









## About the validation of a questionnaire on behavioral addiction to the internet and its relationship with the student population





### Acerca de la validación de un cuestionario sobre la adicción conductual al internet y su relación con la población estudiantil

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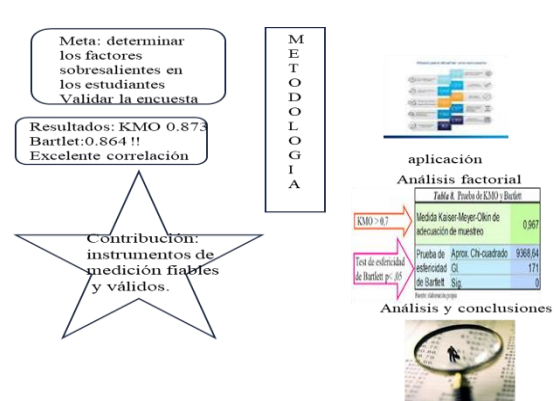
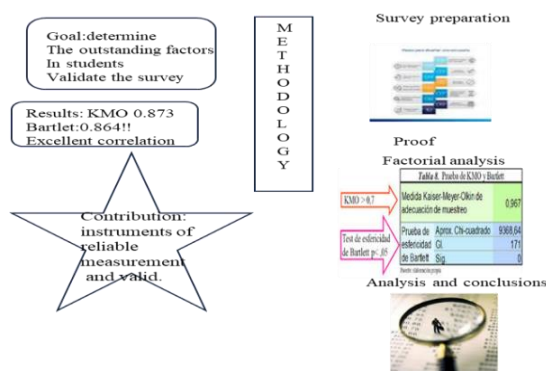


#### Abstract

Factor analysis is considered to be a very important technique for the investigation of complex situations, in the particular case of Internet addiction, as it allows complex behavior to be broken down into more manageable and understandable factors. This process facilitates the evaluation, intervention and understanding of its implicit dimensions, so that a relationship of its impact on mental health could be established. The validation of a questionnaire is a fundamental part of ensuring that the measurement instruments are reliable and valid. One of the most used statistical methods is factor analysis, this examines the hidden structure of the data and has a certainty that measures what you want to quantify. The method of principal factors and not principal components is used here. The objective of this research is to determine the outstanding factors in the students of TecNM, Campus Mérida and Campus Tuxtla Gutiérrez, who interact with the use of the Internet in a non-academic way; subsequently validate the survey applied. A series of questions were considered to determine if its use is excessive, the questionnaire contains 14 questions that deal with addictions related to behavior and its effect on their daily performance and its possible relationship with academic performance.

#### Resumen

Se considera que el análisis factorial es una técnica muy importante para la investigación de situaciones complejas, en el caso particular la adicción al internet, pues permite descomponer el comportamiento complejo en factores más manejables y comprensibles, este proceso facilita la evaluación, intervención y comprensión de sus dimensiones implícitas, de forma que se podría establecer una relación de su impacto en la salud mental. La validación de un cuestionario es una parte fundamental para que se garantice que los instrumentos de medición son fiables y válidos. Uno de los métodos estadísticos más utilizado es el análisis factorial, este examina la estructura oculta de los datos y se tiene una seguridad que mide lo que se desea cuantificar. Se usa aquí el método de factores principales y no de componentes principales. El objetivo en esta investigación es determinar los factores sobresalientes en los estudiantes del TecNM, Campus Mérida y Campus Tuxtla Gutiérrez, que interactúa con el uso del internet de forma no académica; posteriormente validar la encuesta aplicada. Se consideró una serie de preguntas para determinar si su uso es excesivo, el cuestionario contiene 14 preguntas que tratan con las adicciones relacionadas con el comportamiento y su efecto en su desempeño diario y su posible relación con el desempeño académico.



#### Validation, Factor analysis, Conflict

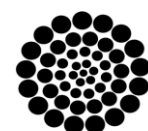
#### Validación, Análisis factorial, Conflicto

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## Introduction

Information and communication technologies appeared at the end of the 20th century and the beginning of the 21st century, originating from the development of electronics and computing, especially with the integration of various technologies, including cloud computing, artificial intelligence, virtual reality and the internet of things.

The internet is seen as a vast global network of interconnected computers, enabling communication between people and the rest of the world, which has transformed the way people live, work and learn in ways that have revolutionised life today, offering different impacts on what people do.

The diversity of entertainment options has been enhanced by video and music streaming services, as well as the massive exchange of information through platforms such as You Tube, where experiences and knowledge are shared. In addition, the international economy, business models and industries have been transformed by e-commerce and remote work (Martín and Medina, 2021).

The existence of various social networking platforms, instant messaging, emails facilitate communication with anyone, bridging distances and transforming the concept of community, on the other hand, access to knowledge is virtually unlimited as it is possible to have a vast diversity of educational resources available online, which facilitates learning and continuing education (Moreno, et. al. 2020).

However, the rapid and open dissemination of information gives rise to fake news and misinformation, influencing public opinion and behaviour, and in severe cases can lead to the political destabilisation of societies and governments. The security of personal data shared online leads to the emergence of privacy concerns, which also generates the counterpart of digital surveillance and the prevention of cyber-attacks.

There is also the so-called digital divide, as not everyone has access to an internet, nor the digital skills, which has led to inequality in educational and work opportunities, caused by automation and digitalisation.

The abuse of the use of the internet and social networks leads to mental health problems, such as anxiety, depression and addiction, in addition to the affection of self-esteem due to the search for acceptance and recognition from others (Amador-Ortiz, 2021).

Interaction and communication between people is undergoing radical changes due to the way in which they develop, because of its invasiveness in personal, academic and all areas of daily life, as it causes situations that impact on various aspects of modern life, such as time management to correctly and effectively carry out daily activities and those tasks that by their nature are necessary for the social, economic and psychological development of human beings (Gutiérrez-Monsalve, et. al., 2021).

This makes it necessary to prioritise the development of an objective way of managing time, so it is important to establish clear limits to prioritise tasks, with set schedules for the use of technology, which implies the use of digital tools in a strategic and conscious way to minimise distractions and increase the availability of efficient, productive time (Ramírez, et al. 2021).

The large amount of information makes it difficult to make a classification of what is relevant and useful, a task that demands time and the need to retain the important elements in memory and give them the corresponding attention (Ramírez, et al. 2021).

However, by its very nature, communication generates a constant exchange of notifications that suddenly interrupt the activity being carried out, making it difficult to concentrate on important tasks, delaying activities or situations that should be attended to, thus giving rise to procrastination.

In addition, Salas-Blas et al. (2021) point out that on many occasions it demands an immediate response, which requires permanent attention to be available to return the message, which affects the ability to concentrate and psychological balance, and often leads to the need to perform multiple tasks with the consequent possibility of making mistakes or forgetting important and necessary matters to be done.

As a consequence of these activities, according to Rojas, et. al. (2020), repetitive and to some extent compulsive behaviour patterns are generated, tending to the development of behavioural addictions, with negative consequences in people's lives.

Despite being considered as addictions without the presence of toxic substances, they can lead to situations that affect physical, emotional and personal interaction health, as they are considered to have a negative impact due to the behaviours that are developed, such as becoming addicted to intensive internet use, obsessive work, food, exercise, shopping, etc. Becoña, (2018).

The development and then the formal habit of these addictions share similarities in the way they affect behaviour and the brain in its cognitive behavioural processes, as they activate components of the reward area circuits in the brain, which can lead to a permanent desire for pleasure and reward, which multiplies people's addictive behaviour (Secretaría de Salud, 2023), (Ramírez, et. al 2021).

An interesting point is the time spent in carrying out these communication processes (Suryasa, et. al. 2020), in the case of students it has an impact on the time allocated to study and the completion of tasks, which leads to be a determining factor in the academic development during their university education.

It should be noted that good time management will improve efficiency, reduce stress, as well as develop important skills for the study process and preparation of assignments and exams, for which it is necessary to determine the conditions of use of internet-related applications (Cervantes López, et al. 2020) .

In terms of increasing academic productivity (García, et al. 2022) expresses that it is important to develop an adequate time management to perform intellectual activities more efficiently, which can be the prioritisation of tasks according to importance and urgency in order to meet on time with deliveries, so that you can achieve better concentration on the activities commissioned to perform.

According to Pelikan et al. (2021), a significant reduction in the level of stress is obtained by planning well in advance the development and distribution of activities and tasks in an adequate way, avoiding last minute problems, allowing the process of studying to be proper and can also improve the understanding and use of different

## Methodology

The objective of this research is to determine the outstanding factors in the students of TecNM, Campus Mérida and Campus Tuxtla Gutiérrez related to the use of the internet in a non-academic way; in order to subsequently validate the survey applied. A set of questions was considered to determine whether their use is excessive, a questionnaire containing 14 questions was applied that deals with addictions related to behaviour and their effect on their daily performance and their possible relationship with academic performance.

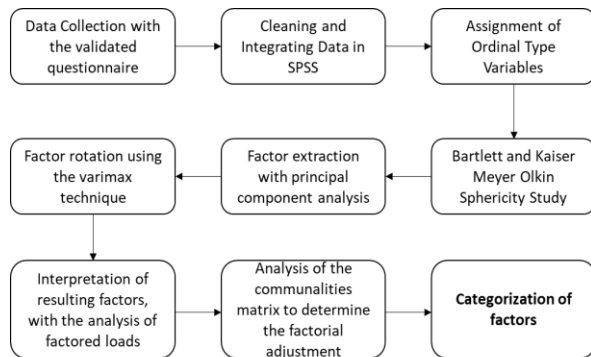
The questions were closed-ended, Méndez, L. & Peña, J. (2020), Olmedo, et al.( 2019), Reyes-Cruz, et. al. (2018), Manchado, et. al. (2021) with predefined options that allow quantitative analysis; they are formulated concisely and are neutral in order to avoid bias in the answers provided, they were made to be answered under the options of the Likert scale, valued and worded as follows: 0=never, 1=almost never, 2=sometimes, 3=frequently, 4=very frequently.

The selection of the sample (Matamala, & Hinostroza, 2020) was intentional and non-probabilistic; it sought to identify the social group in which the behavioural effects of the internet needed to be known, made up of students from the Computer Systems Engineering, Biochemical Engineering, Electrical Engineering and Industrial Engineering degrees, thus defining the population of 264 people, who responded voluntarily and confidentially, under written consent, to the survey using a Google form.

The validation of the questionnaire, Echeburúa, et. al. (1994), Meerkerk, et. al. (2009), was carried out with a pilot test on a small group of students to identify and correct inconsistencies and other problems related to the clarity and functionality of the survey; following a structured and orderly procedure (see Figure 1).

It is important to note that, in order to strengthen the quality of the work, the support of a group of teachers was also required to identify errors in the wording and objectivity of the content of the questionnaire, as well as the clarity of the questions and the functionality of the survey format.

### Box 1



**Figure 1**

Validation Procedure of the Questionnaire on behavioral Internet addiction and its relationship with the student population

*Own creation*

In the data analysis stage, the data was exported from the Excel spreadsheet to SPSS 27, where the process of assigning data and ordinal variables was carried out, and subsequently Bartlett's test of sphericity was performed, where the Kaiser-Meyer-Olkin sample adequacy measure was also used, these tests with values above 0.80 indicate that they are suitable for conducting a factor analysis.

The factorial method Hair, J. et. al (2021) corresponds to the type of multivariate methods that have an inferential approach to determine or generate knowledge of the data examined, by means of indicators, also with a descriptive approach, to find information we find the methods of data exploration, whose purpose is to extract information, in them are the methods of principal components, the correspondence, in the same tenor are the methods of clusters to classify and build groups, as well as the regression methods very suitable to relate variables. The factorial method is a powerful tool for discovering underlying structures in data (Ho,2022) as well as reducing the complexity of the data by reducing dimensionality and identifying hidden patterns, the most common forms of this type of analysis being the so-called Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA).

It was noted that these analyses allow the simplification of a large dataset, as well as identifying patterns between variables, which facilitates the interpretation of multivariate data by reducing the dimensions involved.

However, it is considered to have some disadvantages, among which we find that it requires the data to be normal within the multivariate conditions and to have the characteristic of being linear, in addition there is the possible subjectivity of interpretation in the rotation of factors and the interpretation of factor loadings, being subjective, must be taken into account.

Hair, J. et. al. (2021) used the PFA because it lacks a prior hypothesis about the structure of the data, making it possible to determine the underlying structure of a set of variables that have been observed. It is based on the collection of data in which it is believed that there are common underlying factors, determining the correlation matrix of the observed variables to determine the relationship between them.

Continuing with the analysis, according to Ho (2022), the next step is the extraction of the factors using principal component analysis or the maximum likelihood method, followed by the so-called rotation of the factors using techniques known as varimax (orthogonal) or oblimin (oblique) rotation.

The interpretation of the factors was followed by the analysis of the factor loadings, which are correlations between observed variables and the factors, in order to make sense of the factor to be extracted.

## Results

After applying the SPSS to the questions of the questionnaire, the KMO index and Bartlett's test of sphericity were determined with values of 0.873 providing a robust validity of the data which means obtaining significant and reliable results, representing the suitability of the data to apply the Confirmatory Factor Analysis and indicating that the variables are sufficiently correlated.

Considering that if the index is between 0.90 and 1 it is excellent, 0.80 and 0.89 is considered with merit, between 0.70 and 0.79 is average, for values from 0.60 to 0.69 it is mediocre, bad between 0.50 and 0.59 and frankly unacceptable with values of 0.50, in the case of the results obtained with the value of 0.864 suggests that the correlations between the variables are sufficiently large for factor analysis to be useful.

Bartlett's test of sphericity determines whether the correlation matrix is an identity matrix; if it is an identity matrix, then all the variables are not correlated with each other, which means that factor analysis is not appropriate.

To carry out this process the following hypothesis tests are developed: Null hypothesis (H0) is considered that the correlation matrix is an identity matrix and the variables are not correlated, in the case of the alternative hypothesis H1, it states that the correlation matrix is not an identity matrix, which is considered that there are some significant correlations between the variables.

The hypothesis test is performed with the chi-square, to determine whether the observed correlations are significantly different from zero, for the survey that was applied the result was zero, so this value is small, less than 0.05 which indicates the criteria, so it is considered that the null hypothesis is rejected and the alternative is accepted, indicating that the variables are sufficiently correlated for factor analysis.

Another result is the communality, which provides information on the amount of variance in each variable that is explained by the factors that are extracted, allowing us to evaluate the adequacy of the factor model and ensure that the variables are well represented in the factor space, so that when analysing the communality it is possible to eliminate variables that are not very representative, indicating the appropriate number of factors that can be extracted, allowing the validation of the theoretical model of the questionnaire with its questions.

In the analysis performed, taking into account the extraction communalities, the highest communality close to one is found in question 13, having the highest validity, question 11 has the lowest communality, as it has a value close to zero.

This indicates that the total variance of the variables can be explained by the extracted factors, indicating that the model is adequate to explain the relationships between the variables, so it is indicated that for example question 13 fits the model well and question 11 does not.

Thus question 11 is not well represented by the factors, so it can be eliminated, in general if the communalities are low it indicates that the number of factors extracted is insufficient and it can be considered that more factors should be extracted, also that the theoretical model should be revised.

In addition, the total variance explained was determined, considered as a fundamental metric for factor analysis, indicating the quantification of the variance in the observed variables that are retained by the extracted factors, a high variance represents a model that is effective, otherwise a low variance explained suggests the need to adjust the number of factors or to reconsider the proposed questionnaire model.

In the data analysis process the values that emerge are three according to Keiser's criterion so that initial eigenvalues greater than one are to be taken into account, the cumulative variance of the three is 57.759, which is above 50%, and indicates the variance of the measurement instrument, the remaining corresponds to the variance of uniqueness (specific + error).

To obtain the above data, the factors were extracted from the correlation or covariance matrix of the observed variables, partially explaining the total variance of the data set. The eigenvalues measure the amount of variance of each factor. In addition, the matrix of components or factor loadings was considered, in which the correlations or loadings between the observed variables and the latent factors are established.

In order to make a better interpretation, the rotation was carried out, as the initial proposals of the factor analysis solutions are not clear and the rotation simplifies the relationships.

The rotation was of the orthogonal type, called varimax, maximising the variance of the loadings and making each factor associated fundamentally with a reduced subset of variables.

This resulted in the grouping of 3 factors as can be seen in Table 1, which shows the questions of the questionnaire applied.

## Box 2

**Table 1**

Grouping of factors resulting from varimax

FACTOR ONE			
	(Factor 1) <sup>2</sup>	(Factor 2) <sup>2</sup>	(Factor 3) <sup>2</sup>
9. have you unsuccessfully tried to spend less time on the Internet?	0.700	0.152	0.069
1. do you find it difficult to stop using the Internet when you are online?	0.693	0.205	0.197
8. do you think you should use the Internet less often?	0.683	0.011	0.278
3. do others (e.g., partner, children, parents) say you should use the Internet less?	0.665	0.186	0.120
2. do you continue to use the Internet despite your intention to stop?	0.598	0.281	0.171
5. are you short of sleep because of the Internet	0.568	0.29	0.215
FACTOR TWO			
	(Factor 1) <sup>2</sup>	(Factor 2) <sup>2</sup>	(Factor 3) <sup>2</sup>
6. do you think about the Internet, even when not online	0.169	0.815	0.033
7. do you look forward to your next Internet session?	0.284	0.768	0.105
14. do you feel restless, frustrated, or irritated when you cannot use the Internet?	0.237	0.675	0.317
4. do you prefer to use the Internet instead of spending time with others (e.g., partner, 0.67 0.64 0.66 children, parents)	0.061	0.658	0.238
10. do you rush through your (home) work in order to go on the Internet?	0.295	0.597	0.191
FACTOR THREE			
	(Factor 1) <sup>2</sup>	(Factor 2) <sup>2</sup>	(Factor 3) <sup>2</sup>
12. do you go on the Internet when you are feeling down?	0.170	0.192	0.870
13. do you use the Internet to escape from your sorrows or get relief from negative feelings?	0.180	0.231	0.868
11. do you neglect your daily obligations (work, school, or family life) because you prefer to go on the Internet?	0.391	0.273	0.465

Source: Own elaboration (2024)

It can be observed that there is a very low loading compared to the rest of the items in the questionnaire in question 11, so it is feasible and it could be suggested not to be taken into account for the model explaining the topic.

## Conclusions

The process of validating a questionnaire is an essential part of ensuring that measurement instruments are reliable and valid.

One of the most commonly used statistical methods is factor analysis, which examines the hidden structure of the data and how reliably it measures what it is intended to measure. The principal factor method is used here rather than the principal component method.

In this way the underlying structure of a set of variables can be identified, without imposing a preconceived structure.

In this particular case we started with the determination of the main factors through descriptive factor analysis by applying the KMO test (Kaiser-Meyer -Olkin) to measure whether the data are suitable for factor analysis, resulting in a value of 0.864.

Then the KMO test with its obtained value shows the sampling adequacy, i.e. the proportion of the variance in your variables that could be caused by latent factors.

The KMO index varies between 0 and 1, where values closer to 1 indicate that factor analysis is more appropriate.

The next step in the process of factor analysis is the extraction of common values through principal component analysis and principal factor analysis, in which the Kaiser criterion is needed to eigenvalues than one. But in order to have a better interpretation of the values, a rotation is carried out, in this case an orthogonal rotation called Varimax.

Once the rotation is done, the so-called factor loadings matrix is altered to improve the interpretation, determining that these are values close to -1, 0, 1 compared to the unrotated matrix, thus finding which variables are strongly associated and with which factors.

The result of this stage is manifested in a graph which distinguishes the grouping factors.

The first factor contains the strongly associated questions 9,1,8,3,2,5, the second factor contains 6,7,14,4,10, the third factor contains 12,13 and 11 is eliminated because of its very low rotation value.

Initially five categories are considered and with respect to them the questions were developed that allow to determine if the daily life of a person is being affected by a behaviour: Prevalence, Abstinence, Tolerance, Relapse, Conflict. López, et. al, (2020), AMP (American Psychiatric Association) (2013).

**Box 3****Table 2**

## Categorization of Factors

QUESTION	CATEGORY	FACTOR
1. do you find it difficult to stop using the Internet when you are online?	Conflict	1
2. do you continue to use the Internet despite your intention to stop?	Preponderance	1
3. do others (e.g., partner, children, parents) say you should use the Internet less?	Tolerance	1
4. do you prefer to use the Internet instead of spending time with others (e.g., partner, 0.67 0.64 0.66 children, parents)	Conflict	2
5. are you short of sleep because of the Internet	Preponderance	1
6. do you think about the Internet, even when not online	Conflict	2
7. do you look forward to your next Internet session?	Setback	2
8. do you think you should use the Internet less often?	Setback	1
9. have you unsuccessfully tried to spend less time on the Internet?	Abstinence	1
10. do you rush through your (home) work in order to go on the Internet?	Setback	2
11. do you neglect your daily obligations (work, school, or family life) because you prefer to go on the Internet?	Conflict	3
12. do you go on the Internet when you are feeling down?	Preponderance	3
13. do you use the Internet to escape from your sorrows or get relief from negative feelings?	Preponderance	3
14. do you feel restless, frustrated, or irritated when you cannot use the Internet?	Abstinence	2

It can be seen in table 2 that the behavioural categories of the population are conflict, relapse and prevalence. The categories were defined systematically by the process (AFE) in which question 11 is included.

Prevalence, Abstinence, Tolerance, Relapse, Conflict ( Lopez, et. al, 2020; AMP American Psychiatric Association, 2013 ), are considered as a set of concepts that are fundamental to understand various aspects of human behaviour and the psychological challenges that people may face throughout their lives.

In the analysis carried out it can be observed that preponderance, conflict and relapse are the elements that appear in order of importance, thus preponderance refers to superiority of a factor or tendency over others, in the case of psychology it can be considered that it is the predominant thought in a person in decision making, or its corresponding style to cope with stress, as in the case of a person with anxiety by the use of the internet the preponderance of their thoughts will be in terms of anxiety to interpret and respond to environmental stimuli to define their daily activities.

In the case of conflict occurs when an individual is faced with two opposing forces that generate tension or stress internally or externally between groups, internally is the desire to use the internet, but knows that it is necessary to use and manage time to perform their school activities in the case of a student, which in many cases can generate conflict by disagreement to perform group tasks or joint activities for not having the necessary time.

It can be considered that an adequate management of this type of conflict is necessary, as poor management can lead to chronic stress, mental health problems and deterioration of interpersonal relationships.

Another factor that appeared in the factor analysis was relapse, which can be considered to be the characterisation of an addictive conflict after a period of abstinence, common in an addiction recovery process and is triggered by stress, pressure from society, or being subjected to exposure to stimuli associated with addictive behaviour, making it necessary to find strategies and treatments to improve behaviour and enhance the likelihood of long-term success.

Factor analysis is recognised as an important tool for addiction research, particularly in the case of the internet, as it allows complex behaviour to be broken down into more manageable and understandable factors, thus facilitating assessment, intervention and understanding of its underlying dimensions, as well as its impact on mental health.

**Authors' contribution**

*Ortiz y Ojeda, Pedro Tomás:* Contributed to the development of the idea, its analysis and the writing of the article.

*Ortiz-Sánchez, Pedro Alfonso Guadalupe:* Contributed to the questionnaire and the processing of the information, drafting and writing of the article.

*Sanchez-Iturbe, Patricia Guadalupe:* Contributing to the generation, drafting and application of the questionnaire, its analysis and the writing of the article.

*Basave-Torres, Rosy Ilda:* Contributed to the management of the submission process.

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