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Cross-cultural adaptation and validation of the Undergraduate Clinical Education Environment Measure Instrument

Adaptação transcultural e validação do instrumento Undergraduate Clinical Education Environment Measure Instrument

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Summary: *Introduction:* Assessment of the learning environment is essential for the constant improvement of the quality of teaching and, consequently, the achievement of learning objectives by students. Taking into account the absence of instruments in Portuguese of Portugal to evaluate the learning environment in a clinical environment, this work aimed to validate the *Undergraduate Clinical Education Environment Measure instrument* for Portuguese of Portugal, through the cross-cultural adaptation of this instrument. *Materials and methods:* The target population of the project were medical students from the University of Beira Interior who attended curricular clinical internships in the 2022/2023 academic year. A focus group was held to formulate a first version adapted into Portuguese, a version that was reviewed by experts in the field. This version was then applied in a pre-test, followed by individual interviews. The results obtained were discussed, the instrument was revised and the distribution of responses was analyzed. Finally, the final version of the adapted instrument was applied to the target population, with statistical treatment and evaluation of the instrument's psychometric properties subsequently carried out. *Results* : The first adapted version was applied in a pre-test to 34 participants, generating a final version to be applied to the target population. 270 valid responses were obtained, with confirmatory factor analysis demonstrating that the instrument adapted for the Portuguese context is valid and reliable, with an Omega coefficient of 0.96. *Conclusion* : Further reflection on the question "I have adequate access to computers" will be necessary given the national panorama on medical students' access to clinical records. However, the instrument adapted for the Portuguese context proved to be valid and reliable, being ready to be used to evaluate the learning environment in a clinical environment for medical students.

Keywords: Medical Education ; Learning Environment; Validation Studies; Pre-Graduate Medical Education

Resumo: *Introdução:* A avaliação do ambiente de aprendizagem é indispensável para a constante melhoria da qualidade de ensino e, por consequência, o alcance pelos estudantes dos objetivos de aprendizagem. Tendo em conta a ausência de instrumentos em português de Portugal para avaliar o ambiente de aprendizagem em meio clínico, este trabalho teve como objetivo validar o instrumento *Undergraduate Clinical Education Environment Measure*para português de Portugal, através da adaptação transcultural deste instrumento. *Materiais e métodos:* A população alvo do projeto foram os alunos de Medicina da Universidade da Beira Interior que frequentaram estágios clínicos

curriculares no ano letivo 2022/2023. Procedeu-se à realização de um focus group para formular uma primeira versão adaptada para português de Portugal, versão esta que foi revista por especialistas da área. De seguida, aplicou-se esta versão num pré-teste, seguido de entrevistas individuais. Os resultados obtidos foram discutidos, o instrumento revisto e foi feita a análise da distribuição de respostas. Por fim, aplicou-se a versão final do instrumento adaptado na população alvo, tendo sido feito posteriormente o tratamento estatístico e avaliação das propriedades psicométricas do instrumento. *Resultados*: A primeira versão adaptada foi aplicada num pré-teste a 34 participantes, tendo gerado uma versão final para ser aplicada na população alvo. Foram obtidas 270 respostas válidas, tendo a análise fatorial confirmatória demonstrado que o instrumento adaptado para o contexto português é válido e fiável, com coeficiente de Ômega de 0,96. *Conclusão*: Será necessária uma reflexão posterior sobre a questão "Tenho acesso adequado aos computadores" dado o panorama nacional sobre o acesso dos estudantes de medicina aos registos clínicos. No entanto, o instrumento adaptado para o contexto português revelou-se válido e fiável, estando pronto a ser utilizado para avaliar o ambiente de aprendizagem em meio clínico, dos estudantes de medicina.

Palavras-chave: Educação Médica; Ambiente de Aprendizagem; Estudos de Validação; Ensino Médico Pré-Graduado

1. Introduction

The educational environment is a very comprehensive and complex concept, being seen as an open system which, as such, is subject to different forces (1). There is no consensus regarding its definition, however, it can be seen in general as any and all contexts in which learning occurs (2). It therefore includes several aspects, such as physical space, available resources, teaching style and quality, pedagogical methodologies and interpersonal relationships (2–6).

There are several studies that establish a direct relationship between the learning environment and educational outcomes, and there are even guidelines that define what an adequate learning environment is (2–4, 6–8). This must be a concept present in professionals who work directly in education, given that, according to adult learning theories, the creation of an environment conducive to learning facilitates the acquisition of knowledge and the development of skills associated with the training process, being inseparable of academic success (2, 7–11).

The learning climate refers to students' perception of the educational environment and is closely linked to the teaching-learning process, as it represents an important determinant of behavior and plays a fundamental role in their well-being and academic success, as well as in the development of fundamental attributes for medical practice (6, 7, 10).

Learning in a clinical environment is essential for the training of a health professional, and is even considered the basis of pre-graduate medical training (10, 11, 13–16). In this sense, it is important to distinguish this as having its own learning environment, different from that which exists in a non-clinical context (16).

The interaction between students and the clinical learning environment leads to the acquisition of practical knowledge, skills and attitudes, as well as the development of

professional identity (7, 11, 13, 17). Furthermore, it is the place where problem management skills and clinical reasoning are also developed (7, 11, 18).

Learning in this context is essential and indispensable for the training of health professionals, and cannot be replaced by any other type of teaching, including simulation, which should be seen as a complement (5, 11, 14, 19). Several studies show that there is a direct relationship between the quality of teaching in a clinical environment and the quality and safety of clinical care, a relationship strong enough to motivate everyone involved to mobilize resources to strengthen both (5, 7, 8, 11, 13, 18).

According to the guidelines of the World Federation for Medical Education (WFME), regular assessment of the learning environment taking into account student feedback is essential for improving the curricula of different medical schools (20). Students' perspective on their learning environment is an effective indicator for both the teaching and learning process (21). In order for the positive aspects of the environment to be maintained and reinforced, and for the negative aspects to be eliminated and/or replaced, there is a need to evaluate students' perception of the various aspects that make up the educational environment, generating information directly related to the process teaching-learning process (4, 5, 7–9). The impact that the learning climate has on the quality of learning is undeniable and, as such, its assessment brings benefits to both the educational institution and the student (3, 5, 7, 9, 11, 15, 21).

It is therefore essential to evaluate the learning environment in a clinical context, to identify system failures in order to correct and prevent harmful consequences not only for future health professionals themselves, but also for patients (1). In this sense, several assessment instruments have already been developed, such as the Dundee Ready Educational Environment Measure (DREEM), which has even been translated into Portuguese (22). However, none of these is a stable instrument from a psychometric point of view when it comes to assessing the pre-graduate clinical learning environment, given that they sometimes mix clinical and non-clinical learning environments, and sometimes they do not distinguish between pre-graduate medical education and postgraduate (1, 18).

In 2013, the first instrument that specifically assesses the learning climate in a clinical context appeared – the Undergraduate Clinical Education Environment Measure (UCEEM) (1, 18). This instrument allows you to obtain feedback on the learning environment in places where clinical internships are carried out in different institutions associated with teaching, evaluating how students perceive the social, emotional and cognitive dimensions of the learning environment. When originally created, it only consisted of 25 items. Its application in several countries allowed the incorporation of improvements, with the original team publishing UCEEM 2.0, adding one more item (23).

The Brazilian Portuguese version was published in 2022 and resulted from translation, cross-cultural adaptation and validation into Brazilian Portuguese by a team of researchers from Faculdades Pequeno Príncipe, Curitiba, Paraná, Brazil (3). In this version, as in the original version, the 26 items are divided into four subscales or factors (F): (1, 3)

- F1 reflects students' perception of learning opportunities and the quality of supervision by tutors (items 3, 4, 5, 6, 13, 14, 15, 16, 17, 18, 26);
- F2 reflects students' perception of the preparation of the workplace and supervisors to make the learning experience meaningful and relevant to the curriculum (items 1, 2, 9, 10, 11, 12);
- F3 reflects students' perception of the work environment and student inclusion (items 7, 8, 19, 20, 21, 22);

• F4 reflects students' perception of whether there are differences in the treatment of individual students (items 23, 24 and 25) (23).

In this way, it can therefore be used not only to assess the learning climate, but also to subsequently monitor the effectiveness of changes implemented to improve it (3). However, due to linguistic and cultural differences, it is necessary to adapt it for use in Portugal.

With this work, the aim was to validate the Undergraduate Clinical Education Environment Measure instrument in Portugal, through its cross-cultural adaptation. The adapted and validated instrument will allow obtaining reliable information about students' perception of the educational environment, associated with different clinical internships, for use by any Portuguese medical school.

2. Methods

Kind of study

Cross-cultural adaptation of the questionnaire "Measuring the Undergraduate Clinical Teaching Environment" and validation of the instrument generated, through the retrospective evaluation of clinical internships by Medicine students at the University of Beira Interior (3). The present study was approved by the authors of the original and translated instrument, as well as by the Ethics Committee of the University of Beira Interior.

Sample Selection

The sample was selected from the project's target population, which were medical students from the University of Beira Interior who attended curricular clinical internships in the 2022/2023 academic year.

Procedures

To use the instrument in Portugal, it went through the following stages, as outlined in figure 1.

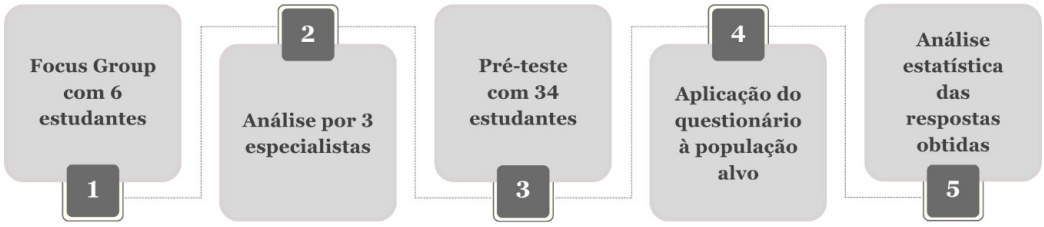

Figure 1. Stages of the work methodology

In order to evaluate semantic differences and interpretation of the questionnaire in Brazilian Portuguese, a focus group was held with 6 students, belonging to the target population, from different cultural backgrounds (24). The focus group was moderated by the main researcher and her co-supervisor as supervisor, and the words and phrases that led to inappropriate responses from the participating students were identified (25).

The first adapted version of the questionnaire resulting from the focus group was shared with specialists in the field of medicine who have worked in Portugal for several years, but who were born, lived and completed their academic training in Brazil, in order

to assess the semantic, idiomatic, experiential and conceptual aspects of the construct (26). A document with the instrument in its original version, in English, in the version translated into Brazilian Portuguese and in Portuguese Portuguese, was shared with 3 doctors and professors from the University of Beira Interior (UBI).

In order to determine the average time taken to complete the questionnaire, whether the adapted version still maintains its equivalence in the situation applied, and also evaluating the distribution of responses, a pre-test was carried out with the adapted instrument (24–26). According to the literature, the participants in this phase, around 30, must belong to the target population, but must not have participated in the focus group or in any other phase of the process (25, 26). This phase consisted of individual interviews with 34 students, after they completed the questionnaire, exploring both the meaning of the items and the answers, thus ensuring that the adapted version still maintains its equivalence in the applied situation (24–26).

The last stage of the questionnaire adaptation process consisted of the psychometric evaluation of the instrument. The questionnaire was made available through the Google Forms platform and shared via UBI's institutional email.

Statistical Methodology

The descriptive statistics of the data obtained and normality tests of the items were carried out using the SPSS ® software. To check whether the data followed a normal distribution, the Kolmogorov-Smirnov test was used. Confirmatory factor analysis was performed using the Lavaan package in the R software. The estimator used was the Weighted Least Square Mean and Variance Adjusted (WLSMV), since variables on five-point scales were analyzed as ordinal variables (27). To verify the reliability of the instrument, internal consistency was assessed based on the Omega coefficient.

3. Results

Focus group results

The focus group was made up of 6 students: two with Cape Verdean Creole, one with Ukrainian, one with Brazilian Portuguese and two students with Portuguese from Portugal. All students speak and understand the Portuguese language, having lived in Portugal for at least 3 years (24). This allowed us to obtain a more representative, comprehensive instrument with less associated cultural bias (28). After analyzing the considerations obtained in the focus group, an adaptation proposal was written for analysis by medical experts, with essentially grammatical and vocabulary changes.

Result of expert analysis

The medical experts, professors at FCS-UBI (Faculty of Health Sciences, University of Beira Interior) did not make any suggestion for changes, having given their positive opinion on the work carried out up to this point, therefore adapting the questionnaire to Portuguese from Portugal it was considered finished and ready to be applied in the pre-test.

Pre-test results of the adapted instrument

34 students were interviewed in person, from different curricular years and based on internships carried out in different specialties and health institutions. An average time required to complete the questionnaire was 5 minutes. Based on the results of the pre-test, new changes were made to the questionnaire, after discussion with the supervisors of this work:

- The expression "tasks (work)" was replaced by "clinical activities" in all items in which it appeared;
- The word "here" has been largely replaced by "internship site." Likewise, in the item "My problem-solving skills are developing well in this place" "in this internship place" was added;
- Regarding the response options, a symmetric scale was chosen: "Totally disagree/disagree/neutral/agree/totally agree".

Regarding the distribution of responses, no item proved to be problematic, since no trend was observed in any of the poles of the response scale, meaning that all items were included in the final version of the instrument to be applied. This is described in Table 1, with the changes made to each item highlighted in bold.

Table 1. Proposal for adapting the instrument to Portuguese from Portugal

Brazilian Portuguese	**Portuguese from Portugal**
Consider the following statements. Express your point of view by checking the box that you believe most accurately matches your perception of conditions in your current clinical placement (or most recent practice location).	**Consider** the following statements. **Express O your** point of view by checking the box **you believe which corresponds** more accurately to **your** perception of the conditions **at your last internship site.**
1. I received helpful initial instructions for this practice location.	**internship** location .
2. My supervisors were waiting for me when I arrived.	**My tutors** were waiting **for me** when I arrived.
3. My tasks (work) are relevant to the learning objectives.	**My clinical activities** are relevant to the learning objectives.
4. I am sufficiently busy with meaningful tasks (work).	I am sufficiently occupied with meaningful **clinical activities in accordance with the learning objectives** .
5. My tasks are appropriately challenging for my level of knowledge and skills.	**My** tasks are appropriately challenging for **my** level of knowledge and skills.
6. I am encouraged to actively participate in work.	I am encouraged to actively participate **in the** work.
7. I have adequate access to computers.	I have adequate access to computers.
8. There is enough physical space for the number of health students allocated here.	There is sufficient physical space for the number of medical students allocated **to the internship site** .

9. I have a supervisor I know I can turn to.	I have a **tutor who** I know I can turn to.
10. I have enough supervisors.	I have enough **tutors** .
11. Supervisors are well prepared to supervise.	Tutors **are** well prepared to **guide activities** .
12. My supervisors are familiar with the learning objectives.	**My tutors** are familiar with the learning objectives .
13. I receive useful *feedback* from my supervisors.	I receive useful *feedback* from my **tutors** .
14. I feel comfortable asking my supervisors any questions I wish.	I feel comfortable asking my **tutors** any questions I may have.
15. I have the opportunity to justify my actions during supervision sessions.	I have the opportunity to justify **my** actions during **the internship** .
16. My problem-solving skills are developing well in this location.	**My** problem-solving **skills** are **developing** well at this **internship site** .
17. Here, I have the opportunity to put my theoretical knowledge into practice.	**At this internship site** , I have the opportunity to put my theoretical knowledge into practice.
18. Here, I have the opportunity to learn together with other health students.	**At this internship site** , I have the opportunity to learn alongside other **medical students.**
19. As a student, I am received positively by the team.	As a student, I am positively received **by** the **team** .
20. Here, I feel included in the work team.	**At this internship location** , I feel included in the work **team .**
21. I feel welcome in the staff room/dining room.	I feel welcome in the staff room/dining room.
22. Communication between those who work here is good.	Communication between those working **at this internship site** is good.
23. Here, everyone is treated with equal respect and dignity, regardless of their cultural origin.	**At this internship location** , everyone is treated with equal respect and dignity, regardless **of** their cultural origin.
24. Here, everyone is treated with equal respect and dignity, regardless of their gender.	**At this internship location** , everyone is treated with equal respect and dignity, regardless **of** their **gender** .
25. Here, everyone is treated with equal respect and dignity, regardless of their profession.	**At this internship location** , everyone is treated with equal respect and dignity, regardless **of** their profession.
26. I feel that I have influence over my learning	I feel like I have influence over **my**

in this place of work.	**learning at this internship** site .

Results of applying the adapted instrument to the target population

The questionnaire was sent to 1,007 medical students via email, with 270 valid responses obtained. The response rate was 26.8% (270/number of students enrolled in the Integrated Master's in Medicine in the 2022/2023 academic year). These responses came from students based on internships carried out in different specialties and health institutions, with an age range between 18 and 45 years. 22.96% of the sample consists of male individuals (n=62), 76.66% female individuals (n=207), and one individual indicated "other". Regarding the curricular year, 3.7% of the sample consists of individuals enrolled in the 1st year (n=10), 0.74% in the 2nd year (n=2), 17.04% in the 3rd year (n=46) , 20% in the 4th year (n=54), 28.89% in the 5th year (n=78) and 29.63% in the 6th year (n=80).

The adapted instrument uses a Likert-type response scale, as in the original instruments and translated into Brazilian Portuguese, which varies from 1 to 5. In the Likert scale used, the value 1 corresponds to "I completely disagree" and the value 5 corresponds to to "I completely agree".

After performing the Kolmogorov-Smirnov test, it was found that the data set does not follow a normal distribution, with $p<0.05$ for all items analyzed, which is why the items were treated as ordinal variables. Confirmatory factor analysis was performed using the Lavaan package in R software, based on the theoretical model derived from the literature with four latent factors. The values of the fit indices (table 2), which vary between 0 and 1, indicate that the model fits the data well, with a Comparative Fit Index (CFI) of 0.994, a Tucker-Lewis Index (TLI) of 0.994. High CFI and TLI values indicate better results, and given that they are above 0.95, they indicate a good fit of the model. The model presents Root Mean Square Error of Approximation (RMSEA) values of 0.077, and a Standardized Root Mean Square Residual (SRMR) of 0.068 (table 2). Values below 0.08 of RMSEA and SRMR are considered adequate, also reflecting a good fit of the model. The results of the model fit analysis are presented in Table 2. The factor loading coefficients for each measurement item, as well as the explained variances, are presented in Figure 2.

Table 2. Model fit measures

Fit index	Value
Chi-square (χ^2)	763,403
Degree of freedom (df)	293
CFI	0.994
TLI	0.994
RMSEA	0.077
SRMR	0.068

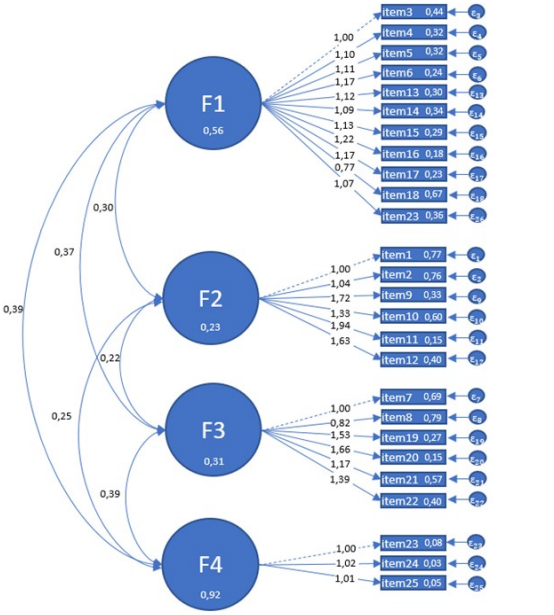

Figure 2. Factor loading coefficients

The Average Variance Extracted (AVE) was also calculated to evaluate the validity of the latent factors, presenting acceptable values, given that they are not less than 0.5 (F1 = 0.66; F2 = 0.50; F3 = 0.52; F4 = 0.95) (29). The reliability analysis was evaluated using the Omega coefficient, which is a more precise measure of reliability than Cronbach's alpha in the case of variables that do not follow a normal distribution, as it takes into account the factorial structure of the model (30). The Omega coefficients for each factor indicate that the model has good internal consistency (F1 = 0.94; F2 = 0.82; F3 = 0.83; F4 = 0.96), as does the coefficient in relation to the instrument as a whole (0.96). The adapted instrument then presents satisfactory internal consistency, with positive correlations between its questions. This indicates that, as the individual values of each item increase, the total instrument score also increases.

The confirmatory factor analysis presented satisfactory results regarding the validity and reliability of the proposed measurement model. The model fit indices, factor loading coefficients, explained variance and reliability analysis indicate that the model is valid and reliable for measuring the theoretical construct in question.

4. Discussion

Verifying the validity of an instrument is crucial, as it allows measuring and analyzing subjective aspects of individuals that are not easily observable. The use of validated instruments in the health sector helps to determine the need to intervene in a certain process or method.

The subscales of the Undergraduate Clinical Education Environment Measure Instrument allow monitoring the main aspects associated with the learning environment, responding to the need described by several authors to effectively evaluate the clinical learning environment (9, 13, 31, 32).

Regarding the question “I have adequate access to computers”, the work teams responsible for translating the instrument in other countries have been adapting it depending on their context – the Turkish team replaces it with “I have adequate access to

clinical software on computers at all times what I need", the Swedish team has not yet published, but states that it will be in line with the Turkish team's reasoning and the Indonesian team replaces it to have adequate online access, as students from that country are not authorized to access clinical records (23, 33). In Portugal, students are also not authorized to access clinical processes (unlike what happens in Brazil), so if this question were replaced, it would be in the same direction as the question adopted in Indonesia. However, the objective of this work is only to make a cultural adaptation of the questionnaire, which does not involve improving it, but rather reproducing it, obtaining its equivalence in the various dimensions, in the target population. For this reason, it was decided not to make any changes to this question and allow the psychometric analysis to justify removing it, if necessary (24). At all stages of the test, it was expected that this question would not be stable at a statistical level and would have to be removed, which did not happen. However, it is recommended that in future studies, this issue be re-evaluated and adapted to the national context.

The results of the statistical analysis indicate that this is a valid and reliable instrument to be used in Portugal, presenting results in line with the results obtained by the Brazilian team. This therefore makes it possible to have a scale available that quantitatively measures students' satisfaction with their educational environment in a clinical environment, generating data that can be comparable over time and between different stages.

Through this instrument, Portuguese medical schools will be able to obtain relevant feedback on the strengths of their clinical internships, which can strengthen them, and on the weaknesses, which can improve or replace them. Only in this way can the quality of teaching be kept constantly improving and updated, in addition to training students on their role in pre-graduate medical education and their fundamental contribution to it.

This work also opens doors to compare, in a simple way, the different learning environments in different internships, hospitals and other health institutions, generating relevant information for research in medical education in Portugal, with the aim of improving there. The various Portuguese medical schools will be able to evaluate the learning environment in a clinical environment not only for their own individual interest and improvement, but also in a consistent way between them, even opening up the possibility of creating a database that allows comparing the various stages in different hospitals, giving rise to multiple research works and improving medical education in Portugal. Furthermore, they can also be compared with other learning environments taking place in other countries where the instrument is also applied, allowing a global and synergistic comparison between different contexts and cultures.

5. Conclusions

- The *Undergraduate Clinical Education Environment Measure Instrument* generates the instrument in Portuguese called “Pre-Graduation Clinical Education Environment Measure” (Annex 1);
- The instrument “Measurement of the Clinical Teaching Environment in Pre-Graduation” is a valid and reliable instrument to be used in Portugal.

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Author contributions : The first author was responsible for completing all stages and writing the work, with the exception of statistical analysis, which was the responsibility of the second author. The third and fourth author were the advisors responsible for this work.

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