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Participation in regular classroom of student with hearing loss: frequency modulation System use

Participação em sala de aula regular do aluno com deficiência auditiva: uso do Sistema de frequência modulada

ABSTRACT

Purpose: Translate and adapt to Portuguese the Classroom Participation Questionnaire (CPQ) and compare the participation in regular classroom of students with hearing impairment with and without the use of frequency modulation (FM) System. **Methods:** The translation and adaptation of CPQ included the translation into Portuguese, linguistic adaptation and review of grammatical and idiomatic equivalences. The questionnaire was administered to 15 children and teenagers using hearing aids (HA) and/or cochlear implant (CI), fitted with personal FM System. **Results:** The translation of the English CPQ into the Portuguese instrument resulted in the “*Questionário de participação em sala de aula*” with the same number of questions as the original version; regarding linguistic adaptation, no difficulty was observed in the understanding of the items proposed in the application for students with hearing loss. **Conclusion:** The CPQ instrument was translated and culturally adapted for the Brazilian population, being named “*Questionário de participação em sala de aula*” in the Portuguese version. The study contributes to observation and monitoring of participation in regular classroom of students with hearing impairment using FM System. In general, students reported increased confidence and participation in the classroom with the use of FM System.

RESUMO

Objetivo: Traduzir e adaptar para o Português o questionário *Classroom Participation Questionnaire* (CPQ) e comparar a participação em sala de aula regular do aluno com deficiência auditiva com e sem o uso do Sistema de frequência modulada (FM). **Métodos:** A tradução e adaptação do questionário CPQ incluiu tradução para o Português, adaptação linguística e revisão das equivalências gramatical e idiomática. O questionário foi aplicado em 15 crianças e adolescentes usuários de aparelho de amplificação sonora individual (AASI) e/ou implantes cocleares (IC), adaptados com Sistema de FM pessoal. **Resultados:** A tradução do CPQ do Inglês para o Português resultou no instrumento “*Questionário de participação em sala de aula*” com o mesmo número de questões da versão original; quanto à adaptação linguística, não foi observada dificuldade na compreensão dos itens propostos na aplicação em alunos com deficiência auditiva. **Conclusão:** O instrumento CPQ foi traduzido e adaptado culturalmente para a população brasileira, sendo nomeado “*Questionário de participação em sala de aula*” na versão em Português. O estudo contribui para observação e acompanhamento da participação em sala de aula regular do aluno com deficiência auditiva usuário do Sistema de FM. De maneira geral, os alunos informaram maior confiança e participação em sala de aula com o uso do Sistema de FM.

Study carried out at the Speech-Language Pathology and Audiology Clinic of the School of Dentistry at Universidade de São Paulo – USP – Bauru (SP), Brazil.

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Conflict of interests: nothing to declare.

INTRODUCTION

The inclusion of students with hearing loss in the school system is assured by the public power in Brazil through official documents, among them the Law of Guidelines and Foundations of National Education 9.394/96, promulgated in 1996⁽¹⁾ as well as decree 5.296 of December 02, 2004⁽²⁾. The latter regulates law number 10.048, of November 08, 2000, which gives priority of service to disabled individuals by specifying and establishing general rules and basic criteria to promote accessibility.

For individuals with hearing loss, assistive technology pertains to technical aid, that is, products, instruments, equipment or technology adapted, or especially projected to improve the functionality of disabled people, thus favoring personal, total, or assisted autonomy (law 5.296 of December 02, 2004)⁽³⁾.

In this context, systems of frequency modulation (FM) consist of two elements: a microphone/transmitter and a receptor. The microphone/transmitter, used by the speaker, captures sounds, decodes them into electrical signals, and then converts them into modulated frequency signals. This FM signal is then decoded by the receptor, used by the listener, and again transformed into acoustic energy. FM transmission provides a simple solution to reduce the distance between speaker and listener, and to consequentially decrease the masking effects of noises as well as of reverberation on speech signals⁽⁴⁾.

Personal FM systems, self-contained or open-field style, are considered the most important and essential educational tools developed for children with hearing loss, as they are the most effective way to improve the captured speech signals and to eliminate the effects of distance, noise, and reverberation, especially in the school environment⁽⁵⁾.

Ordinance 1.274, of June 25, 2013⁽⁶⁾, includes personal FM systems in the table of Procedures, Medications, Orthotic and Prosthetic Devices, and Special Materials.

Through hearing aid devices, programs of early detection and prevention of hearing loss have enabled and made urgent the access to listening environments. The primary focus of a program of early hearing loss intervention is to provide support and encourage family members during the structuration of the child's communication process^(7,8), including guidance about the need to use hearing aid devices, among them FM systems⁽⁹⁾.

If a student is not able to hear the teacher's instructions at school, the entire educational process is affected⁽¹⁰⁾. In this context, speech-language pathologists and audiologists can collaborate with action programs based on instruments of assessment that indicate environmental adaptations and provide the necessary guidance for teachers and children with hearing loss, as communication aid devices, such as FM systems, are part of the assistive technology to which teachers must have access so that students with hearing loss can receive information in an effective manner^(3,11,12).

Information pertaining to how students with hearing loss evaluate themselves in regard to their participation in regular classrooms can aid in the development of strategies in this aspect, by the students as well as by their teachers and classmates.

On the basis of the above considerations, in this study our purpose was to:

- translate and adapt the Classroom Participation Questionnaire (CPQ) to Portuguese;
- compare the participation of students with hearing loss in regular classrooms who used and who did not use FM systems.

METHODS

This study was carried out at the Speech-Language Pathology and Audiology Clinic of the Department of Speech-Language Pathology and Audiology of the School of Dentistry of Bauru at Universidade de São Paulo (FOB/USP). A total of 15 children and adolescents with hearing loss, aged between 7 and 18 years, agreed to participate. The individuals were users of personal sound amplifiers (PSA) adapted with an FM system (Table 1).

The children and adolescents were enrolled in elementary, middle, or high school, and their parents and/or legal guardians signed the informed consent form previously approved by the ethics committee (140/2010).

Instruments and procedures

Classroom Participation Questionnaire

The CPQ⁽¹³⁾ (Appendix 1) is a subjective assessment tool that enables a situational analysis of the student's participation in the classroom. It is filled out by the student, who is instructed to use paper and pencil. The questionnaire contains 28 hearing-related situations, divided into four subscales, scored as follows: 1 (almost never), 2 (sometimes), 3 (usually), and 4 (almost always). A visual scale was offered to the students to indicate the score, as presented in Figure 1.

Table 1. Demographic distribution of the research participants

Student	Age (years)	Type of device	Approximate time of use
1	15	CI and PSA	1 year
2	15	CI and PSA	4 years
3	14	CI and PSA	4 years
4	8	CI and PSA	1 year
5	8	CI and PSA	3 years
6	14	CI and PSA	4 years
7	11	CI and PSA	4 years
8	18	Bilateral PSA	8 months
9	10	Bilateral PSA	4 years
10	8	CI and PSA	3 years
11	15	CI and PSA	1 year
12	14	CI and PSA	4 years
13	7	CI and PSA	1 year
14	12	CI and PSA	1 year
15	8	CI and PSA	3 years

Caption: CI = cochlear implant; PSA = personal sound amplifiers

Following are the subscales contained in the questionnaire:

1. Understanding teachers;
2. Understanding students;
3. Positive affect;
4. Negative affect.

The subscales “Understanding teachers” and “Understanding students” are considered cognitive components, and “Positive affect” and “Negative affect” are considered affective components.

Of the total 28 items, we selected 16 items marked with an asterisk for the simplified version suggested by the author of the original questionnaire.

High scores are desirable, except for the scale of “Negative affect”, in which the reverse score is expected in both versions.

Cultural adaptation

The translation and cultural adaptation of the CPQ followed the steps recommended⁽¹⁴⁻¹⁶⁾, described in the following sections.

Translation of the questionnaire into Portuguese

The original instrument was given to two English translators and interpreters, fluent in this language, who did not know each other and had no knowledge of the questionnaire. The purpose was to elaborate, individually and in confidentiality, the first Portuguese version. This procedure aimed at generating two independent translations of the questionnaire.

Linguistic adaptation

The group of revisers comprised two speech-language pathologists (Brazilian individuals who knew the original instrument and were fluent in English) who analyzed the two resulting documents, reduced the differences found in the translations, and adapted the text to the Brazilian culture. Thus, a new inventory named “*Questionário de participação em sala de aula*” (“Class Participation Questionnaire”) was obtained.

Revision of grammatical and idiomatic equivalence (back-translation)

For the revision of grammatical and idiomatic equivalence, a copy of the questionnaire was sent to two other translators

who had the same linguistic and cultural characteristics of the translators used in the first stage. Without any knowledge of the original text, they produced the English counter part of the new version of the instrument. The same group of revisers evaluated the two resulting versions, comparing them to the original in English.

Cultural adaptation

In this stage, the purpose was to establish a cultural equivalence between the English and Portuguese versions of the questionnaire. Cultural equivalence is achieved when at least 80% of the population evaluated has no difficulties to comprehend the questions elaborated or the terms used.

Frequency Modulation System

After the translation, the questionnaire was applied by the researcher to the patients at the Speech-Language Pathology and Audiology Clinic who effectively used PSA or cochlear implant (CI; 8 h or more per day) and FM systems (at school). The FM system in question was of the traditional personal type with a receptor attached to the PSA or CI, all manufactured by Phonak.

It is worth highlighting that the participants obtained the FM system with personal funds or through court-of-law requests, as this system was made available by the government through the ordinance of June 25, 2013. For this reason, it was not possible to obtain a larger number of participants who met the inclusion criteria.

Statistical Method

We used Wilcoxon’s test to analyze the results obtained with and without the use of the FM system in the four subscales of the questionnaire, considering $p < 0.05$ as statistically significant.

RESULTS

The translation of the CPQ (Appendix 1) resulted in the instrument “*Questionário de participação em sala de aula*” (Appendix 2), with the same number of questions as in the original version.

Differences between the situations with and without FM were found in the four subscales (Tables 2 and 3), most markedly in the scale pertaining to “Understanding teachers,” as visualized in Figure 2.



Caption: 1 = almost never; 2 = sometimes; 3 = usually; 4 = almost always

Figure 1. Visual scale of the questionnaire score

Table 2. Results obtained with and without the use of frequency modulation systems on the “*Questionário de participação em sala de aula*” (“Classroom Participation Questionnaire”)

Categories	Answer options	Almost never		Sometimes		Usually		Almost always	
		Without	With	Without	With	Without	With	Without	With
		FM (%)	FM (%)	FM (%)	FM (%)	FM (%)	FM (%)	FM (%)	FM (%)
Understanding teachers	My teacher understands me	20	0	40	26.6	20	33.3	20	40
	*I understand my teacher	20	6.6	46.6	0	33.3	40	0	53.3
	I have enough time to answer the teacher's questions	13.3	6.6	46.6	0	13.3	40	26.6	53.3
	I understand the homework assignments my teacher gives me	0	0	60	0	40	46.6	0	53.3
	I understand when my teacher tells me what to study for a test	0	0	53.3	0	46.6	46.6	0	53.3
	*I understand my teacher when she gives me homework assignments	0	0	73.3	0	26.6	46.6	0	53.3
	*I understand my teacher when she answers other students' questions	13.3	0	60	13.3	20	46.6	6.6	40
	*I understand my teacher when she tells me what to study for a test	0	0	60	0	33.3	40	6.6	60
	Understanding students	The other students in class understand me	13.3	13.3	46.6	6.6	26.6	40	13.3
*I understand the other students in class		13.3	0	60	26.6	20	40	6.6	33.3
*I join in class discussions		33.3	6.6	46.6	33.3	0	26.6	20	33.3
*I understand other students during group discussions		46.6	20	46.6	26.6	0	33.3	6.6	20
*I understand other students when they answer my teacher's questions		20	0	60	26.6	13.3	53.3	6.6	20
Positive affect	*I feel good about how I communicate in class	20	13.3	26.6	20	26.6	20	26.6	46.6
	I feel relaxed when I talk to other students	20	0	26.6	26.6	33.3	33.3	20	40
	*I feel relaxed when I talk to my teacher	13.3	0	20	13.3	46.6	33.3	20	53.3
	I feel relaxed in group discussions	33.3	13.3	26.6	20	26.6	33.3	13.3	33.3
	*I feel happy in group discussions in class	33.3	13.3	20	20	26.6	33.3	20	33.3
	*I feel good in group discussions in class	33.3	13.3	20	26.6	33.3	33.3	13.3	26.6
Negative affect	I feel lonely because I cannot understand other students	46.6	53.3	6.6	20	20	6.6	26.6	20
	*I feel frustrated because it is difficult for me to communicate with other students	33.3	40	0	20	40	20	26.6	20
	*I get upset because other students cannot understand me	40	60	20	13.3	20	6.6	20	20
	*I get upset because my teacher cannot understand me	60	66.6	6.6	20	20	6.6	13.3	6.6
	I feel nervous when I talk to other students	40	53.3	26.6	40	26.6	6.6	6.6	0
	I feel nervous when I talk to my teacher	46.6	80	13.3	6.6	33.3	13.3	6.6	0
	I feel nervous in group discussions in class	40	66.6	20	6.6	13.3	13.3	26.6	13.3
	I feel frustrated in group discussions in class	46.6	66.6	20	6.6	20	13.3	13.3	13.3
*I feel unhappy in group discussions in class	40	60	20	26.6	26.6	6.6	13.3	6.6	

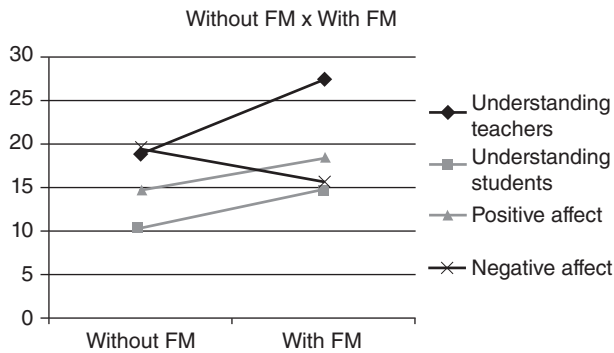
*Simplified version of the questionnaire

Caption: FM = frequency modulation**Table 3.** Statistical analysis (Wilcoxon's test) of the results obtained with and without the use of frequency modulation systems on the “*Questionário de participação em sala de aula*” (“Classroom Participation Questionnaire”)

	Understanding teachers		Understanding students		Positive affect		Negative affect	
	Without FM	With FM	Without FM	With FM	Without FM	With FM	Without FM	With FM
Mean	18.86	27.4	10.4	14.66	14.66	18.26	19.33	15.46
Minimum	14.00	22	6	9	6	11	9	9
Maximum	26	32	17	20	24	24	29	28
SD	4.53	3.96	2.94	3.35	5.57	4.80	7.72	6.64
Median	17.00	29	10	15	14	18.00	22	13
p-value	0.0006*		0.0006*		0.0015*		0.0035*	

*p<0.05 (statistically significant)

Caption: FM = frequency modulation; SD = standard deviation



Caption: FM = frequency modulation

Figure 2. Graphical analysis of the differences found between the use and non-use of frequency modulation systems in the subscales “Understanding teachers,” “Understanding students,” “Positive affect,” and “Negative affect”

DISCUSSION

The purpose of the CPQ was to evaluate the participation of students with hearing loss in the classroom. Its application and effectiveness in evaluating this population has been demonstrated in previous studies^(13,17,18), and it is recommended by the American Academy of Audiology in the guide about procedures with remote microphone and assistive technology⁽¹⁹⁾ for follow-ups of FM system fittings.

As the actual purpose of an evaluation process can only be achieved when adequate instruments and procedures are used⁽¹⁶⁾, efforts have been made in the national scenario to translate and adapt questionnaires that are widely used and recommended by international academia^(15,20-22). The cultural adaptation of the CPQ was effective, as 100% of the sample did not present any difficulties to answer the instrument. Therefore, we suggest adding visual references to the answer sheet, such as, completely filled out circles for the option “almost always” and empty circles for “almost never,” with the purpose of facilitating comprehension (Figure 1).

The effectiveness of the use of the FM systems by students who use PSA and CI promotes accessibility in schools, broadening communication conditions and the interaction between students and teachers, as observed in Table 3. The table shows the differences pertaining to the four subscales of the questionnaire, namely “Understanding teachers,” “Understanding students,” “Positive affect,” and “Negative affect”. We highlight that the results of the questions related to negative affect were concentrated in the option “almost never,” and those related to understanding teachers were concentrated in the option “almost always” when FM was used (Table 2).

The authors of the “Project of Instruction about Hearing Disability and the use of FM Systems for professionals in the area of Education nationwide”⁽²³⁾ also found in their results evident improvement of hearing accessibility with the use of FM systems. They pointed out benefits for children with hearing loss, especially when immediately responding to the teacher’s voice without the need to rely on the help of classmates. This increases the students’ autonomy while performing activities in the classroom.

It is worth highlighting that technology alone is not enough to guarantee accessibility to students with hearing loss. It is also extremely important that the teachers who work with this

population know the potential and limitations of sound amplification resources⁽²⁴⁾. The use of the Portuguese version of the CPQ can aid in this process, considering that the Technical Note number 055/2013 of the Ministry of Education/Department of Continuous Education, Literacy, Diversity and Inclusion (MEC/SECADI)⁽²⁵⁾ attributes the monitoring and evaluation of the functionality and applicability of pedagogical and accessibility resources (such as FM systems) used by the students in regular classrooms to specialized educational assistance teachers.

Although children with hearing impairment have benefited from the inclusion in regular classrooms for years through using FM systems, the national literature shows scarce scientific investment that can aid this process in Brazil. This fact is probably justified by the fact that FM systems were not part of the accessibility devices made available by the Unified Health System. This reality changed with the publication of ordinance 1.274 of June 25, 2013. In this context, the contribution of this study stands out, as the ordinance does not explain the evaluation protocol of this technology, a fundamental aspect to select devices and fit individuals with FM systems in Hearing Health Services.

We recommend the application of this questionnaire in different regions of the country and age ranges not contemplated in this study.

CONCLUSION

The CPQ was translated, culturally adapted to the Brazilian population, and named “*Questionário de participação em sala de aula*” in the Portuguese version.

Overall, the students reported more confidence and participation in the classroom with the use of FM systems.

This questionnaire contributes to the elaboration of protocols to observe and monitor the participation of students with hearing loss who use FM systems in regular classrooms.

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**TKMA was responsible for data collection and tabulation; LGS collaborated with collection and tabulation, and supervised data collection; ALMM, MM supervised collection and collaborated with data analysis; RTSJ was responsible for the study project and outline, as well as overall supervision of the stages of manuscript elaboration and writing.*

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Appendix 1. Classroom Participation Questionnaire

CPQ Items Arranged by Subscale

Understanding Teachers

1. My teacher understands me
2. *I understand my teacher
3. I have enough time to answer the teachers' questions
4. I understand the homework assignments my teacher gives me
5. I understand when my teacher tells me what to study for a test
6. *I understand my teacher when she gives me homework assignments
7. *I understand my teacher when she answers other students' questions
8. *I understand my teacher when she tells me what to study for a test

Understanding Students

9. The other students in class understand me
10. *I understand the other students in class
11. *I join in class discussions
12. *I understand other students during group discussions
13. *I understand other students when they answer my teacher's questions

Positive Affect

14. *I feel good about how I communicate in class
15. I feel relaxed when I talk to other students
16. *I feel relaxed when I talk to my teacher
17. I feel relaxed in group discussions
18. *I feel happy in group discussions in class
19. *I feel good in group discussions in class

Negative Affect

20. I feel lonely because I cannot understand other students
21. *I feel frustrated because it is difficult for me to communicate with other students
22. *I get upset because other students cannot understand me
23. *I get upset because my teacher cannot understand me
24. I feel nervous when I talk to other students
25. I feel nervous when I talk to my teacher
26. I feel nervous in group discussions in class
27. I feel frustrated in group discussions in class
28. *I feel unhappy in group discussions in class

*Items included in the 16-item short scale

Antia et al.⁽¹³⁾

Appendix 2. Questionário de participação em sala de aula (Classroom Participation Questionnaire)**Questionário de participação em sala de aula**

Nome:	DN:	Data:		
Situação: com FM ()	sem FM ()			
1 (quase nunca); 2 (às vezes); 3 (normalmente) e 4 (quase sempre).				
Compreensão de professores				
1. Meu /minha professor (a) me entende	1	2	3	4
2. *Eu entendo meu /minha professor (a)	1	2	3	4
3. Eu tenho tempo suficiente para responder as perguntas do(a) professor(a)	1	2	3	4
4. Eu entendo as atribuições de tarefas que meu /minha professor(a) me passa	1	2	3	4
5. Eu entendo quando meu /minha professor (a) me diz o que estudar para uma prova	1	2	3	4
6. *Eu entendo minha professora quando ela me dá atribuições de tarefas	1	2	3	4
7. *Eu entendo minha professora quando ela responde perguntas de outros alunos	1	2	3	4
8. *Eu entendo minha professora quando ela fala o que estudar para uma prova	1	2	3	4
Compreensão de estudantes				
9. Os outros alunos da sala me entendem	1	2	3	4
10. *Eu entendo os outros alunos da sala	1	2	3	4
11. *Eu participo das discussões em sala	1	2	3	4
12. *Eu entendo os outros alunos durante discussões em grupos	1	2	3	4
13. *Eu entendo os outros alunos quando eles respondem as perguntas do meu/minha professor(a)	1	2	3	4
Aspectos positivos				
14. *Eu me sinto bem falando em sala	1	2	3	4
15. Eu fico tranquilo(a) falando com outros estudantes	1	2	3	4
16. *Eu fico tranquilo(a) falando com o meu professor(a)				
17. Eu fico tranquilo(a) em discussões de grupo	1	2	3	4
18. *Eu fico feliz em discussões de grupos	1	2	3	4
19. *Eu me sinto bem em discussões em grupos na sala	1	2	3	4
Aspectos negativos				
20. Eu me sinto sozinho(a) quando eu não entendo os outros alunos	1	2	3	4
21. *Eu fico frustrado(a) porque a comunicação com os outros alunos é difícil pra mim	1	2	3	4
22. *Eu fico chateado(a) porque os outros alunos não conseguem me entender	1	2	3	4
23. *Eu fico chateado(a) porque meu /minha professor(a) não consegue me entender	1	2	3	4
24. Eu fico nervoso(a) quando eu falo com outros alunos	1	2	3	4
25. Eu fico nervoso(a) quando eu falo com o meu professor(a)	1	2	3	4
26. Eu fico nervoso(a) com discussões em grupos na sala	1	2	3	4
27. Eu fico frustrado(a) em discussões em grupos na sala	1	2	3	4
28. *Eu fico infeliz em discussões em grupos na sala	1	2	3	4

*Versão simplificada do questionário