

ORIGINAL RESEARCH

Translation and cultural adaptation of the Intrinsic Motivation Inventory Task Evaluation Questionnaire (IMI-TEQ) into Brazilian Portuguese for interactive products evaluation

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ABSTRACT

Self-determination theory (SDT) is a psychological theory that has proven relevant in human-computer interaction (HCI) and games studies by providing a greater understanding of what constitutes an engaging experience. SDT conceptualizes intrinsic motivation, described as voluntary behaviors motivated by the person's interest. One method to evaluate intrinsic motivation in different contexts is using the self-report questionnaire Intrinsic Motivation Inventory (IMI). This paper proposes the translation and cross-cultural adaptation of IMI in its 22-item version Task Evaluation Questionnaire for use in general contexts. We used the five steps for translation and cross-cultural adaptation of questionnaires proposed by Beaton: Translation, Synthesis, Back-translation, Expert Committee, and Pre-testing. To evaluate the association of motivating and demotivating scores, we performed T-tests for independent samples. As results, the translated version has a good comprehension and demonstrated significant difference between scores of motivating and demotivating experiences.

KEYWORDS

Self-determination theory; intrinsic motivation; self-report instrument; translation; cross-cultural adaptation;

1. Introduction

The self-determination theory (SDT) is an empirical psychological theory of human motivation and personality. Its popularity has increased in several areas, such as education, health, and technology, due to its practical characteristic of identifying the conditions that facilitate or hinder the motivation and satisfaction of a person (Ryan et al., 2017).

In human-computer interaction (HCI), SDT has proven relevant especially in game studies, mainly because it provides a greater understanding of what constitutes an engaging experience, considered one of the main goals of this intersection of areas (Tyack et al., 2020). The main applications of the theory in HCI and game research have been in investigating the motivational appeal of games, the player experience,

the construction of the game design, and industry evaluation and testing (Tyack et al., 2020).

Among the concepts described by SDT concerning the understanding of an engaging experience is intrinsic motivation, described as voluntary behaviours motivated by the person's interest and satisfaction (Ryan et al., 2017). For example, playing is considered an intrinsically motivated activity since it does not depend on external incentives or pressures but rather on one's satisfaction and joys (Ryan et al., 2020).

Concerning the intrinsic motivation measurement, researches in HCI and game studies has mainly used two alternatives: (i) self-report instruments, such as questionnaires and (ii) the measurement of free-choice behaviours, the latter being less frequent (Tyack et al., 2020). Self-report questionnaires are subjective measures that provides information concerning a person's emotional. An assessment using this type of instrument enables accurate measurement that is less intrusive and easy to apply compared to objective methods such as heart rate or electrodermal activity measurements (Adams et al., 2008; Fuentes et al., 2017). Questionnaires are formulated using psychometric techniques to ensure validity and reliability (Sauro et al., 2016).

Two self-report questionnaires are most frequently used in studies considering SDT constructs in HCI (Tyack et al., 2020). The first is the Player Experience Need of Satisfaction (PENS), which proposes the measurement of player experience's elements. The second is the Intrinsic Motivation Inventory (IMI), a multidimensional instrument used to measure intrinsic motivation and self-regulation in general activities (Ryan et al., 2006). The IMI questionnaire is used in several types of research related to measuring concepts proposed by the self-determination theory, as seen in (Deci et al., 1994; Plant et al., 1985; Ryan, 1982; Ryan et al., 1983, 1990, 1991). The questionnaire assesses the dimensions: interest/enjoyment, perceived competence, effort, value/usefulness, pressure/tension, perceived choice, and relatedness during a given activity, producing seven scores.

The full version of IMI is composed of 45 items divided into the seven dimensions evaluated. Some minor versions of the questionnaire have been used in research to assess more specific dimensions such as a 22-item version named Task Evaluation Questionnaire (IMI-TEQ), which was adapted in order to focus in more general tasks. The IMI-TEQ was developed and validated in English and uses four of the seven dimensions evaluated by IMI, namely: interest/enjoyment, perceived choice, perceived competence, and pressure/tension. These dimensions are proposed as determinants for evaluating intrinsic motivation (Ryan et al., 2006).

Miranda et al. (2021) highlights that most valid self-report questionnaires are developed and validated in English and cannot be used by non-native speakers. The use of questionnaires in different languages may compromise the validity of the research, independently of the language (Gerritsen et al., 2010). In the absence of methods, researchers will create ad-hoc translations of validated questionnaires (Darin et al., 2020), leading to erroneous implications of psychometric properties.

In this scenario, Miranda et al. (2021) point out the importance and lack of valid methods in the Community of Portuguese Language Countries (CPLP), which has over 221 million speakers all over the world. The Portuguese language can be divided into two variations, Brazilian and European being the European version adopted by all countries except Brazil, which uses the Brazilian variation (Baxter, 1992). Despite this, Portuguese is considered a pluricentric language, containing differences in the vocabulary of each country, regardless of the variation used (Janssen et al., 2018).

This paper aims to present a translation of IMI-TEQ into Portuguese and its cross-cultural adaptation to the Brazilian context. To do so, we used the guideline proposed

by Beaton et al. (2002) for translation and cross-cultural adaptation and performed t-tests to evaluate the association of motivating and demotivating scores. As results, the IMI-TEQ Br version was evaluated with good comprehension and evaluates motivating and demotivating experiences differently. This translation can benefit CPLP users, researchers, and practitioners in identifying intrinsically motivated and self-regulated tasks within various fields such as education (Monteiro et al., 2015), sports (McAuley et al., 1989; Tsitskari et al., 2010), computer-related such as HCI (Carrera et al., 2018) and games (Alankus et al., 2012; Birk et al., 2016), providing a tool that can assist in generating more enriching and motivating experiences.

2. Background

2.1. *Eudaimonia, The Self Determination Theory and Motivation*

The concept we characterize as "well-being", understood as the optimal psychological experience and functioning, has been understood in different ways throughout history. Currently, two main lines support different perceptions of what happiness and well-being would be (Deci et al., 2008), Hedonia and Eudaimonia. In the hedonic perspective, based on the general theory of social science, the presence of positive affections and absence of negative affections represent the state of well-being.

On the other hand, Eudaimonia states that every individual possesses a latent potential, and that happiness, or the state of well-being, would be achieved through the profound experience of this potential. While hedonic experiences are more related to momentary pleasure, eudaimonic experiences relate to need satisfaction, feelings of significance, and positive affect (Stephanidis et al., 2019). According to Deci et al. (2008), the hedonic perspective limits the actual perception of well-being and does not contemplate the various aspects of human subjectivity.

In this scenario, the HCI area has been working on the design of technologies more focused on long-term well-being, generating eudonic experiences (Stephanidis et al., 2019). This is due to advances in user experience (UX) in regard to emotional and more pleasure-oriented aspects, and by positive psychology¹ that promotes positive human development. However, one of the concerns regarding well-being and eudaimonia is that the merging of positive psychology and interaction technologies are still at a conceptual level. Thus, there is an emerging need in HCI to change focus in order to consider aspects of eudaimonia in the user experience, which has been called user eudaimonia. Nevertheless, one of the greatest difficulties of this convergence of areas concerns the measurement of these concepts, since human eudaimonia is completely subjective.

Some psychological theories of eudaimonia, based on humanistic psychology, have been developed and studied such as the broaden-and-build theory of positive emotions which suggests that cultivating positive emotions serves to enhance coping behavior (Sirgy, 2002). Another theory is the human flourishing theory, which focuses on defining and measuring human flourishing in terms of psychological well-being.

There is also the Self-Determination Theory, which is an empirical psychological theory of human motivation and personality that seeks to understand how biological, social, and cultural factors affect humans' inherent capacities for psychological growth, engagement, and well-being (Ryan et al., 2017). It suggests that the processes of mo-

¹Positive psychology is understood as the study of the conditions and activities that promote optimal functioning in individuals (Gable et al., 2005).

tivation, internalization and well-being are enhanced by the satisfaction of three basic psychological needs - autonomy, competence, and relatedness. Similarly, a context that does not support or frustrates these three psychological needs will impact negatively a person's well-being.

Due to the SDT practical feature in identifying the conditions that facilitate or hinder motivation and satisfaction, it has been used in various fields such as education, health, and technology (Ryan et al., 2017). In HCI, the theory has mainly become popular in studies that intersect the field of games, being applied mainly in investigations of the motivational appeal of games, analyses of player experience, and evaluations and testing in the games industry (Tyack et al., 2020).

SDT is organized into six mini-theories, each with propositions of critical concepts for understanding and explaining phenomena related to motivation or personality functioning, these being:

- **Cognitive Evaluation Theory (CET)**
Describes the processes by which the social context positively or negatively influences intrinsic motivation and, in turn, an individual's performance and well-being.
- **Organismic Integration Theory (OIT)**
Concerns both the social factors that promote or inhibit internalization and the integration of social and cultural regulations that influence extrinsic motivation.
- **Causality Orientations Theory (COT)**
Describes individual differences in people's tendencies to orient depending on the environment and delineates three types of causality orientations: the autonomy orientation, in which people act out of interest and appreciation; the control orientation, in which the focus is on rewards; and the motivated orientation characterized by anxiety about competence.
- **Basic Psychological Needs Theory (BPNT)**
Details how the dynamics of basic needs promote or frustrate the individual's well-being and vitality, regardless of the context in which he or she is inserted.
- **Goal Contents Theory (GCT)**
Describes the concerns about the individual's goals and their relationship to basic needs and well-being satisfaction.
- **Relationships Motivation Theory (RMT)**
Specifies how interpersonal relationships, both between individuals and within groups, depending on individuals' ability to experience positivity or consideration and respect for autonomy.

According to Ryan et al. (2017), etymologically, motivation is an energy that moves people to action. Theories in psychology that seek to analyze this phenomenon focus on aspects that enhance or give direction to motivational behaviour, viewing the concept as a single entity without separation. SDT differs by categorizing motivation into types and sources that impact behaviour dynamics (Ryan et al., 2017).

The theory suggests that some forms of motivation may be voluntary, reflecting the person's internal characteristics, such as values and interests, and external factors may influence others. The drivers of this motivation may vary in magnitude, experiences of the individual, and behavioural consequences, such as health and performance benefits.

SDT establishes an internal dimension called the autonomy-control continuum to differentiate between the types of motivation. When autonomous, behaviours are described as an expression of self, whereas controlled behaviours are those in which a

person feels, externally or internally, pressured to act. For example, a person is controlled when his motivations to act are based on feeling coerced by outsiders.

Cognitive Evaluation Theory (CET), the first mini-theory of SDT, defines the idea of intrinsic motivation. Intrinsically motivated behaviours are performed out of the person's interest, and feelings such as pleasure and competence are considered the primary "reward." These behaviours are voluntary, emanating from the person and are understood as an inherent human propensity.

Some activities highlighted by SDT authors as typical of intrinsic motivation are sports, games, and exploration activities (Ryan et al., 2017). Nevertheless, it is essential to highlight that each individual may be intrinsically motivated by some activities and by others not, and only in specific social contexts. Thus, to assess intrinsic motivation, one must consider how the person experiences the characteristics of activity and context.

The intrinsically motivated behaviour that activity provides varies to the extent that a person finds it inherently exciting and enjoyable, thus becoming an activity that satisfies immediate basic needs. Thus, behaviour differs by the degree to which the individual is interested in the task, and these differences are influenced by situational, contextual, and cultural factors.

2.2. Intrinsic Motivation Inventory and the Task Evaluation Questionnaire

The Intrinsic Motivation Inventory (IMI) is a multidimensional self-report questionnaire proposed to measure the subjective experience of a given activity (Ryan et al., 2006). The instrument is used in several kinds of research to measure the intrinsic motivation and self-regulation dimensions related to self-determination theory, as seen in (Deci et al., 1994; Plant et al., 1985; Ryan, 1982; Ryan et al., 1983, 1990, 1991).

The questionnaire assesses the constructs interest/enjoyment, perceived competence, effort, value/usefulness, felt pressure and tension, perceived choice, and relatedness, yielding seven scores. The interest/enjoyment dimension is considered the direct assess measure to intrinsic motivation. The dimensions of perceived choice and competence are proposed as positive self-report indicators and behavioural measures of intrinsic motivation. The pressure/tension construct, on the other hand, is theorized to be a negative predictor of intrinsic motivation.

The effort dimension is relevant to assessing some motivation-related issues but should be used only if relevant. The value/usefulness construct is used in internalization studies, following the SDT idea that people internalize and self-regulate concerning helpful or valuable activities. Finally, the relatedness dimension is used in studies that have to do with interpersonal interactions or bonding.

The full version of the IMI, named The Post-Experimental Intrinsic Motivation Inventory, is composed of 45 items divided into the seven dimensions assessed. Smaller versions of the questionnaire have been used in research to assess more specific dimensions or adapt to different activity contexts. One smaller version is the Subject Impressions Questionnaire, composed of 29 items, used to describe thoughts and feelings you may have had towards a second participant in the experiment. There is also the Text Material Questionnaire I, consisting of 9 items used to investigate the subjective experience in reading textual materials.

We chose the 22-item version of the IMI, called Task Evaluation Questionnaire (IMI-TEQ), focused on measuring intrinsic motivation in more general activities. The instru-

ment uses a 7-point likert scale and is divided into four dimensions: interest/enjoyment, perceived choice, perceived competence, and pressure/tension, dimensions proposed as determinants for motivation assessments. The overall psychometric properties of IMI are kept stable regardless of the reduction of items per subscale of each dimension or using only some of its subscales, as happens in IMI-TEQ (Ryan et al., 2006).

The relevance of the IMI questionnaire in research related to self-determination theory in HCI and games can be seen in the systematic review by Tyack et al. (2020), which aimed to understand the motivations and effects of using SDT in games and HCI research. The authors selected 110 full papers published at the ACM Conference on Human Factors in Computing Systems (CHI), and ACM SIGCHI Annual Symposium on Computer-Human Interaction in Play (CHI PLAY) conferences between 2009 and 2019. Among the selected papers, 24 distinct research areas were identified. The authors highlight the main ones: (i) studies on player experience (61.82%), (ii) design and interaction techniques (21.82%) and gamification (18.18%).

IMI was used in 40% of the reviewed papers. Almost half of these do not present motivations for explicitly using this instrument. Among the papers that present reasons for its use, one can highlight the use of the questionnaire in other HCI and gaming research, independent validation due to its modular characteristic, and complement results from other types of metrics, such as other questionnaires and interviews. Besides IMI, the self-report Player Experience Need of Satisfaction (PENS) questionnaire also stands out as one of the most cited instruments in the reviewed research, used in about 40% of the selected papers. This study opted for the translation and cross-cultural adaptation of the IMI instrument due to the commercial character of the PENS questionnaire, which would make it impossible to publish its items.

2.3. Questionnaire's Translation and Cross-cultural Adaptation

According to Miranda et al. (2021), several studies have translated and adapted psychometric questionnaires for different languages and areas, usually following translation, localization, and cross-cultural adaptation. In general, these processes can be defined as follows:

- **Translation:**
A communicational process based on changing texts from a source language to a different language.
- **Localization:**
The process of modifying a product for a specific location by combining the target language, thus encompassing the translation process, with the addition of the socio-cultural implications of the geographic/demographic region for which it is intended.
- **Cross-cultural adaptation:**
The process of adapting a questionnaire constructed in a given language to another language and culture, focusing mainly on the cultural characteristics of the two languages and including the validation of its psychometric properties. This concept is similar to localization and the terms have been used interchangeably.

It is important to understand the difference in these processes and that they are not sequential. The processes of localization and cross-cultural adaptation are extensions of the translation process, since they focus on adapting the already translated text in order to improve the reader's understanding. In this sense, we use the translation

processes to bring the source questionnaire from its original language into Portuguese, and then we perform its adaptation so that the target questionnaire is close to the Brazilian context.

The researches of (Azevedo et al., 2020) and (Fonseca et al., 2001) have already sought to translate IMI into Portuguese. In the first work, the authors translated and validated the instrument into Brazilian Portuguese applied to medical students and participants of a "tutorial group". Similarly, in the second study, the authors translated and validated the questionnaire into European Portuguese and applied it to the context of physical activities and sports. This study differs from those cited by the proposal of translation and validation of the Task Evaluation Questionnaire version of IMI applied to general contexts, enabling its use in various areas.

3. Methodology

This study was approved by the Ethics Committee of the Federal University of Ceará, under protocol No. 5325738. The research volunteers received verbal or written information about the research and signed a consent form for participation. The process followed in this work can be separated into two phases: (i) translation and cross-cultural adaptation and (ii) statistical tests to evaluate the association of motivating and demotivating scores using Minitab 18.1. The procedures for each step are described in the following sections.

It is important to emphasize that this paper was produced between November 2021 and June 2022, where we are coming out of a pandemic period caused by the new coronavirus (Sars-CoV-2) that has social distancing as the main preventive measure. In this context, we have chosen to use hybrid methods, giving priority to the remote context as a way to decrease possible risks. Thus, it is also important to highlight that phases such as participant recruitment and execution of the remote activities presented challenges typical of this context.

3.1. Translation and Cultural Adaptation

In the first phase, we followed the guideline proposed by Beaton et al. (2002) for translation and cross-cultural adaptation of health state measures. The guideline is divided into five steps, summarized in figure 1 and described as follows:

(1) **Initial translation**

Direct translation of the instrument, performed by two native speakers of the target language. One of the translators must have knowledge about the concepts being evaluated by the questionnaire. The product of this step is two versions translated into the target language, named T1 and T2.

(2) **Synthesis**

The two translators and an observer meet to synthesize the two translations generated, thus generating the T12 version. A written report of the discussion should be made.

(3) **Back-translation**

Native speakers of the instrument's language should translate the T12 version back into the source language. The two translators should not know anything about the source questionnaire or the constructs being measured by it. As results, two versions from each translator are produced, named B1 and B2.

(4) **Expert committee**

A meeting to discuss the T12 version together with the other versions produced (source, T1, T2, B1, and B2) and the report produced in step two. For this, all four translators present in the previous steps should be present, as well as a linguistic professional, a technology professional, and a methodologist. The product of this meeting is the pre-final version.

(5) **Pretesting (Evaluation of the translation)**

Data is collected to evaluate the target audience’s understanding of the pre-final version generated in the previous stage, with a sample of 30 to 40 participants.

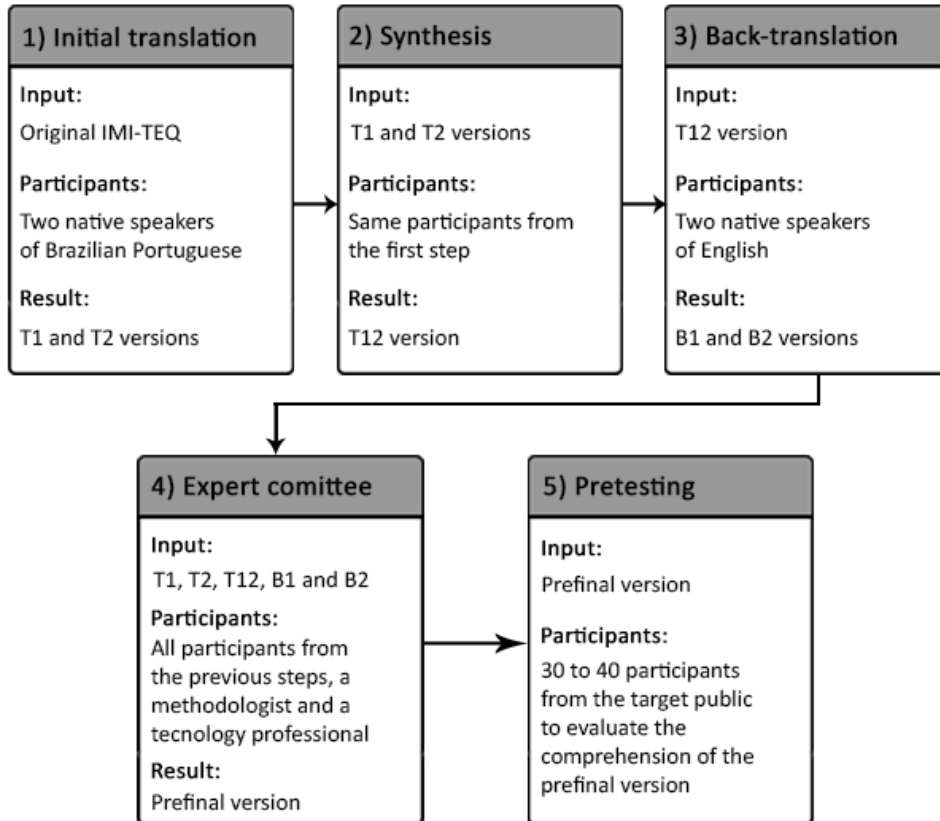


Figure 1. Summary of the steps followed for the IMI-TEQ translation and adaptation.

The profile of each participant in this phase is summarized in table 1. In the initial translation stage, two Brazilian Portuguese speakers translated the source version of IMI-TEQ into Brazilian Portuguese, producing versions T1 and T2. Both translators have opposite profiles, being the T1 version produced by a professional in the HCI area, with experience with the concepts used in the questionnaire, and the T2 version by a specialist in the linguistic area with no experience in the HCI area, nor was he informed about the concepts used in the questionnaire.

The T1 and T2 versions were later merged into a version called T12, which was sent for back-translation. The back-translation focus on translating the T12 version (Brazilian Portuguese) back to the source language (English) and was performed by two native English speakers, one of them being a British English speaker and the other an American English speaker. The versions resulting from this stage are called B1 and

Table 1. Summary of the participants' profiles

Step	Required profile	Participant's information
1) Initial Translation	The translator should be aware of the concepts being examined in the questionnaire.	Gender: Female First language: PT-BR Graduation Field: Computer Science Occupation: Associate Professor Professional experience: 10 years
	The translator should neither be aware nor be informed of the quantified concepts (i.e., naive translator)	Gender: Male First language: PT-BR Graduation Field: Linguistics Occupation: English Teacher Professional experience: 26 years
2) Synthesis	Same profiles from the first step	Same profiles from the first step
3) Back-translation	Naive-translator whose mother-tongue is English. They should neither be aware of the source version of the questionnaire nor be informed of the concepts being quantified.	Gender: Female First language: en-US Graduation Field: Communication Occupation: Admissions Officer and Travel Specialist at an international school Professional experience: 7 years
		Gender: Male First language: en-GB Graduation Field: Business and Systems Transformation Occupation: Retired Professional experience: 31 years
4) Experts committee	All profiles from the previous steps	Same profiles from the first and third steps
	Linguistics professional	Same profile of the naive translator from the first step
	Technology professional	Gender: Female First language: PT-BR Graduation Field: Digital Media and Systems Occupation: Interaction Designer Professional experience: 5 years
	Methodologist	Gender: Male First language: PT-BR Graduation Field: Psychology Occupation: Associate Professor Professional experience: 14 years

B2.

Next, all the translations produced so far (T1, T2, T12, B1 and B2) were analyzed by an experts committee, formed by all the translators from the previous stages, a technology professional working in the field of HCI in Digital Media and Systems, and

a professor of Psychology. This step resulted in the so-called pre-final version.

Finally, the pre-final version went through a comprehension analysis with 31 volunteers from the target audience, amount considered within the ideal sample range of 30 to 40 people (BEATON, 2000). The selection criteria for participants were to:

- (1) Be over 18 years old;
- (2) Have completed elementary school;
- (3) Be a native Brazilian Portuguese speaker; and
- (4) Be unfamiliar with the source version of IMI-TEQ.

The pre-test was conducted partially in a usability lab at the Federal University of Ceará and partially online using the Google Meet tool. Each session had an average of 20 minutes, being conducted by a researcher and had the following procedures:

- (1) Contextualization about the project;
- (2) Explanation and signing of the term of informed consent;
- (3) Application of a socio-demographic questionnaire;
- (4) Application of the IMI-TEQ Br pre-final version, using a 7-point likert scale;
- (5) Application of the comprehension scale, using a 5-point likert scale; and
- (6) Application of a semi-structured interview to collect feedback on words, sentences and expressions used in the translation.

To apply the pre-final version of the IMI-TEQ Br, we asked participants to describe a motivating or demotivating experience with a digital product and, thinking about this experience, to fill out the IMI-TEQ Br. The comprehension scale was adapted from Conti (2009), where for each questionnaire item, the question "What do you think of this sentence?" was answered on a 5-point Likert scale. We modified the scoring range from 0 to 4 to 1 to 5, where: 1 - I did not understand anything; 2 - I understood a little; 3 - I understood more or less; 4 - I understood almost everything but had some doubts; 5 - I understood everything and had no doubts.

In this stage, we noticed some comprehension problems in the items of the subscale perceived choice. Considering this, the expert committee made adjustments, which are presented in the next section. We also noticed that most of the participants who reported comprehension problems evaluated digital games. Thus, in the validation stage of the questionnaire through statistical tests, we sought to collect evaluations of digital games separately from other digital products to understand if this type of application has specificities regarding the use of this subscale. After this step, we sent a document with all the translations produced and the final version of the questionnaire translation to the authors of the source version of IMI-TEQ for appreciation.

3.2. Statistical tests

For this phase, we followed the method used by Kortum et al. (2013), Blazica et al. (2015) and more recently by Miranda et al. (2021) of providing meaning to the questionnaire scores by comparing two groups of data based on people's prior experiences.

To collect this data, we applied two online forms. In the first form, the participants provided ratings of their experiences with a specific task, described by the participant, within a digital product (e.g website, application, software) in which they felt motivated or demotivated doing. The second form had the same objective as the first but for evaluating specifically digital games.

The criteria for participant selection were to:

- (1) Be over 18 years old;
- (2) Have completed elementary school;
- (3) Be a native Brazilian Portuguese speaker; and
- (4) Be unfamiliar with the IMI-TEQ.

Both forms contained questions (i) to collect sociodemographic data, (ii) to describe the chosen digital product/game and the task within it, and (iii) to evaluate the experience of the task, using a randomized version of IMI-TEQ Br.

We conducted dissemination of the forms via social media (Instagram, Whatsapp, Telegram, Facebook, and email) for one month. Despite the separation of the forms, we had to pool the results from both forms to get enough data to perform the test, since at the time of writing we had only 156 responses. We labelled the motivating and demotivating experiences sub-datasets Motivating Experiences (ME) (N=109) and Demotivating Experiences (DE) (N=47) respectively.

To assess whether there is a significant difference in IMI-TEQ Br scores when assessing motivating and demotivating experiences, we performed a t-test for independent samples. The t-test is a statistical significance test used to assess variances that can or cannot be explained by independent variables (Lazar et al., 2017). As a result, the t-test suggests the probability that the observed difference occurs by chance, and if this probability is low (less than 5%), one can state with high confidence that the difference is due to the difference in the control variables. The hypothesis of our t-test is that the Interest/Enjoyment subscale will score significantly higher in evaluating motivating experiences and the Pressure/Tension subscale will score significantly higher in evaluating demotivating experiences.

4. Results

This section presents the data analysis of the (i) comprehension of the pre-final version and (ii) statistical tests.

4.1. Comprehension of the pre-final version

The IMI-TEQ Br comprehension assessment had 31 participants, with 24 from the technology field (11 male, 9 female, 1 agender, 1 non-binary and 2 non-declared) and 7 from other areas (3 male, 3 female and 1 non-declared). The age range of the first group (technology field) was 22 to 34 years, having as mean 26.25, and the age range of the second group (non-technology field) was 18 to 28 years, having as mean 23.28. Table 2 presents the number of participants separated by school level, being most of them at the undergraduate level, being 17 from the technology area and 4 from other fields. The level with the smallest sample was the doctoral level, with only one participant from the technology area.

Table 2. Number of participants from each field per study level.

Education level	Participants (Other Areas)	Participants (Technology)
High School	2	3
Undergraduate Degree	4	17
Master's Degree	1	3
Doctoral Degree	0	1

All participants evaluated the IMI-TEQ Br positively. In the technology field group of participants, 83% of all items were understood without question, while the non-technology field group completely understood 95% of all items. Both Interest/Enjoyment and Perceived Competence subscales had 90% comprehension on their items, while the Perceived Choice scale had 71% total comprehension of its items. The Pressure/Tension scale had 87% comprehension. The mode and median of all responses was 5 - "I understood everything, and had no questions," as shown in Table 3 that presents the descriptive statistics of the IMI-TEQ Br comprehension test.

Table 3. Descriptive statistics for IMI-TEQ Br prefinal test (N=31).

Variable	Mean	StDev	Variance	Min.	Med.	Max.	Mode	N for Mode
Q1	4,709	0,642	0,412	4	5	5	5	30
Q2	4,548	0,767	0,589	3	5	5	5	28
Q3	4,709	0,642	0,412	4	5	5	5	30
Q4	4,903	0,3	0,09	3	5	5	5	26
Q5	4,806	0,654	0,427	4	5	5	5	30
Q6	4,935	0,249	0,062	2	5	5	5	28
Q7	4,612	0,803	0,645	3	5	5	5	27
Q8	4,967	0,179	0,032	2	5	5	5	24
Q9	4,967	0,179	0,032	4	5	5	5	30
Q10	4,709	0,782	0,612	1	5	5	5	22
Q11	4,161	1,035	1,073	3	5	5	5	29
Q12	4,967	0,179	0,032	4	5	5	5	30
Q13	4,87	0,427	0,182	3	5	5	5	28
Q14	4,967	0,179	0,032	4	5	5	5	30
Q15	4,774	0,56	0,313	3	5	5	5	26
Q16	4,967	0,179	0,032	4	5	5	5	30
Q17	4,774	0,762	0,58	2	5	5	5	28
Q18	4,806	0,542	0,294	3	5	5	5	27
Q19	4,483	1,06	1,124	2	5	5	5	24
Q20	4,967	0,179	0,032	4	5	5	5	30
Q21	4,548	0,888	0,789	1	5	5	5	22
Q22	4,903	0,396	0,156	3	5	5	5	29

Some participants, however, had problems with some items on the Perceived Choice subscale, specifically items 11 (15 participants), 19 (8 participants), and 21 (9 participants). Most of these participants answered the IMI-TEQ Br thinking about a task within a digital game. During the interview, they reported that these items did not fit the task they chose since they had a choice about whether or not to perform the task, as it was their choice to play the game. This drew our attention to the possibility that digital games have a specificity when it comes to assessing choice/control in a task, a central point of the Perceived Choice subscale.

Considering this, we separated the data collection in the comparison step of motivating and demotivating experiences in two forms, one for interactive products in general (e.g. websites, applications) and another for digital games to verify if the scores of this subscale presented considerable differences.

The expert committee made adjustments after analyzing the comprehension data resulting in the final version of IMI-TEQ Br, presented in appendix A. These adjustments focused on enabling task filling on each item to fit specific activities. This change

was also intended to help in the understanding of the items noted with some level of doubt on the Perceived Choice subscale, presenting more context for the participant answering the questionnaire. According to Ryan et al. (2006), this practice is often performed when using the questionnaire and does not affect its reliability or validity. Another adjustment made concerns the removal of item 17 from the questionnaire. Although in the source version items 5 "I found the task very interesting" and 17 "I thought the task was very interesting" were different, the translation into Brazilian Portuguese was the same: "Achei a tarefa muito interessante". In the discussions raised by the committee participants, no reasons were found to change the result of the two original sentences, so it was decided to remove them.

Although there were some doubts in those few items, the qualitative and quantitative data analysis showed a shared understanding of the IMI-TEQ Br items. All participants stated that the Prefinal version was easy to understand and fast to score.

4.2. Comparison of motivating and demotivating experiences

The number of responses from the two forms gave a total of 156, with 109 referring to motivating experiences (ME) and 47 referring to demotivating experiences (DE). Most of the motivating answers evaluated digital games, being 75 (68.80%) out of 109, and 34 (31.19%) evaluated other types of digital products. Among the most frequently cited games in motivating experiences are: League of Legends, Free Fire, and games from the Mario and Pokémon franchises. As for digital products, the most frequently cited in motivating experiences are social (Instagram, TikTok, WhatsApp), educational (Duolingo), and utilities smartphone applications.

As for the total of demotivating experiences, 12 (25.53%) out of 47 answers evaluate digital games, and 35 (74.46%) evaluate other types of digital products. The most cited game in the demotivating experiences was League of Legends and among the other types of digital products, the most cited were social smartphone applications (Instagram and Facebook) and banking applications.

The characterization of the samples are presented in tables 4 and 5, separated by the type of experience evaluated. The majority of participants are female, being 58 in ME and 26 in DE against 45 in ME and 18 in DE of male participants. A small portion of the participants (9) identified with other genders or preferred not to state their gender. The average age of the participants was 24 in ME versus 34 in DE. Most of the participants are from the technology field, being 90 participants in both experiences (58 in ME and 32 in DE) against 66 from other fields (51 in ME and 15 in DE). To apply the t-test on the collected data sample, we first calculated the score of each subscale of the IMI-TEQ Br. Initially, the scores of items 2, 9, 11, 14, 19, and 21 were reversed by subtracting 8 from the original score (Ryan et al., 2006). Next, the average of the items of each subscale should be taken, thus generating 4 scores.

A higher score in a subscale indicates more of that concept described in its name. Thus, a higher score on the Pressure/Tension subscale indicates that the person felt more pressured or tense while doing the task, and so on. This can be seen in our t-test results (table 6), where the mean of the scores in the Interest/Enjoyment subscale, considered the real measure of intrinsic motivation, and Perceived Competence and Perceived Choice subscales, considered positive predictors of intrinsic motivation, are significantly higher in motivating experiences (6.27 in Interest/Enjoyment, 5.66 in Perceived Competence and 5.32 in Perceived Choice, while Pressure/Tension has 3.46). Similarly, in the DE scores the Pressure/Tension subscale, considered the negative

Table 4. Motivating experiences - Sample characterization

Gender	Male	45	(\cong 41%)
	Female	58	(\cong 53%)
	Other/Non-declared	6	(\cong 6%)
Age	Mean	24,366	
	SD	4,254	
	Min - Max	18 - 34	
Graduation / Professional Field	Technology	58	
	Other areas	51	

Table 5. Demotivating experiences - Sample characterization

Gender	Male	18	(\cong 38%)
	Female	26	(\cong 55%)
	Other/Non-declared	3	(\cong 6%)
Age	Mean	34,340	
	SD	8,447	
	Min - Max	21 - 56	
Graduation / Professional Field	Technology	32	
	Other areas	15	

predictor of intrinsic motivation, scored higher (1.73 in Interest/Enjoyment, 2.84 in Perceived Competence and 3.62 in Perceived Choice, while Pressure/Tension has 4.80). Thus, we have a positive indication that motivating and demotivating experiences are being evaluated accordingly, using IMI-TEQ br.

Table 6. Results of T-test to independents samples.

Subscale	ME Mean	DE Mean	ME StDev	DE StDev	T-test Report
Int./Enj.	6,27	1,73	0,87	0,73	t(103) = 33.28 p <0.01
Perc. Comp.	5,66	2,84	1,31	1,31	t(87) = 12.3 p <0.01
Perc. Choice	5,32	3,62	1,18	1,32	t(79) = 7.56 p <0.01
Pres./Tens.	3,46	4,80	1,48	1,15	t(111) = -6.13 p <0.01

5. Discussion

We produced a translation and cultural adaptation of the Intrinsic Motivation Inventory Task Evaluation Questionnaire (IMI-TEQ) with the results showing good indications of understanding and a significant difference in the evaluation of experiences considered motivating and demotivating. We highlight some major insights gathered during our process, described in the following sections.

5.1. Specificities in the translation and adaptation of IMI-TEQ Br

The translation and cultural adaptation of a questionnaire into another language version is not a trivial task. Cultural and linguistic differences between the respective populations who speak each language have to be considered during translation (Hunt et al., 1991). In our process, the presence of different profiles during the translation stages of the methodology was crucial to ensure different points of view, such as from the fields of linguistics and psychology, about terms and expressions used and their application depending on the context and target audience.

This importance could be noticed, for example, in one of the discussions during the expert committee, about item 10: "I enjoyed doing the task very much". The word *enjoyment* does not have a direct translation in Brazilian Portuguese and can take on different meanings related to *pleasurable*, *fun* or *satisfying*. So, initially, the Brazilian Portuguese translators used the word "*gostei*" (which can be translated as "*liked*") instead of the word *enjoyed* in item 10 during the initial translation of IMI-TEQ Br. During the expert committee discussions, the English-speaking translators, who also have knowledge of Brazilian Portuguese, pointed out that the word "*gostei*" had a much weaker meaning than the word "*enjoyed*", so after testing the use of other words like "*diverti*" (had fun) or "*prazeroso*" (pleasurable), the word "*curtir*" was chosen.

The verb "*curtir*", in the sense that was used in the translation of IMI-TEQ Br, is an informal vocabulary word defined by a regular dictionary that follows the Common Orthographic Vocabulary of the Portuguese Language as being "To feel pleasure or satisfaction from; to like a lot"². The other participants pointed out that this word would have an informal meaning from the perspective of native Brazilian Portuguese speakers, but since the informal language would not affect the objective of the questionnaire to present a user-friendly language, and that the meaning was closer to the original term for English-speaking participants, it was decided to maintain the term.

Another item affected by the expert committee discussion was item 7 "I think I did pretty well at this activity, compared to other students". The use of the term "*students*" was pointed out by the HCI specialist translator as a limiting term in the sentence, since the use of IMI-TEQ Br might not necessarily evaluate students, but a general audience. Then, a discussion was initiated to replace this word in order to represent other audiences. The term "*demais*" was chosen, resulting in the sentence "*Em comparação aos demais, acho que me sai bem nessa atividade*" (which can be translated as "*Compared to the others, I think I did well in this activity*"). During the comprehension test of the pre-final version it was pointed out by the participants that the term "*demais*" was ambiguous, not making it clear to whom the item was referring. Therefore, the expert committee adjusted the term to "*outras pessoas*", resulting in the sentence "Em comparação a outras pessoas, acho que me saí bem em Tarefa X." (which can be translated as "Compared to other people, I think I did well in Task X").

The method by which the translation process is carried out can have a great effect on its result and, consequently, on its understanding. In this sense, we realize the need for a rigorous process of discussion at the expert committee stage, making sure that it is formed by multidisciplinary professionals who can ensure reliability and maintain the quality of the questionnaire to be translated (Beaton et al., 2002; Nora et al., 2018).

²In Portuguese: [...] 8. Sentir prazer ou satisfação por; gostar muito de, in Dicionário Priberam da Língua Portuguesa [online], 2008-2022, <https://dicionario.priberam.org/curtir> [accessed in 06-07-2022].

5.2. Investigating intrinsic motivation with IMI-TEQ Br

Motivation is a decisive factor for well-being (Cerasoli, 2014), being a fundamental component in any model of human performance. Intrinsic motivation, in turn, enhances behaviors that favor personal growth, such as seeking challenges and pursuing interests. As a natural motivational force, its rise and fall occurs as external variables support or interfere with the individual's self-determination experiences (Reeve, 2003).

To enable an investigation of the factors that may inhibit or promote intrinsic motivation, even if these are subjective, it is necessary to use validated methods. An intrinsic motivation measurement questionnaire such as IMI-TEQ Br can provide support in the assessment of: students' motivation to learn in academic disciplines (Monteiro et al., 2015) or the impact of new technologies in the classroom (Carrera et al., 2018), individual's motivation in sports competitions and camps (Fonseca et al., 2001; McAuley et al., 1989; Tsitskari et al., 2010) or in player's motivation in specific game tasks such as creating avatars (Alankus et al., 2012) or in the activity of playing game (Birk et al., 2016).

Thus, this translation is important to fill the need for a reliable tool for the CPLP for intrinsic motivation research, providing the optimization of everyday tasks in order to enhance the psychological well-being and creativity of the individual, as well as to increase the quality of the effort people put into it.

6. Limitations

The main limitations of this study are in the second part of the methodology, the statistical tests (application of Student's t-tests). The t-test method was only the first step to perform a statistical validation, in order to prove that the translated version of the IMI-TEQ Br evaluates the same psychometric constructs as the source version of the questionnaire, being the other two steps composed of an Exploratory Factor Analysis (EFA) and a Confirmatory Factor Analysis (CFA).

These two methods could not be performed yet due the need for more responses from the data collection questionnaires, where we obtained only 150 responses separated unevenly into motivating and demotivating experiences. Due to this inequality, we were also unable to analyze the data from the games questionnaire comparing it to the digital products questionnaire, in order to understand the specifics of each type.

In addition, we are aware of the limitation of representativeness present in the data collected during the pre-final test and Student's t-test steps due to the unequal distribution of samples from the national territory. Although the variations follow the same Portuguese norm, representing less than one group may generate slightly distorted results.

In order to reduce the impacts of these limitations, the questionnaires will continue to collect data in order to achieve a larger number of responses, sufficient to perform the factor analyses. With sufficient data, we will again conduct a t-test to analyze the new data sample, and after that, conduct the EFA and CFA to validate the psychometric constructs of the IMI-TEQ Br against the source version.

Although incomplete, the data analysis presented in this study shows good indications that the IMI-TEQ Br questionnaire assesses intrinsically motivating experiences as well as the source version, with possibilities of being a useful tool for HCI, game studies and other fields in the CPLP.

7. Conclusion

The lack of translated and validated instruments in Portuguese for use in the Community of Portuguese Language Countries (CPLP) can lead to ad-hoc translations of questionnaires validated in other languages, undermining the reliability of the results.

In this regard, this work aimed to produce the translation and adaptation into Brazilian Portuguese of the Intrinsic Motivation Inventory questionnaire, widely used in HCI, in its 22-item version Task Evaluation Questionnaire (IMI-TEQ), which investigates intrinsic motivation in general tasks.

To verify the questionnaire's comprehension with real users, we applied the translated version and a comprehension scale with 31 volunteers, which generated positive scores. We also performed a Student's t-test in independent samples to evaluate the association between motivating and demotivating scores. The analysis indicated a significant difference between scores of motivating and demotivating experiences.

In future work, we intend to continue the statistical validation stage, performing exploratory factor analysis and confirmatory factor analysis to verify if the Brazilian version of the questionnaire correctly assesses the constructs presented in the source questionnaire. We also intend to apply the IMI-TEQ Br in other contexts and audiences to validate its suitability in different scenarios.

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Appendix A. IMI-TEQ BR

Table A1 compares the source version of IMI-TEQ (left) and its translated version IMI-TEQ Br (right). The translated version presents a blank space, named "Tarefa X" (or "Task X") to fill in the task to be evaluated.

The space should be filled with an expression starting with a verb. For example, if the evaluation is concerned with assessing the player's motivation during a battle against an enemy in a game, the first sentence of IMI-TEQ Br would be: "Ao **lutar contra o inimigo**, eu pensava no quanto havia gostado de fazer isso". This sentence would translate to: "As I fought the enemy, I thought about how much I had enjoyed doing this".

The scoring of IMI-TEQ Br follows the same procedure as the IMI-TEQ, namely, the items indicated with (R) should be reversed (decreasing 8 of the marked score). Then, an average of the items of each dimension should be taken. Nevertheless, it is necessary to pay attention to the items' division by dimension, given that item 17 was removed from the translated version. Table A2 presents the division of items by dimension.

Table A1. The source version IMI-TEQ and its translated version, IMI-TEQ BR

ID	IMI-TEQ	IMI-TEQ BR
Q1	While I was working on the task I was thinking about how much I enjoyed it.	Ao <u>Tarefa X</u> , eu pensava no quanto havia gostado de fazer isso.
Q2	I did not feel at all nervous about doing the task.	Não me senti nervoso de forma alguma em <u>Tarefa X</u>
Q3	I felt that it was my choice to do the task.	Senti que era minha escolha <u>Tarefa X</u> .
Q4	I think I am pretty good at this task.	Acho que sou bom em <u>Tarefa X</u> .
Q5	I found the task very interesting.	Achei muito interessante <u>Tarefa X</u> .
Q6	I felt tense while doing the task.	Eu me senti tenso ao <u>Tarefa X</u> .
Q7	I think I did pretty well at this activity, compared to other students.	Em comparação a outras pessoas, acho que me saí bem em <u>Tarefa X</u> .
Q8	Doing the task was fun.	<u>Tarefa X</u> foi divertido.
Q9	I felt relaxed while doing the task.	Eu me senti relaxado ao <u>Tarefa X</u> .
Q10	I enjoyed doing the task very much.	Curti muito <u>Tarefa X</u> .
Q11	I didn't really have a choice about doing the task.	Eu realmente não tive escolha quanto a <u>Tarefa X</u> .
Q12	I am satisfied with my performance at this task.	Estou satisfeito com meu desempenho ao <u>Tarefa X</u> .
Q13	I was anxious while doing the task.	Eu estava ansioso ao <u>Tarefa X</u> .
Q14	I thought the task was very boring.	Achei muito chato <u>Tarefa X</u> .
Q15	I felt like I was doing what I wanted to do while I was working on the task.	Ao <u>Tarefa X</u> , senti que estava fazendo o que eu queria.
Q16	I felt pretty skilled at this task.	Eu me senti muito habilidoso ao <u>Tarefa X</u> .
Q17	I felt pressured while doing the task.	Eu me senti pressionado ao <u>Tarefa X</u> .
Q18	I felt like I had to do the task.	Senti que tinha que <u>Tarefa X</u> .
Q19	I would describe the task as very enjoyable.	Eu descreveria <u>Tarefa X</u> como muito agradável.
Q20	I did the task because I had no choice.	<u>Tarefa X</u> foi uma coisa que fiz porque não tive escolha.
Q21	After working at this task for awhile, I felt pretty competent.	Depois de <u>Tarefa X</u> por um tempo, me senti muito competente.

Table A2. IMI-TEQ Br items by dimension

Dimension	Items
Interest/Enjoyment	1, 5, 8, 10, 14(R), 19
Perceived Competence	4, 7, 12, 16, 21
Perceived Choice	3, 11(R), 15, 18(R), 20(R)
Pressure/Tension	2(R), 6, 9(R), 13, 17

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