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ProTGT$_{lsm}$: Design and evaluation of an application for the sexual education of young Mexican deaf people

ProTGT$_{lsm}$: Diseño y evaluación de una aplicación para la educación sexual de jóvenes sordos mexicanos

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Abstract
Deaf people who use sign language (SL) make up one of the sexually transmitted infections (STIs) riskiest populations in addition to unwanted pregnancy owing to limited access to reliable information sources in their language. The purpose of this study was to design and evaluate the usability of a web application as an educational strategy to promote sexual health among young Mexican deaf. A multidisciplinary group of six professionals and seven members of the deaf community participated in the (user-centered) design and construction of the application, called ProTGT$_{lsm}$. The application consists of five modules: STIs, contraceptive methods, condom use, correct condom use, and placement steps. The ProTGT$_{lsm}$'s ultimate version usability was evaluated by 13 young deaf people (7 men and 6 women, aged between 18 and 29 years), according to the criteria established by the ISO 9241-11 standard. The results showed that ProTGT$_{lsm}$ was easy to use, informative, and appealing to participants and thus it might very well be useful as part of future programs and actions aimed at this sector of the population.

Keywords: deaf culture; sex education; computer application; condom use; educational materials

Resumen
Las personas sordas usuarias de la lengua de señas (LS) conforman una de las poblaciones más vulnerables ante las infecciones de transmisión sexual (ITS) y a tener un embarazo no deseado, debido al limitado acceso a fuentes de información confiables que se ajusten a su lengua. El propósito del estudio fue diseñar y evaluar la usabilidad de una aplicación web como estrategia educativa para promover la salud sexual en jóvenes sordos mexicanos. Un grupo multidisciplinario de seis profesionales y siete miembros de la

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comunidad sorda participaron en el diseño (centrado en el usuario) y construcción de dicha aplicación, denominada ProTGT$_{lsm}$. Consta de cinco módulos: ITS, métodos anticonceptivos, uso del preservativo, uso correcto y pasos para su colocación. La usabilidad de la versión final de ProTGT$_{lsm}$ fue evaluada por 13 jóvenes sordos (7 hombres y 6 mujeres, entre 18 y 29 años), bajo los criterios establecidos en la Norma ISO 9241-11. Los resultados sugieren que ProTGT$_{lsm}$ es una herramienta fácil de usar, informativa y del gusto de los participantes, por lo que podría ser utilizada en futuros programas de intervención orientados a esta población.

Palabras clave: cultura sorda; educación sexual; aplicación informática; uso del preservativo; materiales educativos

Sexually transmitted infections (STIs) represent one of the current and growing problems of special attention to the health system since infections without a cure, such as the human papillomavirus (HPV) and the human immunodeficiency virus (HIV), are among the most sexually widespread in Mexico and the world (World Health Organization [WHO], 2019). In the most recent report of the National Center for the Prevention and Control of HIV and AIDS (Centro Nacional para la prevención y el control del VIH y el sida [CENSIDA], 2019) it is detailed that, in Mexico, 92,069 registered people are living with HIV and 87,571 with the acquired immunodeficiency syndrome (AIDS), and that most of the transmissions were sexually transmitted, affecting the young population.

Unwanted pregnancy is another recurring problem in this population; among the countries that compose the Organization for Economic Cooperation and Development (OECD, 2019), Mexico ranks first in adolescent pregnancy, which could culminate in its interruption. According to data reported by the Ministry of Health of Mexico City (Secretaría de Salud de la Ciudad de México, 2019), adolescents constitute one of the sectors that have demanded the most legal interruption of pregnancy since its legislation in 2007; the number increases each year, reaching 216,755 cases in September 2019.

These data show that a large proportion of adolescents and young people do not perform practices to prevent these problems, such as double contraceptive protection (use of a hormonal method accompanied by a condom) and protected sex (use of a condom), however, in both cases the condom must be used consistently and correctly to ensure its effectiveness (Robles et al., 2012).

Therefore, many of the intervention programs reported in the literature focus their efforts on promoting condom use and healthy sexual practices. Such strategies help to improve people's knowledge, under the understanding that ignoring the circumstances or factors that put health at risk can lead to vulnerability-state-increasing behaviors. (Fisher & Fisher, 1992; Lee et al., 2014).

Among the programs that have shown efficiency in teaching behaviors and preventive strategies are those that utilize Information and Communication Technologies (ICT); an example of this is the *Safe Sistah* program to prevent HIV in African American women (Billings et al., 2015; Wingood et al., 2011).

The effectiveness of these programs is based on three aspects: they are easy to use, they rely on feedback to maintain interaction with the user of the program, and they include tests that allow putting what they have learned into practice (Ritterband, et al., 2009). They are also a viable option because they raise the treatment's fidelity by reducing the effect of variables that put internal validity at risk (Bull et al., 2009; Wingood, et al., 2011); in addition to being available to young people, since in Mexico, there are 74.3 million internet users, of which 86.9% use this medium to obtain information through smartphones or computers (Instituto Nacional de Estadística y Geografía et al., 2019).

Nonetheless, the statistical information presented corresponds to the group of people participating in the population studies, without specifying whether they have disabilities or not; In fact, the official data on STIs and unwanted pregnancy are probably limited to the population without disabilities, leaving aside the attention to vulnerable sectors, of which little is known regarding their sexual health state (United Nations Programme on HIV and AIDS [UNAIDS], 2017).

Several studies document that the hearing-impaired community is one of the groups with the highest risk of contracting STIs (Moinester et al., 2008); especially deaf people who use LS, who are more likely to acquire HIV / AIDS compared to the hearing population (Robles et al., 2013; Sangowawa et al., 2009). One of the reasons is, unlike people who lose their hearing after mastering the oral and written language, their access to reliable sources and health services is usually extremely limited, due to their low command of Spanish (Collazos, 2012).

Cross-sectional studies report that deaf people carry out behaviors that put their sexual health at risk, for instance, the adoption of contraceptive practices through anal penetration (Gomez, 2011), unprotected sexual encounters with occasional partners (Robles et al., 2013), and incorrect use of contraceptive methods (Mprah, 2013; Robles et al., 2013; Sangowawa et al., 2009; Touko et al., 2010); that can lead to the acquisition of STI practices and unwanted pregnancies (Robles et al., 2013).

These risk practices in deaf young people have been attributed, on the one hand, to the lack of reliable sources of information associated with their low levels of reading and writing or illiteracy; on the other hand, to the communication barriers they have with their relatives, who tend to have certain beliefs that limit sexual education, as well as a low dominance of LS, which contribute to young people turning to unreliable sources of information on the subject (Archibald et al., 2008).

Given the above, the need to develop sexual education programs becomes evident, focused on the communicative characteristics of the deaf population, specifically, using SL and the systematic use of visual means (García, 2010; Toe & Paarsch, 2010). These communicative instruments can be offered in ICT-based educational interventions, which facilitate learning through visual resources and have a great scope to get to hard-to-reach populations (Bull et al., 2009). Nathan et al. (2018) highlight that hardware and software have played a fundamental role in the communication and learning of deaf people, which has been conducted to the creation of computer tools targeted to the teaching of various topics and the interpretation of written messages through the LS. Nevertheless, such tools tend to lack quality standards, as in general, deaf people require the support of others for their correct use, which could be an indicator of the lack of user inclusion during the elaboration process and the evaluation of said technological products (Valenzuela et al., 2014), a usability problem that turns into low software quality.

Faced with the problem presented, this work has two purposes: 1) to describe the process of design and construction of a web application for the promotion of sexual health of young deaf Mexicans; and 2) evaluate the usability of said application considering the effectiveness, efficiency, and satisfaction guidelines, established in the ISO 9241-11 Standard for software development.

Web application design

The first stage of the work consisted of developing the software. For this, there was a multidisciplinary group made up of professionals who collaborated at different times: four psychologists with more than 10 years of experience in the management and delivery of intervention programs in sexual and reproductive health, who valued the contents of the program, an illustrator, a web systems programmer, a deaf interpreter, and six deaf young people (50% women, between 28 and 29 years old, with secondary and high school studies, SL users and notions of the Spanish language). This stage was carried out in three moments:

Preparation of the contents of the program and materials

The first step consisted of preparing the contents of the five modules of the program based on trustworthy, reliable, and scientific information: 1) STIs and unwanted pregnancy, 2) contraceptive methods, 3) correct and incorrect use of condoms, 4) steps to its proper use, and 5) modeling to place and remove a condom. For the first four modules, in addition to the information, an activity was designed to reinforce the knowledge acquired.

With the support of an illustrator, graphic material was designed to facilitate the information's understanding.

The illustrations are 157 figures which were independently tested by three deaf youths. In the process, some

changes were made based on the suggestions of the participants, for example, keeping most of the images in black and white, highlighting the key points of the drawings with color, as well as emphasizing the facial expressions of the characters to manifest risk.

Subsequently, four psychologists who are experts in sexual health evaluated the contents and images and proposed improvements based on their experience.

Production and editing of videos

It was supported by an interpreter, a member of the deaf community, who helped in the preparation of the videos which explained, in Mexican Sign Language (LSM, by its Spanish acronym), the contents of the different modules, as well as a hearing interpreter, a psychologist from the research group whose task was to monitor the consistency of information and program content.

Images previously designed and authorized were incorporated into the videos; the final versions were reviewed by three other deaf young people, with a checklist specifying the topics covered in each video, to improve the recording of scenes that were not fully understood.

The final product was made up of five videos in the MP4 file, in which information is exposed in LSM through a deaf interpreter who uses visual resources (images) to explain each of the contents, the maximum duration is 16 minutes with 36 seconds.

Web application development

A programmer developed the web-based application from the specifications outlined in a software design document.

The resulting software is called *ProTGT$_{lsm}$*; It is based on the standards of the *World Wide Web Consortium*, that requires user interaction for its operation (Kappel, et al., 2006), which distinguishes it from a common page.

ProTGT$_{lsm}$ is compatible with cell phones, tablets, and computers; it was built with an open-source *Hypertext Preprocessor* (PHP) programming language; in an angular work environment with standardized options that favor setting. The database was worked on in *MySQL* and is hosted on the servers of the university to which the researchers are attached.

To access *ProTGT$_{lsm}$* users must register with a pseudonym to ensure anonymity. When opening the application, the five modules are displayed, and at entering each one, the respective video and set activity for each topic are found. The exercises in the first two modules consist of identifying whether a series of presented statements are *true* or *false*. In Module 3 two images are shown; the task is to recognize which of them represents the correct way to put the condom on. In Module 4, the steps to place a condom correctly are arranged in a disorderly way, so that the Internet user can sort them in the correct order. Feedback is given to each user's response as correct or incorrect and it is added up to obtain a score per module that the participant consults to see their progress (Figure 1).

Usability evaluation of *ProTGT$_{lsm}$*

The second stage of the study consisted of evaluating the usability of the web application, considering the effectiveness, efficiency, and satisfaction guidelines (Danielson et al., 2016; Jibb et al., 2017; O'Malley et al., 2014).

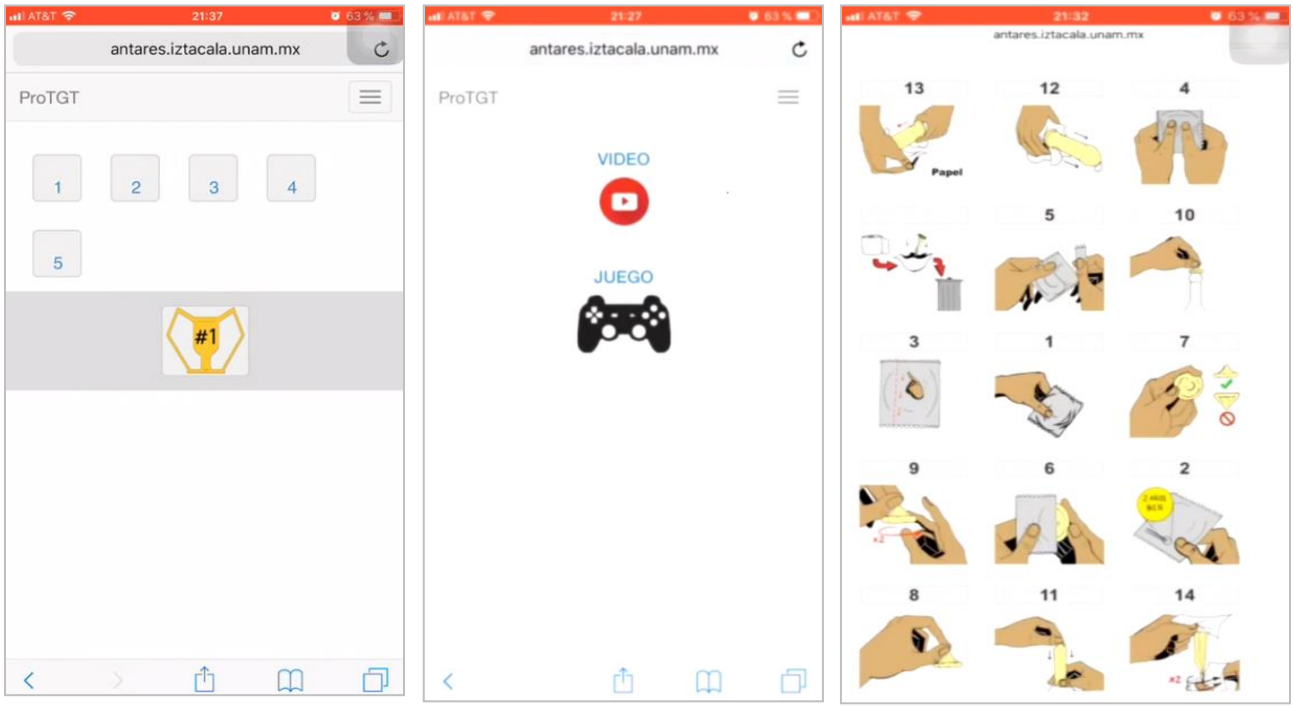
Method

Participants

The study included 13 deaf young people (7 men, 6 women), with primary (n = 2), secondary (n = 5) and high school (n = 6) studies, and a mean age of 23.69 years (SD = 3.96), chosen through a non-probabilistic convenience sampling. The selection criteria were to be between 18 and 29 years old, to be users of the LSM, and to sign an informed consent to participate in the study.

Figure 1

Design and presentation of ProTGT$_{lsm}$



Instruments

The evaluation of the application was carried out following the guidelines established by the International Organization for Standardization, for software development (ISO 9241-11), in terms of effectiveness, efficiency, and satisfaction for the usability evaluation. Aspects such as specificity, software objectives, and the type of users were also taken into consideration (Bevan et al., 2016), under the criteria of O'Malley et al. (2014), who proposed a series of measures attached to said norm:

Effectiveness. How a task is completed (completeness and precision). The test consists of determining whether a person can initiate and end an indication of the software without the intervention of a third party and it is evaluated in terms of success or failure. A case of success is evidenced in the conclusion of the exercises without the intervention of another individual. A failure implies requesting some help to carry out the activity or not having completed/advanced in the task.

Efficiency. Component associated with the time it takes to finish a problem (timeliness). This test consisted of timing an inexperienced user in the activities of each module, a period that is compared with that of an experienced one.

Satisfaction. Participant experience running the software. For its measurement, the System Usability Scale (SUS) (Hedlefs & Garza, 2016) was used, which explores the perception of pleasure, ease, and functioning when using the program; It is made up of 10 items including response options on a five-point Likert-type scale, which ranges from strongly disagree to strongly agree, and has an alpha of .92 for the Mexican population.

Participant profile. To know the traits of the participants, 11 items were included, in which it was explored: age, sex, educational level, device-use frequency (cell phone, tablet, computer), use of computer and cell phone for recreational activities; Three open questions were included for users to freely express which aspects of the software they liked, which they disliked, and suggestions for change.

Procedure

The study was carried out in a well-lit and ventilated classroom, one computer with an internet connection was assigned per participant.

Before starting the usability tests, one of the researchers with mastery of the LSM and an observer

(previously trained) introduced themselves to the participants, explained the objective of the research, and gave a detailed explanation of the work that would be done. It was explained that it would be observed what their interaction was like when using said material, so then ask them about their experience. Likewise, they were told about the ethical considerations of the project, in which their anonymity, free participation, and flexibility were guaranteed to leave the study at any time they wanted. They were asked if they had any doubts to be clarified before asking for their consent to collaborate.

Afterward, prompts were given for them to complete the first four modules of *ProTGT*$_{lsm}$, and request support if necessary. The observer recorded the start and end times of each of the exercises, with the help of a stopwatch, as well as the cases of success or failure. Data collection was done individually, so were additional instructions for those who requested them.

After concluding these activities, the interview was conducted, in which the researcher with mastery of LSM applied the questionnaire to find out the opinions about the software, emphasizing the relevance of answering their sincere opinion to make improvements in the software.

The participants' answers were captured and analyzed with the statistical program SPSS version 24 for Windows. Because this was a cross-sectional, observational study with a descriptive scope, the synthesis of the results is shown through descriptive analyzes (mean and standard deviation) and frequencies, which allow us to appreciate the distribution of the data.

Results

Since the web application is compatible with various devices, it was necessary to know if the study participants had any experience with these tools and, based on the results obtained, consider whether these variables could favor or affect the user's performance. All participants reported having experience in using a tablet, computer, or cell phone, the second being the most widely used device (46.2%), followed by the computer (23.1%). 46.2% of the participants reported having used the cell phone to play and 38.5% reported entering Internet sites to carry out some activity related to a game. Table 1 presents the data corresponding to the characteristics of the participants.

Table 1

Participant characteristics (N = 13)

	Never		Rarely		Sometimes		Frequently	
Characteristics	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Frequency with which they use cell phone	1	7.7	1	7.7	5	38.5	6	46.2
Frequency with which they use tablet	7	53.8	3	23.1	2	15.4	1	7.7
Frequency with which they use computer	5	38.5	2	15.4	3	23.1	3	23.1
	Yes	%	No	%				
Using cell phone to play	6	46.2	7	53.8				
Playing on internet sites	5	38.5	8	61.5				

In the effectiveness evaluation, it was observed that the thirteen participants completed the first three modules; while, in the fourth module, which consists of ordering the steps to use the condom correctly, three of them (23.1%) did not manage to complete the tasks, which is why they were recorded as failure cases. The errors consisted of trying to order the images outside the corresponding space for said task.

The *efficiency* data correspond to the time it took the participants to carry out each of the tasks, compared with the time it took for one of the young people who supported the process of preparing *ProTGT*$_{lsm}$ (expert user).

As shown in Table 2, solving the exercises concerning modules 1, 2, and 4 took the participants almost a minute longer than the expert user. In contrast, the difference in Module 3 was only 8 seconds. In none of the cases, did the users equal the total time of the expert user, a result that amply conforms to the standards indicated by O'Malley et al (2014), who consider that the execution time of the new user maybe two or three

times longer than that of the expert.

Table 2

Descriptive data of the tests of technical effectiveness and relative efficiency of the application web ProTGT$_{lsm}$

Module	Effectiveness *n*/*N*	Efficiency (in seconds)		
		New users *M* (SD)	Expert user	Difference
1	13/13	273.31 (25.89)	224	49.31
2	13/13	281.08 (67.39)	196	85.08
3	13/13	72.46 (9.16)	65	7.46
4	10/13	105.62 (45.32)	54	51.62

Note: Effectiveness = number of tasks requested completed; Efficiency = seconds it takes to complete a task.

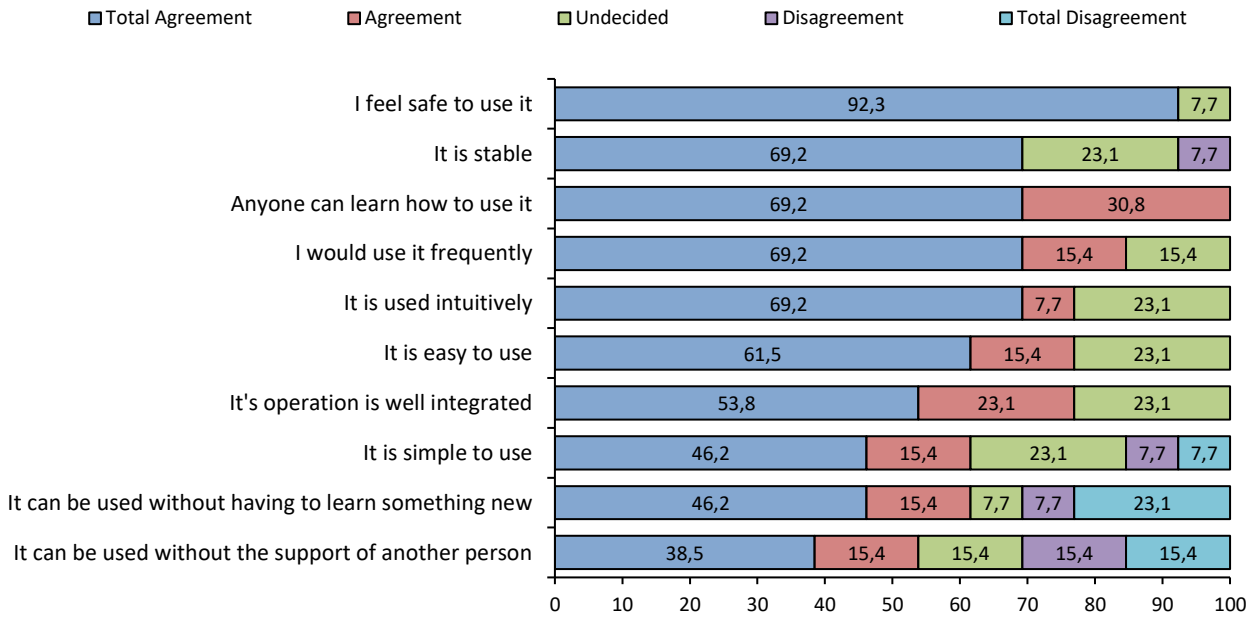
In the interview, to find out the opinion of the participants about what was the aspect that they liked the most about the *ProTGT$_{lsm}$* web application, 84.6% mentioned the complete program, and the majority thought that the information was clear; 15.4% stated that what they liked the most was that the videos and games were accompanied by drawings.

Regarding the aspects which they would change, they suggested using more colors in the design (23.1%), adding more visual aids (7.6%), and increasing the interpreter's histrionics (23.1%). The remaining 46.2% said they would not change anything.

Figure 2 shows the results of the application of the usability scale; the youth expressed strong agreement that it is an application which made them feel safe (92.3%), they consider it to be stable (69.2%), that anyone could learn how to use it (69.2%) and that most would use it frequently (69.2%).

Figure 2

Results of the application of the usability scale to evaluate ProTGT$_{lsm}$



More than half of the participants agreed that *ProTGT$_{lsm}$* can be used without the support of another person and that you do not need to learn anything new to use it. When taking all aspects into account, the application received an average rating of 3.3 (SD = 1.7) for the entire scale, which places it as software with an acceptable rating.

Discussion

The results of the first stage of the study suggest that the first purpose of the present work was fulfilled since it was possible to build a web application aimed at promoting aspects related to the sexual health of young Mexican deaf people, considering the characteristics of the users.

The achievement of this objective is due to taking the recommendations indicated by different authors (García, 2010; Glickman et al., 2013; Moinester et al., 2008; Mprah, 2013; Toe & Paatsch, 2010; Touko et al., 2010) for the development of accessible and easy-to-understand materials for deaf people (Sand-Jecklin, 2007). Such was the case of the 172 images that illustrate the explanations shown in the videos and games that are integrated into the application, where essential ideas are presented, and distractions are avoided. Moreover, they focus on the participation of deaf people, since one of the requirements in the development of psychoeducational material was verified with them: recognition by the audience to which the tool is directed (Hoffmann & Worrall, 2004).

Likewise, the design of the images allowed adjustments to be made during their elaboration, in such a way that they were visibly representative of the contents and different from each other, to avoid confusion and to be able to make systematic use of them, as recommended by García (2010).

The videos are another important element of the *ProTGT*$_{lsm}$ application. The procedure for their production was based on taking care of the grammar of the LSM and avoiding the use of a signed Spanish language, to emit a clear message that would favor abstraction on the part of the receiver (Smith & Cruz, 2006). Two interpreters collaborated in this process, one deaf and the other hearing. The first oversaw exposing the topics in the videos since LSM is his first language and he expresses it fluently, clearly, and with appropriate mimic manifestations, which helped to expose the content (Glickman et al., 2013). The work of the second interpreter, who is a research psychologist, consisted of providing support, monitoring, and feedback to the deaf interpreter, supervising the congruence of the information and the content of the program, which guaranteed an effective interpretation (Jones et al., 2006).

The videos were made under the recommended interpretation guidelines: in them, you can see the performer wearing a T-shirt that contrasts with the tone of his skin, and without jewelry that could distract the audience. In addition to this, space where the recording was made, had lighting and white background that prevented the presence of stimuli that could intervene in the coding and subtle features of the signs. These particularities have been considered for the manufacture of SL material; For example, the British Sign Language Corpus Project, where evidence is collected in SL through filming for scientific research, so it is sought that the shooting context is favorable for the analysis of the language, considering that all manual coding, gestures, and body is not hampered by external factors that affect the transmission of information (Schembri et al., 2013).

The measures are taken during the construction of the material and its evaluation through the checklists allowed to verify that the videos can be understood, remembered, and consequently, relevant for deaf people, as indicated by Hoffmann and Worrall (2004). Even when the content verification was carried out with only three deaf participants, the appearance of problems such as those reported in the *CyberSenga* study (an online program that promotes abstinence and that of the condom through informative vignettes) could be avoided, where it is mentioned that one of the main difficulties was the clarity of the contents (Ybarra et al., 2014).

According to Valenzuela et al. (2014), for the development of computational environments aimed at deaf people, the participation of two deaf individuals in content design is sufficient; with their contributions, an educational and cultural approach can be achieved focused on this population. In such a way that a material in which images refereed by members of the deaf community are integrated and an explanation assisted by a deaf interpreter could have provided guidelines for effective communication. Several authors (Curle, 2015; Hoffmann & Worrall, 2004; Niebaum et al., 2015) have argued that the incorporation of illustrations in psychoeducational materials favors communication, persuasion, and the remembrance of content. In deaf people, this benefit is greater, since their memory is constituted by visual references, so this type of resources

facilitates the understanding of a topic (Toe & Paatsch, 2010).

Another component that could have contributed to the reception of the information and the retention of what was learned was the duration of the videos (between 4 and 17 minutes). Although it can be assumed that it is a short time, given the breadth with which the topics included in each module can be addressed, authors such as Hoffmann and Worrall (2004) have reported that the materials which are presented in a concrete and precise way maintain care and facilitate the understanding of users. This aspect has already been tested; in the pilot of the *I-STIPI project* (online intervention for the prevention of STIs aimed at Chilean women), it was observed that one of the reasons for dropping out of the program was the extension of materials and resources (Villegas et al., 2015). In this sense, it can be considered that *ProTGT*$_{lsm}$ has sufficient strategies to promote the retention of participants.

ProTGT$_{lsm}$ is located within the classification of internet-based applications thanks to its characteristics: it uses specific attributes of the web, demands the mediation of users for its operation and the progress of the interested parties can be monitored using its connection to the network (Kappel et al., 2006; Luján, 2002). Besides, because the software performs independently of the hardware, it is possible to 1) implement it in low-resource settings (Glasgow, 2007); 2) make changes to the same code if an update is required, since it is not necessary to make adjustments to different codes depending on the hardware and the operating system, thus avoiding problems of inconsistencies between the application versions; 3) dispense with the installation of additional tools for its implementation, and 4) integrate the platform of the administrator and Internet users on the same interface, a quality that allows monitoring over time. These aspects translate into cost and time savings (Luján, 2002).

The second objective of the present work was to evaluate if *ProTGT*$_{lsm}$ complied with quality standards when used by the target population. Through a usability test, the certainty of its effectiveness, satisfaction, and efficiency was reached, with which the quality of the product was verified according to the ISO 9241-11 standard (Bevan et al., 2016). The program meets the three dimensions of the quality criterion, that is, effectiveness, efficiency, and satisfaction on the part of deaf youth (O'Malley et al., 2014).

In the technical effectiveness tests, it was revealed that the software did not present critical errors that prevented the completion of the tasks that comprise it, since in the first three modules all the young people were able to finish the activities. Regarding the fourth module, three of the thirteen participants could not advance in the exercise during their first attempt, and even when this could be solved by adjusting the instructions on how to select the cases, in the results of the study it was valued as a minor error. Of course, the adjustment was made for future applications.

The next indicator of usability was the relative efficiency assessment. The gap between the runtime of new users and that of an expert user was shown to be minimal; the difference was about a minute. This fact places *ProTGT*$_{lsm}$ as a simple and fast application to use. This assertion is also supported by the answers obtained in the interviews because most of the testimonies expressed their agreement that learning the operation of the application was not a problem and that it is answered quickly.

The main limitations of the study include the size of the sample. Authors such as Danielson et al. (2016) point out that 18 participants are a standard number for usability studies, but that, for populations with special characteristics, the criterion is located at ten participants. In this sense, it should be considered that *ProTGT*$_{lsm}$ was developed for deaf young people, who represent a small part of the Mexican population, which makes this community a group of difficult access. However, it was possible to integrate a sample with diverse characteristics, given that their educational level ranged from primary to high school, and their experience in using any of the devices (cell phones, tablets, or computers) was zero, medium, or high. Therefore, it can be said that the results were not a function of educational level and that *ProTGT*$_{lsm}$ does not require deaf people to possess high levels of knowledge in the use of technological and digital tools (Glasgow, 2007). Nonetheless, having a larger sample would have diversified the comments and, probably, other problems that the software could present could have been identified (Danielson et al., 2016).

Another limitation was data collection. The application of the usability questionnaire was carried out

through an interview, which could have generated some bias on the part of the interviewer. Even though some authors (Guilhermino et al., 2012; Jones et al., 2006) have pointed out the advantages of using self-applied instruments in deaf people, it is important to consider the time it may take them to adapt to the instruments to achieve the validation. For this reason, some relevant elements were considered to maintain objectivity during the present study: the application of the questionnaire was carried out by the same interpreter, to avoid variations, and emphasis was placed on the initial instructions, where confidentiality and the significance of the participant's honest opinion during the interview were pointed out to make improvements in the *ProTGT*$_{lsm}$ system.

It should not be overlooked that there are usability studies (Danielson et al., 2016; O'Malley et al., 2014; Ybarra et al., 2014), where data collection was also done through interviews. Valenzuela et al. (2014) clarify that, during the development of ICT applications aimed at deaf people, interviews are an especially useful tool, because they allow identifying factors or events that generate concern, without resorting to written instruments since deaf people usually present difficulties of literacy.

It can be considered that the deaf individuals who were involved in this stage of the research openly expressed their experiences and observations about the web application. An example of this was the suggestion made about the design of *ProTGT*$_{lsm}$, the interviewees indicated that the program could be more attractive by incorporating colors, although this comment was omitted because the design of *ProTGT*$_{lsm}$ is based on the recommendations of Valenzuela et al. (2014) to avoid the attention divided by the information on the screen.

In summary, at this stage *ProTGT*$_{lsm}$ showed indications of being a short and easy-to-use application to promote condom use in deaf people; in the words of Hoffmann and Worrall (2004), a psychoeducational material with these attributes could guarantee its frequent use. It was also proven that the web application meets the criteria defined by Glasgow (2007): a program aimed at changing health should not require users to have high levels of experience to manipulate these tools. Its success is centered on a *User-Centered Design (UCD)* since young deaf people participated in its construction from the beginning (Nathan et al., 2018; Valenzuela et al., 2014).

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