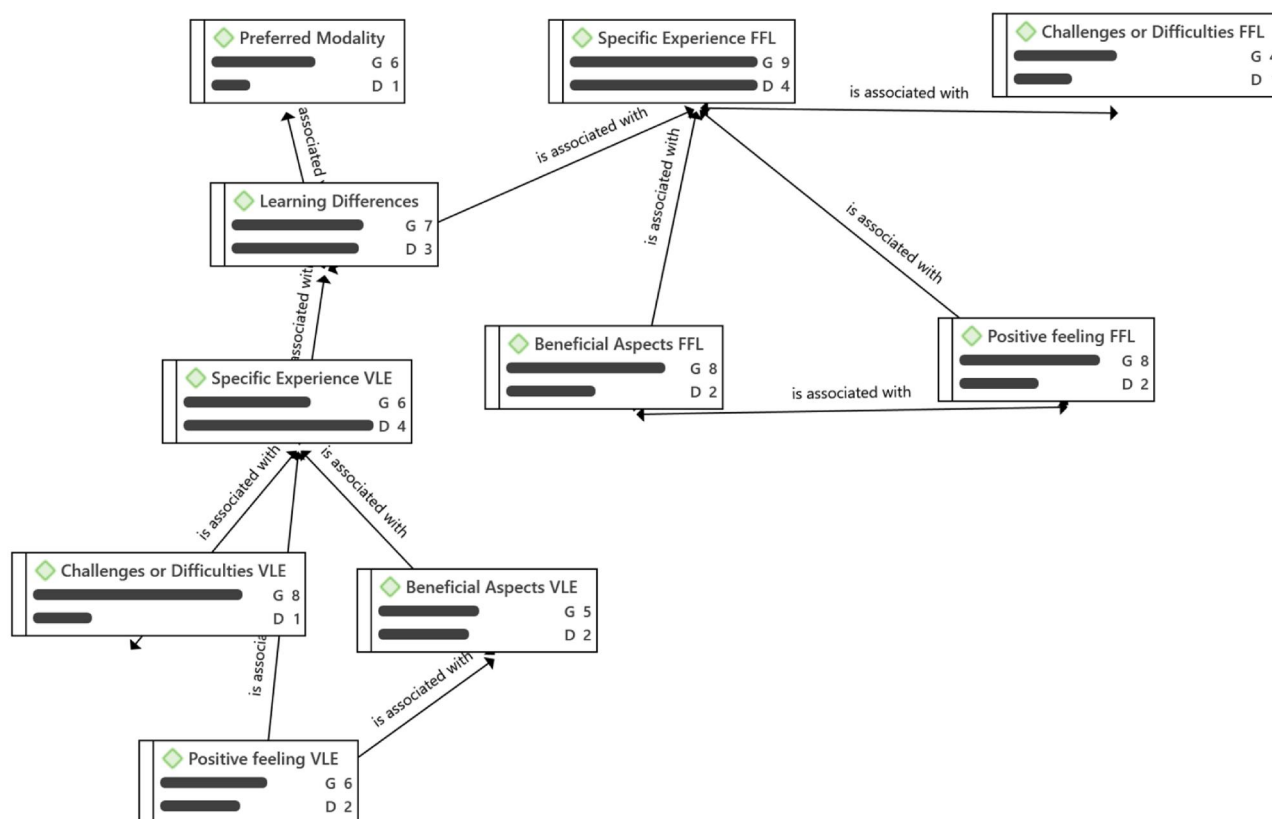
Table 3. Wilcoxon test results and Spearman's rank correlation coefficient.

Type of Teaching	Variables	Wilcoxon Test Results		Spearman's rank correlation coefficient	
		Z	Value of p	Correlation coefficient	Sig. (two-tailed)
Virtual Learning (VL)	Gardening posttest-pretest	-2.809	0.005*	-0.140	0.700
	Baking posttest-pretest	-2.807	0.005*	-0.327	.356
	Crafts posttest-pretest	-2.809	0.005*	.414	.235
	Tourism posttest-pretest	-2.812	0.005*	.452	.189
	Total pretest-posttest	-2.807	0.005*	.104	.775
In-Person Learning (IL)	Gardening posttest-pretest	-2.818	0.005*	.477	.163
	Baking posttest-pretest	-2.805	0.005*	-0.381	.278
	Crafts posttest-pretest	-2.818	0.005*	.502	.140
	Tourism posttest-pretest	-2.807	0.005*	.333	.347
	Total pretest-posttest	-2.807	0.005*	.231	.522

*Statistically significant differences ($p < 0.05$).

Table 4. Mann-Whitney U and Kruskal-Wallis tests.

		U de Mann-Whitney			Kruskal-Wallis Value of p
		Value	Z	asymptotic significance (two-tailed)	
Pretest	Gardening	21.500	-2.182	,029	,029
	Baking	3.00	-3,574	,000	,000
	Crafts	29.00	-1.668	,095	,095
	Tourism	42.500	-0.575	,565	,565
	Total	34.00	-1.214	,225	,225
Posttest	Gardening	11.500	-2.959	,003	,003
	Baking	20.500	-2.269	,023	,023
	Crafts	30.00	-1.535	,125	,125
	Tourism	25.500	-1.862	,063	,063
	Total	47.00	-0.227	,820	,820

**Figure 2.** Code network of study participants' perceptions.

Source: Self-made

indicates that initially, both groups are comparable in terms of their word knowledge, except in the case of baking, where an initial difference is observed.

In the posttest analysis, again, it is observed that most variables do not present significant differences between VLE and FFL, indicating that both learning methods achieved similar results after the intervention. However, in the gardening and baking variables, a significant difference between VLE and FFL in posttest results is identified. This indicates that, for words related to gardening, greater learning is observed in the FFL group compared to the VLE group. Overall, there are no statistically significant

differences between VLE and FFL in the evaluated variables, indicating that both methods are equally effective in terms of performance improvement. However, the specific difference in the gardening variable, where greater learning is evident in the FFL group compared to the VLE group, should be taken into account.

Figure 2 presents the code network representing the participants' perceptions in the study. In this network, the variable 'G' refers to the 'Grade' of how many times a code appears, i.e. how many quotes have been coded with that code. On the other hand, 'D' represents the 'Density' of the network, indicating

the proportion of connections in the network. For example, it can be observed that the code 'specific experience FFL' has a ' $D=4$ ', meaning it is linked to four other codes in the network, including 'Challenges or difficulties FFL', 'Positive feeling FFL', 'Beneficial aspects FFL', and 'Learning differences'. This moderate density in the network suggests that the concept of 'specific experience FFL' is central in the participants' perceptions and is related to multiple aspects of the study. The same occurs with other codes that are also central, such as 'Specific experience VLE' with ' $D=4$ '.

Table 5 presents excerpts of participant quotes categorized according to specific codes. Participants expressed positive feelings toward both virtual and in-person sessions, highlighting enjoyment and satisfaction with activities such as Wordwall and word riddles (*Wordwall activities have been the ones I have enjoyed the most*). While virtual aspects provided benefits such as increased accessibility to speech therapy sessions (*This is how we have been able to have speech therapy on Wednesdays when we couldn't before because there is no speech therapist in the morning*), challenges such as technical difficulties were also reported (*It has been difficult when it didn't work; we had to call [...] to come and fix it, and we would lose*

time). In contrast, in-person sessions fostered a sense of togetherness and ease of communication (*Happy to be with my classmates and the speech therapist*), although participants faced challenges with certain activities like card games (*I especially struggled with card games involving families. Because it's hard for me, the cards slip out of my hands, there are too many cards together and I can't handle them all*). Learning differences between virtual and in-person modes were noted, with preferences divided between the two modalities, reflecting individual experiences and preferences.

Finally, participants were asked to choose between one option and another, indicating their preference (only one possible response), with 60% preferring the FFL and 40% the VLE.

Discussion

The objectives of this research aimed first to determine whether there was an improvement in the vocabulary of adults with mild ID as a result of FFL focused on the instruction and learning of technical concepts and/or virtual intervention focused on the instruction and learning of technical concepts. In this case, it can be stated that significant improvements in

Table 5. Quotes coded by codes.

Code	Quote
Positive feeling virtual	<i>I'm delighted to participate, we've already had more experiences, video calls, and I like them all.</i> (Excerpt 1. Participant 3 Interview).
Positive feeling in-person	<i>Happy to be with my classmates and the speech therapist.</i> (Excerpt 2. Participant 2 Interview).
Specific Virtual Experience	<i>Wordwall activities have been the ones I have enjoyed the most.</i> (Fragment 3. Interview Participant 7). <i>Matching games have been the best.</i> (Fragment 4. Interview Participant 6).
Specific in-person experience	<i>I liked it when we played word riddles and I helped my partner [...], because we paired up, and I like working with him.</i> (Fragment 5. Interview Participant 6)
Benefits of Virtual Aspects	<i>I really enjoyed the word bingo and the stories.</i> (Fragment 6. Interview Participant 5). <i>This is how we have been able to have speech therapy on Wednesdays when we couldn't before because there is no speech therapist in the morning.</i> (Fragment 7. Interview Participant 9). <i>I have enjoyed working from the computer because it looks much bigger than on the sheets we used.</i> (Fragment 8. Interview Participant 10).
Benefits of In-Person Aspects	<i>Being together, on a colleague's birthday, he brought pastries and then we all spent some time together with the speech therapist.</i> (Fragment 9. Interview Participant 5). <i>In the sessions all together, we formed groups of boys and girls, and we talked about it together and thought about it at the moment, it was easier that way.</i> (Fragment 10. Interview Participant 6).
Challenges or Virtual Difficulties	<i>Sometimes, everyone would start talking at once, and it was difficult to get them to quiet down, and with the speech therapist not being here, it was complicated.</i> (Fragment 11. Interview Participant 5). <i>It has been difficult when it didn't work; we had to call [...] to come and fix it, and we would lose time.</i> (Fragment 12. Interview Participant 9).
Challenges or In-Person Difficulties	<i>I especially struggled with card games involving families. Because it's hard for me, the cards slip out of my hands, there are too many cards together and I can't handle them all.</i> (Fragment 13. Interview Participant 10).
Learning Differences	<i>In video conferences, sometimes the internet would go out and it wasn't consistent; we had to stop, and when we resumed, it was difficult to remember where we left off.</i> (Fragment 14. Interview Participant 2). <i>The learning has been similar, but the games, even though they were the same, have been different because in the classroom sessions, we didn't play Wordwall. Additionally, in the video conference classes, sometimes it was difficult for us to say the card, whereas in-person it wasn't.</i> (Fragment 15. Interview Participant 1).
Preferred Mode	<i>I preferred the applications we used during video conferences to learning in the classroom as usual. Because during the video conferences, even though we did them, we didn't play those games.</i> (Fragment 16. Interview Participant 3). <i>I liked the in-person sessions more because sometimes the video call would freeze, and then I enjoy being together and having something to drink.</i> (Fragment 17. Interview Participant 5).

vocabulary knowledge have been found in both modalities. Turning our attention to differential effectiveness across thematic areas, our analysis reveals a moderate positive impact of virtual modalities on crafts and tourism, contrasted by similar outcomes in gardening and crafts for FFL modalities. However, non-significant and weak results are observed for tourism and baking in the FFL modality, as well as for gardening and baking in the virtual setting.

The second objective was to understand the differences between FFL and VLE, and in this regard, it is noteworthy that few significant differences have been found between the two in most variables, indicating that both modalities are effective for vocabulary learning. Two exceptions can be noted: the baking variable in the pre-test, which was not comparable at the end of treatment because participants' knowledge in that variable was already different at the beginning of treatment; and the gardening variable in the post-test, which was significantly different in both modalities, with better results achieved in the FFL modality (improvement of 10.8) compared to the virtual modality (improvement of 8.9). There is no explanation for why this difference exists between modalities only in this variable, as there are no previous studies assessing specific vocabulary learning in adults with mild ID; although it is suspected that there is a relationship between vocabulary and other skills such as reading comprehension (Gallego-Ortega & Figureueroa-Sepúlveda 2020), therefore it is important to improve the understanding of specific vocabulary for adults with mild ID.

The third objective was to assess participants' perception of both FFL and VLE modalities. These results are highly significant for the educational system, especially regarding the attention to individual differences of students, as the understanding of the perceptions of people with ID and the feedback they can provide during the learning process is essential for developing effective teaching-learning strategies to design more inclusive learning situations or environments (Palacios-Garay et al. 2020).

In this regard, the analysis has shown that in general, participants prefer FFL sessions (60%) over VLE ones (40%). Additionally, the 'Positive Feeling FFL' quotes highlight students' satisfaction with being in the company of their peers and the speech therapist during in-person sessions. This also occurs in the research conducted by Selick et al. (2021), which included various types of populations, people with autism spectrum disorder and people with Intellectual

Disability and expressed that the majority of participants preferred in-person sessions to virtual ones.

Although most prefer in-person sessions, there are also quotes categorized as 'Positive Feeling VLE', in this sense, comments stand out in which they feel 'delighted' to participate in virtual activities. These results are similar to others found in therapeutic activities other than speech therapy conducted virtually (Datlen and Pandolfi 2020; Selick et al. 2021). Additionally, they also express that virtual sessions include novel techniques and instruments and being different, they like them; but, on the other hand, they complain about the technical difficulties they may have encountered. These technical difficulties are common for people with disabilities, as sometimes conducting any type of therapy through an online platform tends to be a challenge for them (Guerra et al. 2019).

These differences in perceptions can influence participants' learning. Preference for one modality over the other can affect participation and information retention, as there is evidence that many factors influence the learning process, such as learning needs, teaching dimensions, and the context in which it takes place (Sáez 2018). The advantages and challenges observed in each modality can help educators adapt their pedagogical approaches to meet the needs of students with intellectual disabilities. It is important to note that this study focused on adults with mild ID. For a more comprehensive understanding, future research could expand to include adults with moderate intellectual disabilities.

Conclusions

In summary, and based on the following conclusions can be drawn:

There are indeed improvements in the vocabulary of adults with mild ID as a result of a systematic intervention to learn specialized vocabulary, whether FFL or VLE. However, it is advisable to interpret these data with caution, as despite the overall improvements, significant differences are observed between both modalities in some variables, although a precise explanation for this difference in these variables could not be identified. It's important to acknowledge the limitation of our study. Firstly, the sample size for a pretest-posttest design is quite small. This limitation may affect the generalizability of the findings. This limitation warrants further investigation with larger sample sizes in future research to confirm and extend our results. Additionally, it should be

noted that all participants underwent virtual sessions followed by in-person sessions, and the order of these sessions was not randomized among participants. This lack of randomization could introduce potential sequence effects, such as participants becoming more familiar with the testing procedures over time or the possibility that the skills acquired in the virtual sessions may influence performance in the in-person sessions. Future studies should consider randomization of session order to mitigate such effects and provide a more robust understanding of the interventions' impacts.

The next conclusion relates to the perceptions that participants have regarding both teaching modalities. Participants prefer FFL sessions, as they express happiness to be in the company of their peers and the speech therapist during the sessions. However, they also show a high degree of satisfaction and enthusiasm with virtual activities. Therefore, although FFL sessions are the preferred option, VLE ones are not disliked. However, some technical difficulties during virtual intervention were also mentioned. These differences in perceptions can influence the learning process, as preferences for one modality over the other can affect participation and comprehension of information by individuals with intellectual disabilities. Therefore, it is recommended to use FFL sessions to teach technical concepts to individuals with mild intellectual disabilities whenever possible; however, the implementation of VLE sessions is not ruled out as a valid option.

Disclosure statement

No potential conflict of interest was reported by the authors.

ORCID

Alba Ayuso-Lanchares  <http://orcid.org/0000-0002-0740-7212>

Inés Ruiz-Requies  <http://orcid.org/0000-0001-5785-1795>

Rosa Belén Santiago-Pardo  <http://orcid.org/0000-0002-3317-503X>

Data availability statement

The data used to support the findings of this study are available upon request from the corresponding author.

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