Exploring the sign language proficiency of university undergraduate students in a preservices preparation program for teachers of deaf students

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ABSTRACT
Communication through sign language is essential for teachers of deaf students. This study sought to assess and evaluate the sign language proficiency of preservice teachers of deaf students to help preservice teacher preparation program designers identify what aspects of sign language need to be focused on and provide recommendations to improve preservice teachers’ sign language levels. An exploratory research design was used through questionnaires distributed to a convenience sample. The research subjects were undergraduate female students \((N = 36)\) enrolled in a Saudi Arabian university’s preservice preparation program for teachers of deaf students. This study’s results indicate that preservice teachers of deaf and hard of hearing students scored highly for lexical signs, on an average level for iconic lexical signs, but on a low level for the domain of arbitrary lexical signs. There was a significant effect of participants’ grade point averages (GPAs) on their overall sign language proficiency score. No significant effect of age, academic level, and the number of completed sign language training on overall sign language proficiency score was reported. This study’s outcomes show that preservice teachers’ sign language level needs to be improved and developed. Recommendations are presented for future research and preservice teacher preparation program designers to develop learners’ sign language skills.

Introduction
The Kingdom of Saudi Arabia (KSA) is witnessing a tremendous scientific and educational renaissance that began decades ago, especially in education. This was demonstrated in the expansion of the establishment of universities and colleges in various regions of the Kingdom to serve students, researchers, and various community institutions. This includes interest in developing and establishing specialized centers within universities to provide services to many sectors of society, especially after announcing the Kingdom 2030 Vision (Alotaibi, 2020). The mission of universities in the Kingdom is dedicated to the practical and pioneering contribution to understanding society with its characteristics, issues, and problems, monitoring new educational phenomena, analyzing
them, and working to provide appropriate solutions to them, such as the establishment of special education departments in Saudi universities considering the Kingdom’s concern for people with special needs (Mohammed, 2018). The national government supports special education programs and schools to fulfil their psychological, educational, health, and social development (Abed & Shackelford, 2020) and follow modern education principles. Globally, the literature on sign language education identifies gaps in research in sign language proficiency among preservice teachers, requiring special attention and investigation.

**Overview of language acquisition**

Most of the research conducted in the language field has focused on the study of how language is acquired, its development, and the practice of teaching it on linguistic, psychological, social, and pedagogical foundations (Pereltsvaig, 2020). In the 1950s, two opposing theories were developed and became popular, explaining how language is acquired. The first theory is Behaviorism which holds that language develops as a result of environmental influences (Kargozi & Faravani, 2018). The second theory is Nativism which purports that language develops due to innate factors born with a person and that continue in his life within him (Bickerton, 1984). However, modern theories about human language acquisition focus on the combination and interaction between environmental factors and innate abilities, such as Interactionist Theories which differ in their interpretation of language acquisition (Berk, 2003). By reviewing previous theories, it can be seen that there is no single curative theory to explain second language acquisition. Therefore, some theories have combined more than one opinion to find a more acceptable explanation. One is Vygotsky’s (1978) theory which contends that language learning is based on social interaction which has a strong influence on the development of knowledge. Vygotsky believed that peers are an essential factor for the development of the individual, which is complements Bandura’s and Walters (1977) work on Social Learning Theory that emphasizes interactions with others as the main source of learning. Vygotsky believed that there is a specific period for the development of knowledge. The level of development during this period (i.e. the zone of proximal development) depends on the level of interaction that occurs during it. The current study aimed to evaluate receptive sign language proficiency among preservice teachers, and these theories can be beneficial in understanding the process of teaching or learning a second language (i.e. sign language).

**The importance of effective communication in classrooms**

Nowadays, education is based on dialogue, opinion, and discussion using sign language for deaf students (Mercer, Hennessy, & Warwick, 2019). Modern education calls for a diversification of communication methods that provide educational content intended to improve educational experiences. The nature of the subject, educational goals, learners’ levels, characteristics, and preferences must be followed and used to improve educational experiences (Hiver, Al-Hoorie, & Mercer, 2020). Therefore, teachers should undertake several appropriate classroom roles that contribute to effective teaching methods to bring about the learners’ desired learning, especially modern methods that
focus on the communicative process. Effective classroom communication is required for all students, especially disadvantaged children (Bambaeroo & Shokrpour, 2017). Accordingly, it is vital to have effective communication between teachers and their students in classrooms. This makes school class time more enjoyable and builds a strong relationship between students and teachers and vice versa. This may increase children’s understanding capacity in the classroom and help them feel more comfortable asking questions or asking for their teacher’s help (Frey, Fisher, & Smith, 2019).

**Sign languages as a method of communication**

Deafness may hinder oral communication. This results in deaf people’s use of sign language. Sign language in education is not a ‘teaching method’ but is a fully natural language with grammar, vocabulary, and dialects. However, there are many types of sign language, each with its own lexicon and grammar (Liddell, 2003). Other spoken languages, specifically with co-speech gestures, use some of those signs. However, sign languages have their own rules, syntax, synonyms, and idioms. They evolve like other languages and are used by some deaf people in all aspects of life (Smith, 2004). One of the goals of preservice special education teacher preparation programs is to develop future teachers’ receptive sign language skills. Communication ease among deaf students and their teachers is crucial for access to educational and social information (Alshutwi, Ahmad, & Lee, 2020). Sign language is an important channel of communication between teachers and students as it contributes to obtaining feedback and to the linguistic and cognitive development of deaf individuals (Bergen, Lee, DiCarlo, & Burnett, 2020). Furthermore, effective communication through more coherent sign language develops a positive relationship between teachers and students who use sign language (Hall, Hall, & Caselli, 2019; Polat, 2003). Thus, effective communication is essential to deaf children’s mental health and to those around them to break the isolation barrier and expose them to active social interaction.

Previous studies have reported that teachers proficient in sign language could develop their students’ comfort, learning experiences, and knowledge (Alamri, 2017; Long, Stinson, Kelly, & Liu, 1999; Nikolarazi, 2000). Furthermore, Hunt and Marshall (2012) emphasized that preparation programs for teachers of deaf students have the additional component of sign language acquisition so that teachers can proficiently communicate with deaf students. Therefore, using sign language can have a positive effect on personal growth and learning, growth in print awareness related to spoken language, and dealing with others, as well as contributing to the development of language skills, communicating with others, and enhancing self-esteem and self-reliance (Herman, 2018; Kholis, Purwowibowo, & Ibra, 2020; Leeson, Wurm, & Vermeerbergen, 2014). Considering those mentioned earlier, teachers of deaf students must have proficient sign language skills to provide access to communication and educational information for deaf students. Sign language is essential as it is a language of communication for deaf people and hearing people; therefore, this study focused on exploring preservice teachers’ sign language proficiency.
**Sign languages in Saudi Arabia**

There is no accurate statistic in the number of deaf and hard of hearing persons in Saudi Arabia. However, this population was estimated to be around 455,732 (i.e. 1.4% of the total population), where 27,748 (i.e. 5.7%) of them use sign language (General Authority for Statistics, 2017). Sign languages have emerged in the Arab world as an alternative to spoken language and are documented officially as independent languages. The concerned authorities have made many efforts to spread awareness of sign language. Recently, the Saudi Society for Deaf and Hard of Hearing issued the ‘Saudi Signs Dictionary’ (SSD) which includes the signed alphabet and numbers, in addition to more than 2,700 signs or signed phrases that correspond with spoken Arabic words and phrases. It is a valuable dictionary that includes words and phrases that children commonly use in the first stages of language development.

Before the launch of the SSD, the pan-Arab Sign Language (ArSL) was produced by the Council of Arab Ministers of Social Affairs and used by 18 Arab countries, including Saudi Arabia. The ArSL is a devised sign language; signs were drawn from different Arab sign languages and faced wide resistance, especially by the deaf communities reporting difficulties in understanding the language (Al-Fityani & Padden, 2010). To overcome this issue, the effort to use the SSD for deaf individuals in one country (i.e. Saudi Arabia) as a communication tool for deaf societies considering the absence of spoken language is essential to their communicational and social interaction. Using the SSD helps them express their views and thoughts and acquire necessary knowledge and experiences, which increases efficiency in their social and vocational life and increases their feelings of social belonging. It should be noted that any sign language is related to the context, so it differs not only from one country to another but also inside the same country from one region to another (Al-Fityani & Padden, 2010; Meir et al., 2017). Thus, it is used differently by deaf societies and deaf people in the same schools or institutions; therefore, the SSD should be used in the KSA rather than the ArSL.

Sign languages use a visual and spatial modality, whereas spoken languages use an auditory and verbal modality. Hence, language is a brain-based way of communicating regardless of its modality. Sign languages have their own rules and grammar to ensure well-formed sentences (Liddell, 2003) that preservice teachers should know and follow. In terms of the types of signs that form language, the SSD can be divided into three primary types of signs, similar to types of American Sign Language (ASL) investigated by other researchers (e.g. Caselli & Pyers, 2020; Ortega, 2017). The first is lexical signs which include the signed Arabic alphabet and numbers. Signed letters are manual representations of written letters, and signed numbers are a special subset of lexical signs.

A second type of signs is iconic lexical signs, representing shapes, objects, and directions of their meaning, in which a sign is iconic (looks like) its actual representation. For example, the sign of the word SQUARE can be made by drawing the shape of a square where the sides of the shape should be equal in length, so viewers understand the meaning. Another example is for the verb WALKS by showing the index and middle finger spread out and pointing downward, simulating legs, then moving the two fingers to simulate how people walk. Boyes-Braem (1986) argued that about a third of lexical signs are iconic, meaning that sign forms imitate the perceptual and sensorimotor
characteristics of a referent (Perniss, Thompson, & Vigliocco, 2010). Taub (2001) stated that there are many similarities between signs’ physical forms and their referents’ forms; thus, some signs can be abstract through conceptual metaphors.

The third type of signs is arbitrary lexical signs, including metaphor that does not represent signs’ meaning. These signs can be described as ‘non-iconic’ or ‘not visually motivated.’ For example, the sign for the word TEACHER in the SSD is to fold all fingers except the index finger from both hands and place the hands in an X-shape in front of the chest horizontally; hence, the sign for TEACHER does not represent any hint as to its meaning. Other sign languages have similar types of signs, as ‘lexical variants may represent physical features of a referent [perceptual signs] or an action associated with an object [action signs]’ (Ortega, Sumer, & Ozyurek, 2014, p. 1114). The present study was interested in whether there are any learnability differences among the participants regarding different types of SSD signs and their iconic representations.

Preservice teacher preparation programs in Saudi Arabia

One of the most significant factors related to successful educational experiences for deaf children is accessible, proficient communication with their teachers (Andzik, Schaefer, Nichols, & Chung, 2018; Pennington, Walker, & Tapp, 2021). For example, Easterbrooks and Beal-Alvarez and Scheetz (2015) noted the need for a communication match between deaf students and their teachers. Unfortunately, a number of the signs in the SSD do not achieve the required level of effective communication. This may be due to some teachers’ lack of coordination and organization to become fluent signers (Chen Pichler & Koulidobrova, 2015; Lillo-Martin & Henner, 2021), or that the SDD does not contain enough signs to assist teachers in becoming fluent signers, which hinders the communication and learning processes of deaf students in their schools and societies. Accordingly, teachers’ mastery of sign language is necessary for classroom management, especially concerning the human relations that must be established with learners, the recipients. In the United States, for instance, many high schools offer ASL courses as a foreign language, so some university students already have some knowledge of sign language when they begin their teacher preparation programs. However, this is not the case in Saudi Arabia. Therefore, sign language training should be an essential part of the preservice teacher preparation program in Saudi Arabia.

Preservice special education teacher preparation programs, the deaf and hard of hearing education path, in some of the Saudi universities, in particular, Qassim University, focus on strategies for teaching deaf and hard of hearing children, and social and communication issues that deaf learners may face during the different learning stages (Aldabas, 2015). Twenty-four preservice special education teacher preparation programs exist in Saudi Arabia (Alajlan, 2017). However, all programs are now on hold in admitting new participants (preservice teachers) for several reasons, such as reforming education strategies according to the Kingdom’s 2030 Vision and raising unemployment rates where there is a rapidly increasing number of graduates competing for an inadequate number of jobs. Importantly, preservice teacher preparation programs aim to teach participants techniques to modify curricula and prepare them with teaching methods for students who cannot attend general classrooms and meet their requirements (Alnahdi & Anastasiou, 2020).
According to Darling-Hammond and Bransford (2005), preservice special education teacher preparation programs ought to provide graduates with opportunities to master content knowledge and related practice skills related to learners’ needs, pedagogies, and curricula. They should be able to deal with students with special needs’ development within the social context, creating and construing effective instructional and assessment strategies. Graduates of preservice special education teacher preparation program can also work on social services, health, labor, and organization institutions that include children with special needs.

In the special education teacher preparation program, the deaf and hard of hearing education path, at Qassim University, three courses with three-semester credits are provided to teach attendees some sign language. One course focuses on oral communication, concerning lip reading and training the student on applying this method with deaf students. The two sign language courses are taught by hearing people, and they allow students to learn and practice sign language with the teaching faculty. The first course (Communication Methods – 1) focuses on learning and practicing the alphabet and numbers in fingerspelling, so students are expected to correctly express numbers and the alphabet using fingerspelling. This course is provided on the sixth level (term). The second course (Communication Methods – 2) focuses on primary sign language vocabulary (i.e. signs related to colors, countries, religions, family, and measurement units) and is provided on the seventh level/term. Attendees learn lists of signs, and there is no attempt to teach grammar. Although attendees of these programs will work with deaf students in the future, they only get trained on the mentioned aspect of sign language without actual practice with deaf individuals, which seems to be insufficient.

In light of the researcher’s attention to the field of preservice teacher preparation programs in hearing loss and in trying to link theoretical courses with skills needed in practice, the researcher noted insufficient attention paid to sign language with its standard of rules and principles. Sign language skills of teacher candidates of deaf students are insufficient, and most new teachers do not sign properly; indeed, they have created their own signs. Others used the old sign language dictionary (ArSL), whereas some used the new SSD. This has led to two systems (ArSL vs. SSD), which negatively affects the academic learning aspects of deaf students and causes conflict between the various sign language systems. This is similar to what was reported by Al-Fityani and Padden (2010) regarding criticism of the use of the ArSL. In the SSD, there is no sign language curriculum, whereas some other developed sign languages have one (e.g. the Signing Naturally curriculum in ASL). Therefore, I became interested in studying the level of preservice teachers’ sign language proficiency, possessing sign language, and developing a proposed vision to improve the sign language skills of future teachers of deaf students.

As previously discussed, preservice special education teachers should communicate well using sign language to communicate effectively with their future students. Therefore, this study was designed to focus on future teachers’ levels of sign language proficiency. This would help preservice teacher preparation program designers identify areas for improvement and provide recommendations to improve future teachers’ levels of sign language proficiency.
The focus of this research

Previous research has investigated the issue of using and communicating through sign language from different angles; for example, the historical perspective of the educational use of sign language in teaching and learning (Stokoe, 1976), the education of ASL interpreters (Ball, 2007), ASL Teacher Preparation (Jacobowitz, 2005), differences between hearing and deaf translators (Cerney, 2004), effects of a communication method (Hsing & Lowenbraun, 1997; Wise, 2006), and characteristics and responsibilities of educational sign language interpreters (Jones, Clark, & Soltz, 1997). However, there is a gap in the body of knowledge on teachers’ sign language proficiency, which is one of the primary teaching program outcomes (as discussed earlier); thus, this study can be helpful to investigate what variables may be related to this issue. For example, Alofi, Clark, and Marchut (2019) reported a lack of sign language specialists. Teachers in Saudi deaf schools are nondeaf and may be unable to explain some of the curriculum content due to limitations in knowing or performing the correct signs. Furthermore, due to some communication problems in using sign language, some Saudi deaf people believe that their teachers have received poor-quality education (Alofi et al., 2019). In comparison to other international programs, Beal (2020) also reported about 74% receptive ASL accuracy for learners who had completed four ASL courses; however, preservice teachers in the KSA completed only two sign language courses.

There is little research on this topic, not only in Saudi Arabia but more widely, and there is enormous variation internationally concerning requirements for sign language skills in training programs for teachers of deaf students. Globally, Beal-Alvarez and Scheetz (2015, p. 319) reported that they could not locate any ‘studies that addressed teachers’ sign language proficiency’ and that no data were available for ASL levels of teachers of deaf students. Beal (2020) stated that it is unclear how learners develop their ASL skills across university preparation programs. Hence, there is a global gap in the literature on this topic, and no research paper is found in discussing sign language proficiency among teachers of deaf students, assuming it may be a significant issue on a more global level than local stakeholders in Saudi Arabia.

The present research proposes recommendations on increasing preservice teachers’ sign language proficiency. Consequently, the main research questions were:

1. What are the sign language proficiency levels among preservice special education teachers of deaf students at Qassim University in Saudi Arabia?

2. Are there statistically significant differences between the participants’ sign language scores in the three domains (i.e. lexical, iconic lexical, and arbitrary lexical signs) related to participants’ age, grade point average (GPA), academic level, or the number of sign language training sessions attended?

Method

Based on the purpose of this study, the researcher used an exploratory research methodology. Robson (2002) defined the exploratory design as a way to find ‘what is happening’ to ‘seek new insights’ toward phenomena without investigating reasons. The rationale for
using this methodology is that the researcher has no past data or studies about the issue. It can be a tool for initial research that provides a hypothetical idea of the research problem.

**Study sample**

Participants were 36 female preservice teachers enrolled in a bachelor’s degree program for special education at Qassim University in Saudi Arabia (Table 1). The researcher intentionally selected participants to limit participation to those who were attending the focus program and who fit with the research aims. This type of sampling is commonly used in quantitative studies with similar aims. The participants were only females as the preservice program admitted only females. The participants were from only one learning institution (Qassim University), so the findings could serve as initial data for more regional research if needed; all participants majored as preservice special educators as they were the main focus of this study. Ethics approval was granted by Qassim University’s Permanent Committee on the Ethics of Scientific Research because this investigation met their criteria. Participants had the capacity to make decisions regarding their participation and informed consent. The informed consent form was provided electronically at the beginning of the questionnaire and was written in the participants’ first language, Arabic. Participants were informed that they were free to withdraw without being asked for a reason at any time during the data collection and analysis. The participants were also informed that their data would be completely anonymous, so it would be impossible to identify their data.

| Variable | Participants (N = 36) |
|----------|----------------------|
|          | F           | %   |
| **Age**  |            |     |
| 20–21 years old | 12 | 33.3 |
| 22 years old | 13 | 36.1 |
| 23 years old | 4  | 11.1 |
| 24 years or older | 7  | 19.4 |
| **Gender** |         |     |
| Female | 36 | 100 |
| **Academic Level*** |     |     |
| Sixth | 8  | 22.2 |
| Seventh | 26 | 72.2 |
| Eighth | 2  | 5.6 |
| **GPA** |            |     |
| 4.50–5.00 | Excellent | 16 | 44.4 |
| 3.75–4.49 | Very good | 14 | 38.9 |
| 2.75–3.74 | Good | 5  | 13.9 |
| 2.00–2.74 | Acceptable | 1  | 2.8 |
| **N of sign language training**** | | |
| Three or more | 2  | 5.6 |
| 1–2 | 14 | 38.9 |
| 0  | 20 | 55.6 |

*The academic level presented the semester in the degree work of students (e.g. students in the sixth level are in Year 3 whereas the seventh and eighth levels are in Year 4). Each level represents a semester.

** This presented training courses completed independently outside the university.
**Study instrument**

An online and self-administered questionnaire was designed to collect the data considering restrictions caused by the COVID-19 pandemic on attending the university, conducting academic research, and social life. A self-report questionnaire (through Qualtrics) was used to collect data to ensure a high response rate with less time and effort and provide greater privacy and anonymity (Johnson & Christensen, 2012). The questionnaire used in the study included two sections: demographic questions in the first section and sign pictures in the second section, which included three domains. The lexical sign domain \( (N = 10) \) included number and letter signs. For example, the participants were shown pictures of numbers (e.g. 8, 12, 6, and 1) and some Arabic letters (لا-ش-ج-م-س). They were given four options for each picture and asked to select the correct one for the sign in the picture. The distractors were similar in form to the target item. The second domain was related to the iconic lexical signs \( (N = 8) \). An iconic lexical sign represents a word’s shape and meaning. The participants were shown a picture of the vocabulary word (e.g. dance, shy, spins, bicycle, bathtub eating burger, carrying a bag, and potatoes) and were given four options for each of the pictures to select the one related to the sign in the picture. The third domain includes arbitrary lexical signs \( (N = 8) \) that do not have form and meaning by themselves (i.e. the sign cannot describe and clarify its meaning by itself). The participants were shown a picture of the vocabulary word (e.g. dream, compliments, bathroom, teacher, Thursday, a university, tired, and cleaned), then given four choices for each picture and asked to select the correct meaning of the sign in the picture. All the signs were chosen from the SSD because these preservice teachers would work with deaf students in Saudi Arabia and will have to use this dictionary with their future students.

The survey was validated using face and content validity. It was presented to six sign language interpreters to express their opinions on the signs’ truthfulness. There was over 80% agreement among the arbitrators on the included statements that the other choices could be distractors and that those signs were the most important signs that teachers should know. Thus, the number of items in the first design of the questionnaire was 34. After that, the questionnaire was given to a pilot sample \( (N = 10) \) of the whole sample. Reliability was measured using internal consistency through Cronbach’s coefficient alpha of the items’ interrelatedness within the questionnaire (Tavakol & Dennick, 2011). This method, called internal consistency (half segmentation) involved using the SPSS 25.0 program. The Cronbach’s alpha result for the whole questionnaire, comprised of three domains with 34 items across the sample, was \( \alpha = .781 \). However, due to some reliability risk for some items in the domains pointed out by the Cronbach’s alpha, eight items were deleted; thus, the total Cronbach’s alpha result and the score of each domain were considered to be sufficiently reliable as presented in Table 2.

| Table 2. Cronbach’s alpha on the questionnaire parts. |
|------------------------------------------------------|
| The domain of sign language | N of statements | Cronbach’s Alpha |
|-------------------------------|-----------------|------------------|
| Lexical signs                 | 10              | .702             |
| Iconic lexical signs          | 8               | .595             |
| Arbitrary lexical signs       | 8               | .677             |
| Total scores                  | 26              | .809             |
Data analysis

Statistical analysis was completed used SPSS 25.0 software to conduct statistical analysis. Before any statistical analysis, normality was tested using the Shapiro-Wilk test. Two values, lexical sign score ($W = .911, p < .01$) and arbitrary lexical signs score ($W = .873, p < .01$), did not meet the normality assumption; consequently, significant differences in these two domains among groups were analyzed using the Kruskal-Wallis test. The normality assumption was met in the other two domains: iconic lexical signs ($W = .965, p = .35$) and the total scores of all three domains ($W = .976, p = .64$): as such, one-way ANOVA were used to obtain the required results. A $p$-value of less than 0.05 was determined as statistically significant for all tests. The normality assumption was met in the other two domains: iconic lexical signs ($W = .965, p = .35$) and the total scores of all three domains ($W = .976, p = .64$): as such, one-way ANOVA were used to obtain the required results. A $p$-value of less than 0.05 was determined as statistically significant for all tests. The overall sign language scores were compared with age, academic level, GPA, and the number of sign language training completed by the participants. This was to see whether there were differences in sign language proficiency based on individual factors. First, the total score for each domain was analyzed first. Then, the second analysis aims to scan the data for differences in each of the three outcomes (i.e. sign language scores) separately. The data are presented according to the outcome scores.

Results

This study assessed preservice special education teachers’ ability to recognize some sign language. To serve this purpose, means, standard deviations, and ranks of teachers’ sign language proficiency on the test were extracted. Table 3 illustrates this.

Table 3. Means and standard deviations of preservice special education teachers’ sign language scores.

| Rank | Domains of sign language | Mean | SD | Level |
|------|--------------------------|------|----|-------|
| 1    | Lexical signs            | 7.11 | 1.87 | High  |
| 2    | Iconic lexical signs     | 4.14 | 1.81 | Average|
| 3    | Arbitrary lexical signs  | 2.47 | 1.81 | Low   |
|      | Total scores             | 13.76| 4.36| Average|

Table 4. Descriptive statistics for the overall sign language proficiency score.

| DV                      | IV                         | Groups | Mean | SD  |
|-------------------------|---------------------------|--------|------|-----|
| Overall sign language score | Age (years old)            | 20–21  | 15.75| 4.33|
|                         | 22                        | 13.30  | 3.19 |
|                         | 23                        | 15.00  | 2.82 |
|                         | 24 or older               | 12.00  | 4.97 |
|                         | Excellent GPA             | 16.06  | 3.73 |
|                         | Very good GPA             | 13.08  | 2.99 |
|                         | Good GPA                  | 8.50   | 2.51 |
|                         | Acceptable GPA            | 16.00  | -    |
| Academic Level          | Sixth GPA                 | 10.85  | 3.62 |
|                         | Seventh GPA               | 14.87  | 3.81 |
|                         | Eighth GPA                | 15.50  | 4.94 |
| N of sign training      | Three or more             | 17.50  | 2.12 |
|                         | 1–2                       | 14.23  | 3.78 |
|                         | 0                         | 13.55  | 4.36 |
It should be noted that the highest possible score was 10 in the domain of lexical signs and 8 in the other two domains (i.e. iconic lexical signs and arbitrary lexical signs). The means ranged from 7.11 to 2.47 across the three sign language domains. Lexical signs scored the highest means (M = 7.11, SD = 1.87), followed by the domain of iconic lexical signs (M = 4.14, SD = 1.81), and then the domain of arbitrary lexical signs (M = 2.47, SD = 1.81) which might be at the chance level. Taken together, the mean overall score for the group was (M = 13.76, SD = 4.36).

The second research question concerned whether there were statistically significant differences between the participants’ sign language scores across the three domains (i.e. lexical, iconic lexical, and arbitrary lexical signs) related to participants’ age, GPA, academic level, and the number of sign language courses completed by the participants.

**Differences in overall sign language proficiency scores**

A one-way ANOVA (see Tables 4 and 5) was conducted to compare the differences in overall sign language proficiency scores based on the independent variables. There was a significant effect of GPA on the overall sign language score at the p < .05 level for the three groups [F (3, 29) = 6.004, p = .003]. However, there was no significant effect of age, academic level, or the number of sign language training on the overall sign language score.

To find the differences between the groups based on GPA, A Tukey post was used; however, post hoc tests could not be conducted for the overall sign language scores because one group (acceptable) had fewer than two cases; therefore, the participant who was in the acceptable GPA group was removed only from the Tukey post hoc test. The Tukey post hoc test revealed that the overall sign language scores were statistically significantly lower in the very good group (12.38 ± 3.81 min, p = .03) and good group (8.5 ± 2.51 min, p < .00) compared to the excellent group (16.06 ± 3.73 min). There was no statistically significant difference between the very good and good groups (p = .17).

**Table 5.** A one-way ANOVA to compare the effect of age, academic level, and the number of completed sign language courses on overall sign language proficiency score.

| ONE-WAY ANOVA | DV | IV | ANOVA | Sum of Squares | df | Mean Square | F | Sig. |
|---------------|----|----|-------|---------------|----|-------------|---|------|
| Overall sign language scores | Age | Between Groups | 68.86 | 3 | 22.95 | 1.444 | .250 |
| | | Within Groups | 461.01 | 29 | 15.89 | | |
| | | Total | 529.87 | 32 | | | |
| Academic Level | Within Groups | 91.89 | 2 | 45.94 | 3.147 | .057 |
| GPA | Total | 437.98 | 30 | 14.59 | | |
| | Between Groups | 203.02 | 3 | 67.67 | 6.004 | .003 |
| | Within Groups | 326.85 | 29 | 11.27 | | |
| | Total | 529.87 | 32 | | | |
| N of sign training | Between Groups | 28.62 | 2 | 14.31 | .857 | .435 |
| | Within Groups | 501.25 | 30 | 16.70 | | |
| | Total | 529.87 | 32 | | | |
Differences in lexical sign domain scores

The second research question asked if there were statistically significant differences in lexical sign language scores based on the independent variables. Therefore, a Kruskal-Wallis test was conducted to compare the participants’ lexical sign language proficiency scores.

The test showed no statistically significant difference in the lexical sign scores between groups based on age ($\chi^2(3) = 3.886, p = 0.274$); GPA ($\chi^2(3) = 6.574, p = 0.087$); academic level ($\chi^2(2) = 2.163, p = 0.339$); or number of sign language courses ($\chi^2(2) = 2.895, p = 0.235$). The mean rank score of each group under every variable is represented in Table 6. Thus, no statistically significant difference in terms of proficiency as demonstrated by lexical sign language scores was identified between all variables groups.

Differences in iconic lexical sign domain scores

This research also addressed statistically significant differences between the participants’ sign language scores in the iconic lexical domain (i.e. representative shapes, objects, and directions of meaning) related to participants’ variables. Thus, a one-way ANOVATest was conducted to compare differences in the participants’ iconic lexical scores of sign language proficiency based on the independent variables (Table 7).

| DV | IV | Groups | M. | SD | Mean Rank | Kruskal-Wallis H | df | Asymp. Sig. |
|----|----|--------|----|----|------------|-----------------|----|-------------|
| Lexical signs | Age (years old) | 20–21 | 8.00 | 1.27 | 21.88 | 3.886 | 3 | .274 |
| | 22 | 6.92 | 1.44 | 14.69 |
| | 23 | 7.33 | 1.52 | 17.00 |
| | 24 or older | 6.66 | 2.16 | 15.08 |
| | Total | 7.29 | 1.56 |
| GPA | Excellent | 7.87 | 1.25 | 20.81 | 6.574 | 3 | .087 |
| | Very good | 7.15 | 1.40 | 16.23 |
| | Good | 5.25 | 1.89 | 7.38 |
| | Acceptable | 8.00 | - | 21.50 |
| | Total | 7.29 | 1.56 |
| Academic Level | Sixth | 6.42 | 1.81 | 12.79 | 2.163 | 2 | .339 |
| | Seventh | 7.48 | 1.38 | 18.56 |
| | Eighth | 8.00 | 2.82 | 20.75 |
| | Total | 7.29 | 1.56 |
| N of sign training | 3 or more | 9.00 | 1.41 | 27.75 | 2.895 | 2 | .235 |
| | 1–2 | 7.53 | 1.12 | 18.38 |
| | 0 | 6.94 | 1.74 | 15.82 |
| | Total | 7.29 | 1.56 |
There was a significant effect of GPA on participants’ scores in the iconic lexical signs’ domain at the $p < .05$ level for the three groups [$F (3, 29) = 4.761, p = .008$]. However, there was no significant effect of age, academic level, and the number of completed sign language courses on iconic lexical sign scores.

A Tukey post hoc test was conducted to identify differences between groups based on GPA; however, post hoc tests could not be conducted for the iconic lexical sign scores because one group (acceptable) had fewer than two cases; therefore, the participant who was in the acceptable GPA group was removed only from the Tukey post hoc test. The Tukey post hoc test revealed that the iconic lexical sign score was statistically significantly lower in the good group ($3.769 \pm 1.23$ min, $p = .008$) compared to the excellent group ($4.81 \pm 1.869$ min). There was no statistically significant difference between the very good and good groups ($p = .133$), the excellent group, and the very good group ($p = .189$).
Therefore, the data reveal that an excellent GPA was statistically significant in affecting sign language proficiency scores, meaning that preservice teachers with excellent GPAs had higher scores than the group with good GPAs. This means that students with higher GPAs are expected to be proficient in iconic lexical sign language, similar to the overall sign language score outcome (see Table 5).

**Differences in arbitrary lexical sign domain scores**

Kruskal-Wallis test was conducted to compare differences in the participants’ arbitrary lexical sign language proficiency scores (i.e. signs that usually cannot be understood by nonsign language speakers and need to be translated).

The Kruskal-Wallis test (Table 9) showed no statistically significant difference in the arbitrary lexical signs scores between age ($\chi^2(3) = 2.187, p = 0.535$); GPA ($\chi^2(3) = 7.082, p = 0.069$); academic level ($\chi^2(2) = 3.945, p = 0.139$); and number of completed sign language training ($\chi^2(2) = 2.652, p = 0.266$) groups. The mean rank score of each group under every variable is represented in Table 9. Overall, similar to the lexical sign domain, no statistically significant difference was found in the arbitrary lexical sign scores.

**Table 9.** Means, standard deviations, and the Kruskal-Wallis H coefficient for preservice special education teachers’ proficiency on arbitrary lexical signs based on age, GPA, academic level, and number of completed courses.

|                          | IV            | Groups       | M.  | SD  | Mean Rank | Kruskal-Wallis H | df | Asymp. Sig. |
|--------------------------|---------------|--------------|-----|-----|-----------|------------------|----|-------------|
| Arbitrary lexical signs  | Age (years old) | 20–21        | 3.08| 2.10| 19.58     | 2.187            | 3  | .535        |
|                          |               | 22           | 2.30| 1.65| 16.12     |                  |    |             |
|                          |               | 23           | 2.50| .70 | 19.00     |                  |    |             |
|                          |               | 24 or older  | 1.83| 1.83| 13.08     |                  |    |             |
|                          |               | Total        | 2.51| 1.82|           |                  |    |             |
|                          | GPA           | Excellent    | 3.37| 1.92| 21.19     | 7.082            | 3  | .069        |
|                          |               | Very good    | 1.91| 1.37| 14.38     |                  |    |             |
|                          |               | Good         | 1.25| 1.25| 10.13     |                  |    |             |
|                          |               | Acceptable   | 1.00|       | 9.00      |                  |    |             |
|                          |               | Total        | 2.51| 1.82|           |                  |    |             |
|                          | Academic Level| Sixth        | 1.42| 1.61| 10.79     | 3.945            | 2  | .139        |
|                          |               | Seventh      | 2.79| 1.76| 18.65     |                  |    |             |
|                          |               | Eighth       | 3.00| 2.82| 19.00     |                  |    |             |
|                          |               | Total        | 2.51| 1.82|           |                  |    |             |
|                          | N of sign training | 3 or more  | 4.50| .70 | 27.00     | 2.652            | 2  | .266        |
|                          |               | 1–2          | 2.23| 1.83| 15.46     |                  |    |             |
|                          |               | 0            | 2.50| 1.82| 17.00     |                  |    |             |
|                          |               | Total        | 2.51| 1.82|           |                  |    |             |

**Discussion**

This study explored the sign language proficiency of undergraduate Qassim University students who attended a preservice preparation program for teachers of deaf students. This section discusses the findings according to their implications for future preservice teachers in sign language preparation. The data show no statistically significant difference
in all domains of sign scores across the age groups, which is in line with previous studies (e.g. Beal, 2020; Beal & Faniel, 2019). Table 3 shows that participants scored highly proficient on the lexical sign domain and average for the iconic lexical sign domain. This was expected because, as mentioned earlier, they had completed two courses on basic sign language or because there was a 25% chance that the participants guessed correctly, given the assessment format. The courses on total communication methods (1) and (2), as they are called in some universities, does not satisfy the desired purpose as they focus on the foundations and rules of this language and some primary and vital terms. Some teacher preparation program designers think that sign language skills or knowledge are sufficiently taught in many introductory courses, similar to the sign language course, and that this starts a learning path for students, but the full development of teachers’ sign language skills takes place in the field by engaging with deaf students. As discussed earlier, I do not think this is healthy learning as it requires communication with deaf individuals, which cannot be done effectively at a basic sign language level. However, it should be noted that participants in this study completed only two online sign language courses due to restrictions brought on by the COVID-19 pandemic, which placed some limitations on sign language learning, as reported by Alawajee (2021).

**Overall sign language score and iconic lexical sign domain scores**

Data presented in Table 5 reveal that an excellent GPA was statistically significant in the overall sign language score, meaning that preservice teachers with excellent GPAs had higher scores than students with lower GPAs. This is expected because higher GPAs may indicate how students perform in their courses, as in the sign language courses that are part of their teacher preparation programs. Similarly, data presented in Table 8 show that an excellent GPA was statistically significant in affecting iconic lexical sign scores, meaning that preservice teachers with excellent GPAs had higher scores than those with good GPAs. This finding confirms the findings of Wohlstetter’s (2011) study on the academic performance of undergraduate students enrolled in an ASL course. Wohlstetter reported that students with higher GPAs earned higher final course grades than students with lower GPAs. Likewise, Verkler (1994) reported that GPA was significantly related to language achievement. Thus, students with higher GPAs may be proficient in sign language as they tend to perform well in sign languages courses as well as in other courses.

**Lexical and arbitrary lexical sign domain scores**

Table 6 shows no statistically significant difference between all variables groups regarding proficiency in lexical sign language scores. Although this was not a significant difference, and it was in the lexical sign domain (including only the alphabet and numbers in fingerspelling) and fewer participants in the eighth level, it can indicate that participants developed their skills over time. The number of completed sign language courses also indicates increases in the mean rank of the participants, where students who completed three or more additional courses showed a higher mean rank than those who completed one or two courses and who did not receive any additional courses; however, the outcomes of this variable should be considered cautiously as the number of participants in this group was very low.
It should be noted that there was no statistically significant difference in the arbitrary lexical sign scores between all groups (see Table 9). Like the lexical sign domain, the mean rank shows that students with higher GPAs showed better mean ranks of proficiency than very good or good GPA groups. This is also similar to the finding of Wohlstetter (2011) who reported that students with higher GPAs earned higher final course grades than other students. A lack of statistically significant difference between the groups based on the academic level variable may be due to the two courses on basic sign language provided by the university, so students in the eighth level groups had completed the two courses; therefore, they may have been more proficient than those who had not yet completed those courses.

**Recommendation for future practice**

Sign language is similar to spoken language and equally involves four different angles: speaking, writing, reading, and listening (e.g. ASL literacy, including ABC Stories, Number Stories, Classifier Stories, Handshapes Stories, Narratives, and ASL poetry). Using more than one language has become an essential and fundamental matter in teaching children with special needs. Learning a new language, especially sign language, may take time and effort (Kemp, 1998; McKee & McKee, 1992). With the internet and various means of communication, six main points for consideration in implementing a sign language course are presented.

The first recommendation is to communicate with someone who uses sign language fluently (Liddell, 2003). The best way to learn any new language is to use it rather than reading a book or sitting behind a computer screen. Students who learn sign language only from the dictionary may not be able to practice; therefore, they lose the language over time and lose confidence in using it. In a sign language, comprehension and production skills are equivalent to listening and speaking in a spoken language (Leeson, van den Bogaerde, Rathmann, & Haug, 2016). Therefore, the university is encouraged to include more deaf people in their new hires to offer students in special education programs the opportunities to communicate with them and practice sign language. Programs for preservice teachers can support social clubs like deaf clubs and future teachers of deaf students’ clubs to facilitate practicing sign language. For example, participants in the ASL courses were encouraged to attend events for deaf individuals with weekly meetings using ASL (Rosen, 2014), as this was one key in Vygotsky’s (1978) theory on the development of knowledge.

The second recommended method of learning is to use sign language daily. Al Zoubi (2018) stated that daily exposure to the language could enhance second language acquisition. Preservice teachers are exhorted to use sign language in related courses similar to the method used in learning any other spoken language, as any language should be used daily to be mastered. The number of sign language courses completed in preservice programs should be duplicated every semester as there are currently only three sign language courses (according to the special education program plan at Qassim University). Therefore, the number of courses seems insufficient as attendees will work with deaf and hard of hearing students in the future and need to use the language daily. Increasing the number of sign language courses would allow faculty members and students to apply these recommendations. Artificial intelligence can be used to support
and practice sign language learning as computers able to recognize and render signs (for more information review: Hamouda & Gabsi, 2021; Jiang, Satapathy, Yang, Wang, & Zhang, 2020; Kumar et al., 2020; Paek & Kim, 2021; Papastratis, Chatzikonstantinou, Konstantinidis, Dimitropoulos, & Daras, 2021).

The third recommendation is to design an appropriate curriculum (Beal-Alvarez & Scheetz, 2015), from an existing curriculum in other sign languages (such as Signing Naturally for ASL), including learning morphology and syntax. Besides, learners can practice signs highlighted by cultural aspects, such as learning some greeting words. Then, participants should learn the signs of the alphabet and numbers for the language if necessary. They should collect phrases and signs commonly used to respond to simple inquiries made by deaf individuals they may meet. Most people who fail to learn sign language (based on my experience) are afraid of making mistakes, whereas the deaf society is friendly and understands that the preservice teachers in preparation programs are learners who may make mistakes.

Social media can be used to practice receiving and understanding signs (Tannenbaum-Baruchi & Feder-Bubis, 2018), especially since most TV channels provide live translation through sign language. Learning a new language usually includes substantial video use, so online social media can provide an innovative means of sign language learning to make learning more accessible to interested people (Quinto-Pozos, 2011). For example, faculty members could remove the voice and then ask learners to observe the lip speech and sign language. Distributed practice and repeated practice testing are found to be correlated with increase effective learning (Dunlosky, Rawson, Marsh, Nathan, & Willingham, et al., 2013). However, the signing on broadcast media is often provided by interpreters who do not actually use sign language but instead provide a manual version of a spoken language (with no consideration of the grammar of the sign language). Therefore, these may not provide ideal learning support material or may use the ArSL which has been criticized for being misread or misunderstood by deaf viewers (Al-Fityani & Padden, 2010). Thus, signing on broadcast media might be useful only for sign language learners using the SSD.

Programs for preservice teachers should focus on learning some signs and the grammar of the hands’ position and directions in sign language. Some words may be similar in movement, but they differ in the hands’ place, position, or shape. The individual parameters of signs might suggest explicit instruction and changing one parameter may change the entire meaning of the sign (Beal & Faniel, 2019). Therefore, it is imperative to know the sign’s correct location, position, and direction, as sign language movements start between the ears, forehead, and waist area.

The final recommendation is to develop learners’ ability to read and use facial expressions correctly. Sign language is related to the upper torso, arms, head, and face, and to integrate sign language, all of these parts must work together; therefore, they should observe, interpret, and use facial components (i.e. nonmanual markers) correctly. These recommendations can be used by other disciplines or contexts that want to improve any language proficiency for their participants.

However, courses cannot developed attendees’ sign language, but they should work in their self-regulated learning. Zimmerman (2000) proposed a model of self-regulated learning through three stages: forethought, performance and self-reflection. Students start analyzing the task by setting targets and motivational beliefs energies to reach those
goals then perform the task and monitor progressing using self-control strategies. Students then assess their progress to improve later performances. One of the main pieces of advice for improving students learning and improving educational outcomes is through helping students to regulate their learning using effective learning techniques, such as self-testing, scheduling study time, and rereading (Biwer, Oude Egbrink, Aalten, & de Bruin, 2020; Dunlosky et al., 2013; Hartwig & Dunlosky, 2012).

The current practical side did not take its place in the teachers’ professional development in line with this era changes and the stability of professional development plans. For example, there is a need to teach specific sign language standards, as Ashton et al. (2012) outlined for second language learners of ASL. Therefore, the relation between professional development institutions for special education teachers and practical educational reality needs to be developed to overcome the two concepts’ current isolation and insufficiency. Some studies have indicated an urgent need to establish a national body or council for special education to set standards for the practice of the profession (Brownell, Ross, Colón, & McCallum, 2005), like the Council for Exceptional Children (CEC) in the United States. The role of the proposed council is to develop study plans and specifications, facilitate links and cooperation between and among all parties, monitor the education of disabled individuals at the national level, and develop in-service training programs for teachers in cooperation with the education centers of existing universities. For example, the KSA provides many training programs for special education teachers with all the material resources. However, they are not well invested in achieving their goals, which wastes educational spending and is not an investment in training with a return and an effective product. Therefore, such a council can make effective use of these resources through collaboration with private and governmental organizations, institutions, and schools. Importantly, further studies need to be conducted to get a fuller picture of the status quo of methods for teaching and learning sign language and considerations in designing and delivering sign language courses.

**Study limitations and recommendation for further research**

Although this study seems to be very useful in setting forth the initiation of further direction for future research and practice, the generalizability of the sign language proficiency outcomes may be limited due to four reasons. Firstly, the study was conducted during COVID-19 restrictions on attending the university, so learning sign language during this time may not be the same as when attending the university in person. Secondly, the sample was limited to females in one local university, so further research on a national level with a random sample is highly recommended. Thirdly, this study was conducted through a questionnaire, and qualitative research would provide a deeper understanding of how learners perceive their sign language learning and develop it. The fourth factor limiting the generalizability of this investigation is related to the design of the questionnaire, which was short, so further research would benefit from including multiple signs to increase the outcomes’ validity. Thus, arrangements to avoid these limitations in further research are highly recommended for any future research.

Another limitation of this study is that it has not considered all variables related to language acquisition. For example, some studies have shown that individuals’ mastery of the first language makes it easier to learn a second language because they had gained experience in language learning in general. Some other studies indicate that the failure to master a second
language depends on the age at which the learners began studying that language (Cook, 2010); thus, further research could include these variables to better understand the studied issue. Further research would benefit from including these variables to better understand sign language acquisition. More study is needed to find out the rules and foundations of Saudi sign language used in university education and how it is applicable in teaching practices with deaf learners. Further research could also investigate the problems of academic program specializations in special education and sources of learning sign language in higher education programs, especially after the Covid-19 pandemic during which more programs were provided online, which can be considered additional resources in sign language learning. Learning sign language is also essential to other disciplines, such as in marketing or providing legal and health services, so further research may study how sign language courses can be provided effectively and efficiently to participants in other disciplines.

Conclusion

This study indicates that preservice special education (in the deaf and hard of the hearing path) teachers are highly proficient in using lexical signs and average in using iconic lexical signs, but on the low level of proficiency in using arbitrary lexical signs. There was a significant effect of GPA on the overall sign language proficiency score. The overall sign language scores were statistically significantly lower in the very good GPA group and good GPA group than in the excellent group. However, there was no significant effect of age, academic level, and the number of completed sign language courses on the overall sign language proficiency score. The study did not find any statistically significant difference between all variables groups in terms of proficiency in lexical sign and arbitrary lexical sign language scores. Nevertheless, the data reveal that preservice teachers with excellent GPAs had higher scores on iconic lexical sign language proficiency than those with good GPAs. It can be concluded that none of the participants had adequate sign language skills to work with deaf children, so teacher preparation program developers need to consider how to develop and deliver an appropriate curriculum taught by proficient signers. Overall, the outcomes of this study can disclose that attendees’ sign language proficiency level needs to be improved and developed; therefore, six recommendations were presented to help preservice program designers help develop attendees’ sign language proficiency.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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