# INTED 2021

15th International Technology, Education and Development Conference

8-9 March, 2021

# CONFERENCE PROCEEDINGS

*Sharing the Passion for Learning*

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# THE RELATIONSHIP BETWEEN MOTIVATION AND PERFORMANCE OF UNIVERSITY STUDENTS

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## Abstract

Different variables affect the performance of university students. Motivation is one of them, so teachers try to enhance it through their teaching methodologies. However, most of the studies focused on the influence of motivation come from a single experimental situation, so extrinsic variables such as the specific design of the classroom could be affecting it simultaneously. Therefore, although there are reasons to consider that higher motivation helps to increase cognitive performance, the quantification of this relationship is not clear. This was the aim of the present study: to evaluate the relationship of motivation in students' cognitive performance in different design situations, so that the design effect is diluted. For this purpose, a field study was conducted. 100 university students carried out cognitive performance tests in two very different real classrooms, after which they were asked about their motivation. The quantification of performance focused on memory (remembering an auditory list of words, similar to the experiments based on the DRM paradigm) and attention (reaction time to auditory stimuli, similar to the auditory and continuous performance experiments). The quantification of motivation was done through the Spanish version of the EMSI scale, making it possible to discern between intrinsic motivation, external regulation, identified regulation, and amotivation. The results show that there are very strong relationships between motivation and performance in attention and memory; especially in attention. Results may be of interest for educators and for researchers.

Keywords: University students, motivation, attention, memory.

## 1 INTRODUCTION

The concept of motivation refers to the motive and interest for which each subject performs their actions. It is a hypothetical construct that, far from being an observable variable, is inferred from the manifestations of behaviour [1]. For years, specialists have focused on the study of motivations. Most of them have agreed in stating that the importance of this complex motivational psychological process is its explanatory and predictive power of human behaviour in various contexts. This difficulty of direct observation means that there are different ways to quantify it. Most research is based on self-administered questionnaires [2] [3] [4]. In any case, its measurement depends on the motivational theory on which it is based. So, to understand it, it is necessary to start from a series of terms and principles on which the best-known theories have been based.

The main theories agree that it is a multifactorial construct. The theory of achievement motivation linked to the subject's desire to overcome challenges with completing demanding tasks [5]. Elsewhere, attribution theory relates motivational sentiment with the attribution that is made of a result [6]. For his part, Bandura [7] relates the degree of motivation to the judgments that each individual makes of his own abilities, it's the theory of self-efficacy. These and other models denote the intense evolution that the concept of motivation has had throughout history.

There are studies that have analysed the relationship of motivation with two variables: memory (ability to store, withholding and retrieve information) and attention (ability to generate, select, direct and maintain an appropriate level of activation to process relevant information). Although each of these variables are two cognitive processes closely related [8] [9] and difficult to delimit each other.

Much of the research has focused on studying the relationship between motivation and memory, collecting high levels of motivation as well as high levels of memory. This has even been studied in disciplines such as robotics [10], among others, and with different types of population such as psychotics [11] and autism [12], in addition to the general population. It is clear that it is a topic that arouses a lot of interest.

On the other hand, there are many more studies on the positive correlation between motivation and attention. For example, motivation as a reward influences the improvement of distraction control [13].

This predominance of the theme may be due to the appearance of numerous cases of Attention deficit hyperactivity disorder (ADHD) in which the attention span is severely affected. Furthermore, neuronal structures associated with memory such as the hippocampal formation are difficult to access for the measurement of their activity. This is due to their deep location in the limbic system. In contrast, there are more studies that measure attention with neuroimaging techniques [14] [15].

Motivation, however, must be contextualized. As observed, it is a concept used in different areas and depending on the internal characteristics of the person himself and the environment in which he is found. Academic motivation has been widely studied from basic levels of training to university studies, because it a control of motivation levels can modulate these and other cognitive processes essential for learning [16]. But, in academic practice, it is common to understand academic motivation as the actions that teachers take to motivate students. Motivation is often confused with the art of stimulation. This does not allow to reason that the motivation is the interest that students have for their own learning or for the activities that lead to it.

Motivation has been related to memory in numerous investigations. Focusing on the educational field, the improvement of a motivational impression and memory in school students correlate with the application of an interactive digital whiteboard during classes [17]. In general, all the results have replicated these data, obtaining that different ways of modulating motivation imply high scores in memory recall when there is a high degree of motivation. Coherently, there have been more false memories when motivation has been low.

In the same way, high motivation implies high levels of sustained and divided attention regardless of the paradigm used for its evaluation. To implement an audience response system (ARS) may help students maintain attention and stay motivated to learn [18]. In this way, it is also possible to change the levels of attention when implementing actions focused on motivation.

Most of the studies published in the academic field, focus on knowing how to modulate the levels of motivation in students so that it influences the cognitive processes that take place in the classroom, but without specifying too much in how the physical characteristics of these contexts influence in the improvement of these cognitive processes. Although it has been widely studied that the characteristics of the context where we are, influences internal processes such as the state of mind [19], still it remains to be seen whether there is any effect of classroom design on the relationships between these variables. In this context, the objective of this work is to evaluate the relationship of motivation in students' cognitive performance in different design situations, so that the design effect is diluted.

## 2 METHODOLOGY

To address the objective, a field work in real context was developed. The participants performed psychological tasks focused on quantifying the performance of memory and attention and completed a motivation questionnaire.

### 2.1 Participants

100 subjects participated in the study. The sample was gender-balanced (50 women and 50 men) and the average age was 23,36 ($\sigma$ = 3,06). The inclusion criteria for this work were: (1) to be a University student; and (2) have Spanish nationality, to avoid the cultural factor influencing the measurement of motivation [20].

### 2.2 Classroom

Two real classrooms were used as stimuli. Both presented different physical characteristics in order to eliminate the effect that the classroom design can produce on the relationship of the variables (memory, attention, and motivation). Specifically, “classroom 1" is located in the Higher Technical School of Construction Engineering (ETSIE), and it measures 16.50 x 8.80 meters. The "Classroom 2" is located in the Higher Technical School of Architecture, and it measures 7.50 x 5.90 meters. Both are located at the Polytechnic University of Valencia. These classrooms were chosen because they have a great difference in size (figure 1), at the same time that they have other differentiating characteristics; for example, in terms of orientation, furniture, exterior views, etc.

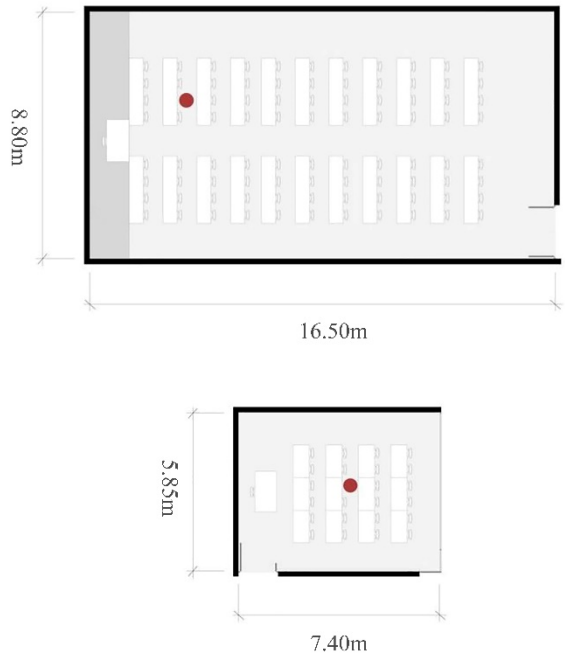


*Figure 1. Plant of classroom (Classroom 1, above; Classroom 2, below). The red point indicates the location of the participant.*

## 2.3 Psychological record

The psychological tasks were focused on quantify memory and attention performances. In addition, situational motivation was also measured.

### *2.3.1 Situational Motivation Scale*

The validation of Spanish version of the Situational Motivation Scale (SIMS) for the assessment of situational motivation in education was used. It has 16 items and assesses the dimensions of intrinsic motivation, identified regulation, external regulation and amotivation in a specific situation (Table 1). It is rated on a Likert-type scale, ranging from 1 (does not correspond at all) to 7 (corresponds exactly), with an intermediate score of 4 (corresponds moderately) [4].

*Table 1. Grouping of items for each dimension. Own translation for exhibition purposes*

| ***Intrinsic motivation*** | ***Identified regulation*** | ***External regulation*** | ***Amotivation*** |
|---|---|---|---|
| 1. Because I think this activity is interesting | 2. For my own good | 3. Because i'm supposed to do it | 4. There may be good reasons for doing this activity, but and I don't see any |
| 5. Because I enjoy this activity | 6. Because I think this activity is good for me | 7. Because it's something I have to do | 8. I do this activity, but I'm not sure if it's worth it |
| 9. Because this activity is fun | 10. By personal decision | 11. Because I have no other alternative | 12. I don't know. I don't see what this activity brings me |
| 13. Because I feel good doing this activity | 14. Because I think this activity is interesting for me | 15. Because I think I have to | 16. I do this activity, but I'm not sure it's appropriate to continue it. |

### *2.3.2 Memory task*

A task similar to the DRM paradigm tests was used to measure the psychological memory [21]. It consisted of remembering 45 words, grouped into 3 lists of 15 words each, presented audibly. The subject had 30 seconds to listen to each word list uninterruptedly. The number of words remembered was taken as a quantification of memory.

### *2.3.3 Attention task.*

A task similar to the continuous auditory performance tests [22] was used to measure the psychological attention. It consisted on reacting as soon as possible to specific auditory stimuli (24 objectives) and to avoid others (96 distractors). All these stimuli presented audibly and were shown randomly, with a minimum of 800ms and a maximum of 1600ms. The reaction time was taken as the quantification of attention.

## 2.4 Data processing.

Following the above, the database was collected. Once it was anonymised, the statistical analyses were carried out. IBM SPSS (v.16.0) was used for this purpose.

# 3 RESULTS

The purpose was to analyse the correlation between the variable that collect motivation and the two variables focused on quantifying attention (reaction time) and memory (correct answers). The statistical treatment for this analysis depended on the normality of the data for each variable. Kolmogorov-Smirnov (K-S) test were used to examine the normality of data. The data corresponding to the attention and the memory performance follow a non-normal distribution (K-S test, $p < 0.05$), so Spearman rank-order correlation (non-parametric test) is used. Since no significant differences were found between the two classrooms, the data was collapsed. The results are organized in the following sections: (3.1) Correlation between motivation and attention; and (3.2) correlation between motivation and memory.

## 3.1 Correlation between motivation and attention

There are 4 items of the SIMS that correlate positively with attention (item 3 “Because i’m supposed to must do it”, $p = 0.005$; item 7 “because it's something I have to do”, $p = 0.019$; iterm 10 “by personal decision”, $p = 0.000$; and item 15 “because I think I have to”, $p = 0.028$). Items 3, 7 and 15 belong to dimension external regulation. However, item 10 (dimension identified regulation) obtained a very strong relationship with the prediction of high attentional levels. These 4 different dimensions have a significant impact on the performance of care, generating the best results. However, one of them also correlated with memory scores with greater significance (Table 2).

## 3.2 Correlation between motivation and memory

Different items have a significant impact on memory (item 4 “There may be good reasons for doing this activity, but and I don't see any”, $p = 0.034$; item 7 “because it's something I have to do”, $p= 0.016$; item 14 “because I think this activity is interesting for me”, $p=0.017$) and has no impact on reaction time of the attention task. But each one belongs to a dimension: amotivation, external regulation and identified regulation, respectively. So, although all of them (item14 highlights) also predicted a high level of memory, the correlation was not as remarkable as with the attention data (Table 2).

*Table 2. Correlations by Spearman’s rank-order.*
*The numbering of the items follows the one indicated in Table 1.*

| | | ***Attention Performance*** | ***Memory Performance*** |
|---|---|---|---|
| Motivation_1 | Correlation coefficient | ,055 | ,165 |
| | Sig. (2-tailed) | ,692 | ,220 |
| Motivation_2 | Correlation coefficient | ,253 | -,116 |
| | Sig. (2-tailed) | ,065 | ,390 |
| Motivation_3 | Correlation coefficient | ,377** | ,105 |
| | Sig. (2-tailed) | ,005 | ,438 |
| Motivation_4 | Correlation coefficient | ,119 | ,281* |
| | Sig. (2-tailed) | ,390 | ,034 |
| Motivation_5 | Correlation coefficient | ,091 | -,035 |
| | Sig. (2-tailed) | ,511 | ,797 |

| | | | |
|---|---|---|---|
| Motivation_6 | Correlation coefficient<br>Sig. (2-tailed) | -,013<br>,928 | ,183<br>,173 |
| Motivation_7 | Correlation coefficient<br>Sig. (2-tailed) | ,319*<br>,019 | ,317*<br>,016 |
| Motivation_8 | Correlation coefficient<br>Sig. (2-tailed) | ,183<br>,185 | ,237<br>,076 |
| Motivation_9 | Correlation coefficient<br>Sig. (2-tailed) | -,220<br>,110 | ,009<br>,948 |
| Motivation_10 | Correlation coefficient<br>Sig. (2-tailed) | -,771**<br>,000 | ,143<br>,287 |
| Motivation_11 | Correlation coefficient<br>Sig. (2-tailed) | ,059<br>,671 | ,048<br>,724 |
| Motivation_12 | Correlation coefficient<br>Sig. (2-tailed) | -,130<br>,349 | ,019<br>,888 |
| Motivation_13 | Correlation coefficient<br>Sig. (2-tailed) | ,004<br>,976 | ,085<br>,531 |
| Motivation_14 | Correlation coefficient<br>Sig. (2-tailed) | ,018<br>,898 | ,351**<br>,007 |
| Motivation_15 | Correlation coefficient<br>Sig. (2-tailed) | ,299*<br>,028 | ,183<br>,173 |
| Motivation_16 | Correlation coefficient<br>Sig. (2-tailed) | -,117<br>,401 | ,092<br>,495 |

## 4 CONCLUSIONS

The analyses indicate that the level of motivation affects memory and attention. In general, it seems that these two variables do not depend on different spatial attributes in this experimental set. Although, there are some very different patterns of the classroom (such as light entry and furniture), it seems that identified regulation (related to items 7 y 14) maintains a stronger relationship with attention and memory. This implies that the effect of the physic context may be diluted. Since both motivational items affect basic cognitive functions of learning, they can be of great help for the design and development of a class session. Knowing the motivation of students towards a certain task predicts their levels of attention and memory. This allows the teacher to adapt her teaching methodology. The results are of interest to all professionals related to teaching, from school to university. These results can be applied to any teaching practice.

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