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Validation of Mental Fatigue Scale Questionnaire in High School Students by Delphi Process

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Abstract

In current study, validation of the Mental Fatigue Scale (MFS) for high school students, examining its reliability and content validity. Mental fatigue significantly impacts students' cognitive, emotional, and physical well-being, affecting attention, motivation, and even school attendance. Using the Delphi method, a panel of experts revised the MFS to ensure relevance for adolescents. After administering the modified scale to 110 students, analysis showed strong content validity (CVR = 0.81) and acceptable internal consistency (Cronbach's alpha = 0.78). This research confirms MFS as a suitable tool for assessing mental fatigue in high school students, with recommendations for future studies on larger, more diverse samples.

Keywords: *MFS (Mental Fatigue Scale), CVR (Content Validity Ratio).*

Introduction

Mental fatigue is a significant concern among high school students and potentially affects their academic performance, overall well-being, and future prospects. The Mental Fatigue Scale (MFS) is a widely used instrument for assessing mental fatigue in various populations, including adults and clinical samples. However, its validity and applicability to high school students have not yet been thoroughly established.[1] This study aimed to validate and adapt the MFS for use in high school students using the Delphi method, a structured approach to gathering expert consensus.

Fatigue is a complex phenomenon with wide-ranging effects on cognitive, psychomotor, and emotional states. It may manifest as either physical or mental fatigue. Physical fatigue typically arises from repetitive muscle activity and results in physical weakness.[2] Mental fatigue, however, is a psychobiological response to extended periods of demanding cognitive activity. Mental fatigue affects individuals on multiple levels: subjectively, it is characterized by increased feelings of tiredness, reduced energy, and decreased motivation; behaviorally, it leads to a decline in cognitive task performance; and physiologically, changes in brain activity are often observed.[3] It is important to note that mental fatigue does not always require changes in all three areas to be identified.

Mental fatigue significantly impacts daily life. Even with adequate rest, it can impair attention, working memory, and motor control, leading to challenges in maintaining optimal job performance and an increased risk of errors.[4] Research has linked mental fatigue to psychiatric issues such as stress, anxiety, burnout, and depression. Health care professionals, particularly those working in hospital settings, are often subjected to high physical and mental demands, which heighten fatigue and

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stress, ultimately affecting their attention, memory, and overall performance.[5]

Methods

Ethical approval for this study was obtained from the AJIRB (Institutional Ethical Review Board, Amar Jyoti Institute of Physiotherapy). As per best practice in conducting Delphi studies a steering committee was first formed to guide the Delphi process.

Mental Fatigue Scale

Developed by Johansson et al. in 2010 and adapted from Rödholm et al, the Mental Fatigue Scale consists of 15 items, with the first 14 items used for evaluation. These items address various symptoms, including cognitive, emotional, and sensory aspects, sleep duration, and daily fluctuations in symptom severity. Specifically, the scale assesses general fatigue, lack of initiative, mental fatigue, mental recovery, concentration issues, memory problems, slowed thinking, stress sensitivity, emotional lability, irritability, and sensitivity to light and noise, as well as changes in sleep patterns. Each item has four descriptive ratings (0–3), allowing respondents to score based on their experiences over the past month, with 0 indicating "no problem" and 3 indicating "serious problems." Intermediate options like 0.5, 1.5, and 2.5 are available for nuanced scoring. Summing the scores from the 14 items provides a total score, where a higher score reflects a greater level of mental fatigue. The 15th item evaluates symptom variability over 24 hours, with options indicating no change, clear fluctuations, or persistent issues. Respondents can also specify the times of day they feel best and worst. The scale has a Cronbach's alpha of 0.944.

Delphi Participants: The steering committee comprised 5 members: (1) a community medicine doctor, (2) two psychologist (3) a physiotherapist with experience in Delphi methodology, and (4) a paediatrician. Experts will be selected based on their academic qualifications, research experience, and practical knowledge of working with adolescents in an educational setting.

Procedure

Delphi Round 1

In the first round of the questionnaire was given to each member of Panel. Every panellist, independent to other panellist responded to each item in the questionnaire for clarity (clear or lacks clarity) and essentiality (essential or useful but not essential or not necessary).The" not necessary items" were removed and " useful but not essential " very modified as per the suggestion of the panellist while "essential items" were retained.

Delphi Round 2

In second round revised questionnaire, containing the essential item and modified non-essential items was revaluated by the expert for essentiality and clarity to yield the final modified questionnaire.

Pilot Survey

Following the Delphi rounds, the revised MFS was administered to a sample of 110 high school from diverse background and academic levels. This pilot survey assessed the following:

1. Comprehension of Items: Students will be asked to provide feedback on unclear or ambiguous questions.
2. Time required to complete the questionnaire: The average completion time was recorded to ensure that the survey was not overly burdensome.
3. Any difficulties encountered during completion: Students will be encouraged to report any challenges they face while answering questions.
4. Relevance and applicability: Students were asked to rate how well the questionnaire captured their experiences of mental fatigue in the school context.
5. Format preferences: Feedback on the questionnaire's layout, response options, and potential for online administration was collected.

Data Analysis

Data Collected from pilot survey will undergo rigorous statistical analyses. The content validity was calculated according to the Lawshe Method. As per this method, CVR (Content Validity Ratio) is calculated for every item in the questionnaire as follows;-

CVR = (Ne- N/2)/ (N/2)

Ne- Number of panellist indicating an item as essential

N- the total number of panellists.

Only those items with CVR of 0.60 of value were retained and CVI was calculated as per the following formula:

CVI = CVR/N

CVR = Content validity ratio

N = No of total Questions

For establishing internal consistence:

The validated questionnaire was administered in 110 high school adolescent students aged 13-18 years and IC of

the modified questionnaire was calculated using cronbach alpha.

$\alpha = k/k\text{-}1[1-\sum s_i^2/S_t^2]$

where, α is Cronbach's alpha, k is number of items, s_i^2 is the variance of the ith item and s_T^2 is the variance of the total score formed by summing all the items.

Result

The initial draft of the questionnaire contained 15 questions, out of which 1 is changed or 1 removed.

Table 1: Expert opinion data on validation of original questionnaire

Item	A	B	C	D	E	TOTAL	CVR
Q.1	1	1	1	1	1	5	1
Q.2	1	1	0	1	0	3	0.2
Q.3	1	1	0	1	0	5	1
Q.4	0	1	0	0	1	2	-0.2
Q.5	1	1	1	1	1	5	1
Q.6	1	1	1	1	1	5	1
Q.7	0	1	1	1	0	3	0.2
Q.8	0	1	0	1	0	2	-0.2
Q.9	1	1	1	1	1	5	1
Q.10	0	0	1	1	1	3	0.2
Q.11	1	1	1	1	1	5	1
Q.12	0	1	1	1	0	3	0.2
Q.13	1	1	1	1	1	5	1
Q.14	1	1	1	1	1	5	1
Q.15	1	1	0	1	0	3	0.2

Table 2: Item-wise CVR values in modified questionnaire

Item	A	B	C	D	E	TOTAL	CVR
Q.1	1	1	1	1	1	5	1
Q.2	1	1	0	1	0	3	0.2
Q.3	1	1	1	1	1	5	1
Q.4	0	1	1	0	0	2	-0.2
Q.5	1	1	1	1	1	5	1
Q.6	1	1	1	1	1	5	1
Q.7	1	1	1	1	1	5	1
Q.8	1	1	1	1	1	5	1
Q.9	1	1	1	1	1	5	1
Q.10	0	0	1	1	1	3	0.2
Q.11	1	1	1	1	1	5	1
Q.12	1	1	1	1	1	5	1
Q.13	1	1	1	1	1	5	1
Q.14	1	1	1	1	1	5	1
Q.15	1	1	1	1	1	5	1

CVI = 0.81

Results

Validity and Reliability Findings

A total of 110 participants were recruited by convenience sampling to participate in the reliability test. The Cronbach's alpha was found to be 0.78.

The validation study of the scale for assessing mental fatigue in high school students showed strong content validity, with a Content Validity Ratio (CVR) of 0.81, reflecting substantial expert consensus on item relevance. The scale also demonstrated good internal consistency, with a Cronbach's alpha of 0.78, indicating that the items reliably measure mental fatigue in this population. These findings support the scale's suitability and reliability for evaluating mental fatigue levels among high school students.

Discussion

Mental fatigue is a critical issue that can contribute to various physical, psychological, and social challenges in high school students, such as decreased attention, burnout, lack of motivation, and even school dropout. Both internal and external factors—such as biological and personality traits, thoughts, experiences, and academic workloads—can influence the mental fatigue experienced by students. Despite these factors impacting levels of mental fatigue, no comprehensive tool currently exists to assess this condition specifically in high school students. Therefore, this study aimed to evaluate the Indian validity and reliability of the Mental Fatigue Scale for high school population. The study included a total of 110 high school students. According to existing literature, it is recommended that the sample size for factor analysis in scale validation studies be at least 5–10 times the number of items in the scale. To meet these criteria, a minimum of 10 participants per item was included for the 14 items assessed in this study.

Conclusion

The developed questionnaire has an acceptable validity and moderate internal consistency to assess validity of mental fatigue in high school going students and it is an effective tool that can be used to examine mental

fatigue of different age group of high school population, for research requirement or for assessing mental fatigue.

Future Research

In future research, larger sample size and stratified sampling in terms of socio economic strata with randomization are suggested for more generalizable results. This study can be replicated across larger population in every state across India. Intervention studies can also be done for assessing the effectiveness of MFS for assessing mental fatigue of other population. Similarly, community health education programs through innovative, short culturally related printed material, focused digital, and social media campaigns may be developed for increasing awareness about mental fatigue.

Conflict of Interest: No conflict of interest.

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Ethical Clearance: Ethical approval for this study was obtained from the AJIRB (Institutional Ethical Review Board, Amar Jyoti Institute of Physiotherapy). Ethical approval number- AJIRB-EC/09/2024.

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