PAPER

The Effect of Group Size on Students' Cognitive and Behavioral Engagement

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ABSTRACT

The size of the group is an important subject to discuss, especially in light of the challenges that appear with the trend toward large institutions with large student bodies in higher education, including the quality of student integration and the quality requirements that higher education must meet in light of the high qualifications demanded by the world of employment. In this study, we examine the effect of learning-group size on students' cognitive and behavioral engagement. In a quantitative approach, a questionnaire survey is used to collect data from 234 students at the Hassan II University in Casablanca. The purpose of this research is to demonstrate the influence of group size on students' cognitive and behavioral engagement. The participants were separated into 140 students in large groups and 94 small groups. A questionnaire measured the impact of group size on participants' cognitive and behavioral engagement and had a Cronbach's alpha value of 0.9. According to the study's findings, group size should be taken into account because it affects most factors related to cognitive and behavioral engagement. To increase student involvement and boost their academic achievement, it is advised that more empirical research should be done in order to develop pedagogical strategies to control this difference much better.

KEYWORDS

behavioral engagement, cognitive engagement, Moroccan universities, group size

1   INTRODUCTION

During the last decade, large-group teaching has become a reality in all Moroccan universities, due to a lack of teachers on the one hand and the explosion of student numbers within the university on the other hand. According to statistics from the Ministry of National Education and Vocational Training and Higher Education and Scientific Research, the number of new students enrolled at Moroccan universities increased from 157,677 students in 2011/2012 to 257,782 students in the 2019/2020 academic year. As a result, small-group teaching has become something of a fantasy nowadays.

As a result, more research has addressed the notion of large groups, making it an important topic for discussion and study because of its impact not only on student engagement but also on teachers' teaching practices.

We identify the difficulties associated with teaching large groups and formulate the research problem that emerges. The concepts of *large group*, *cognitive engagement* and *behavioral engagement* are then defined, before identifying the research objectives. The methodology is presented, followed by an overview of the results and then the interpretations. In conclusion, we identify some suggestions and proposals to alleviate and overcome the problems produced in large-group teaching.

2 PROBLEM STATEMENT

In Morocco, as in many countries, teaching in large groups is still a widespread reality in universities, which are undergoing radical changes in their educational system. The educational system in Moroccan faculties is changing from teaching that transposes simple knowledge to that centered on a student acquiring skills and know-how; in other words, teaching that aims to involve students in the construction of their knowledge and the development of their skills. The Faculty of Sciences Ben M'Sick is also confronted with this situation of large numbers of students, or "massification," in their amphitheaters and heterogeneity of students who have neither the same background nor the same knowledge. However, the faculty has to be able to manage these large classes well and ensure that students are engaged and involved in the teaching-learning process. Most importantly, to be actively involved, students need to engage in such higher-order thinking tasks as analysis, synthesis, and evaluation [1]. But to what extent is large-group teaching an influential factor in learning, making the student passive and only superficially engaged in the construction of knowledge? What is the influence of class size on the cognitive and behavioral engagement of students of the Faculty of Sciences Ben M'Sick (FSBM)?

3 CONCEPTUAL FRAMEWORK

The first part of our study is the definition of a large group at the graduate level in order to present the main theme of our research [2]. In the second part, we discuss the definition of students' cognitive engagement and then behavioral engagement.

3.1 Definition of large groups in higher education

The growth in student numbers over the last ten to fifteen years in some countries has been a challenge for university teachers. This growth is offset by the emergence of so-called large-group classes, but is the large-group question only a question of numbers?

The definition of *large group* varies from one author to another and is based on two approaches: qualitative and quantitative.

From a quantitative approach, Anzieu [3] defined a large group according to its size and noted that from 25 to 50 people is a large group and that beyond 50 people is an assembly. In addition, Ève-Marie Lavoie and Nicole Monney [4] cited two examples of what a large group is in their article entitled "Guide for large group teaching.": the definition of De Paoli [5], who considers a large class to be 130 students, and Mulryan-Kyne [6], who considers a large group to be between 300 and 1000 students.

From a qualitative perspective, the notion of the large group is defined by several authors, including Dah [48], who consider that the number of students can be an obstacle to communication and interaction between the teacher and the student in a teaching-learning situation, and according to Bernatchez and Weiss-Lambrou [7] there are other variables. Besides the number of students, factors that need to be taken into account for a group to be considered large include the age of the students, their level of education, and the teaching conditions. Baker and Westrup [8] state that the number of students alone cannot determine whether class is large; more relevant is if the teacher finds that there are too many students for them all to progress [8].

According to Biggs [9], it is laborious to specify exactly what a large group is in the teaching context [6]. Therefore, the definition of the large group remains very subjective and even relative, as it depends on a plurality of related factors [10], so it is important to discuss the different parameters and not to choose only one or simply count the number of students present in the classroom or lecture hall [11].

In conclusion, the notion of a large group class is not a purely quantitative issue. However, it depends on several variables such as the teaching context, the perception of teachers, the age of the students and their learning and progression rates. A group may be considered large when the teacher has to modify his/her usual teaching method because of the total number of students [2]. Thus, in this article, we consider a large group to be a considerable number of students learning in the same classroom or lecture hall.

3.2 School engagement

Student engagement is one of the most talked about topics in education. It is the subject of several research and study projects. Indeed, it is widely known as a powerful influence on learning and success in university education. According to Bédard [12], commitment is the ability to invest time and effort over the duration of the training program, while Parent [13] defines engagement as the initiation of action and active participation. Connell and James [14] consider engagement to be understood as the initiation of action, the amount, of effort and the quality of consistency when faced with academic tasks.

Behavioral versus cognitive engagement. Many researchers have tried to define three dimensions of school engagement: behavioral, cognitive, and affective [14]–[17]. In this article, we limit our discussion to the behavioral and cognitive aspects of school engagement.

As an example, Gerard and Rubio [18] reported that Prégent [19] consider engagement along two dimensions—cognitive engagement and behavioral engagement—by linking it to student conduct, such as perseverance, class participation, punctuality, and involvement in learning situations. Cognitive engagement is the intellectual

work put into learning by the student [20]–[22] and is shown by concentration, attention, and learning strategies [18].

Cognitive engagement is a topic of concern to many teachers and stakeholders in the Moroccan educational field, and it represents a daily challenge for the teachers of the Ben M'Sick faculty, who constantly search to develop ways to cognitively and behaviorally engage their students in learning, especially as there are studies that show that in higher education the culture of disengagement is very abundant among students and a significant proportion show academic disengagement [23], [24]. Other research shows that students' study behaviors have a real impact on their learning [25].

3.3   Cognitive engagement

According to Greene and Miller [26], cognitive engagement is defined from two angles of information processing, called *surface* or *deep*. Students' cognitive engagement in surface learning is the intentional use of basic cognitive actions, such as rote learning and mechanical repetition without understanding the content to be learned [27] or mastering the material [28]. For deep learning, it is determined by the use of complex cognitive functions [29].

Cognitive engagement is the decision to engage in lessons, the intensity of that engagement, and the persistence in the task [30], It is the student's responsibility for the success of his studies, his personal investment, and the effort he puts into his work [31]. Cognitive engagement is the initiation of action, the amount of effort, and the quality of persistence in the face of academic tasks.

Strategies for cognitive engagement. A number of studies have addressed cognitive engagement from different dimensions and are concerned with self-regulated or strategic learning, as cognitive engagement addresses not only the effort the student puts into tasks or work but also the importance of the student's ability to use cognitive and metacognitive strategies to learn effectively [32].

Pintrich and Schrauben [33] have shown that cognitive engagement consists of the knowledge of learning strategies and the use of self-regulation strategies. They also showed that the adoption of these strategies can be influenced by the controllability of a task, the student's perceptions of their competence, and the value of an activity [31].

According to Corno and Mandinach [34], cognitive engagement refers to the quantity and quality of effort put into learning by the student. They distinguish four types of strategies or forms of engagement: metacognitive strategies, strategies for managing resources in a learning situation, strategies for acquiring knowledge (cognitive), and strategies for performing tasks. Cognitive engagement is the knowledge and use of these strategies in different learning situations, the decision to engage, the intensity of that engagement and the persistence in the task, and the use of learning strategies.

3.4   Behavioral engagement

Behavioral engagement has been the subject of several academic studies and research. According to Heilporn et al. [35], The behavioral dimension of student engagement refers to their participation in activities as well as following rules

or norms. It is their degree of concentration and attention in class, perseverance, contribution to discussions, and asking questions that determine their behavioral engagement. It also refers to observable signs of engagement and is associated with the amount of visible effort involvement.

According to Parent [13], behavioral engagement is also called "socio-relational engagement" and is recognized in a student by the fact that he or she asks questions of both teacher and colleagues. He/she will tend to be proactive, explaining course material to other students and seeking feedback on his/her academic activities from teachers, peers, or those outside the classroom.

The dimension of behavioral engagement is expressed mainly through three axes: disciplinary conduct, involvement in tasks and learning, and participation in school activities [36]. It refers to the observable way in which students act in the school environment [37].

Based on the definitions presented above, we define school engagement as a voluntary choice of active and intensive engagement, but also as active participation in school and extracurricular learning activities. School engagement is a multifaceted process.

4 RESEARCH OBJECTIVES AND HYPOTHESES

Our research is related with studies that attempt to identify factors that influence students' cognitive and behavioral engagement in higher education.

Previous work has identified a number of factors that can influence student academic engagement, with the daily input of teachers to students having a significant impact on academic progress [38]. A study supporting teacher-student relationships conducted by [11] claimed that among adolescents, warm relationships with teachers would act as a protective factor on motivation and academic performance. Therefore, teachers surely have an important influence on students' academic engagement.

Other studies have shown that the school environment can influence students' academic engagement and affect their quality of school life. A negative educational climate and lack of leadership from the principal can be detrimental to student success and engagement [11], [39], whereas a healthy school environment can promote student engagement and perseverance [40].

Our present research attempts to conduct a comparative analysis of the influence of class size on student academic engagement at Ben M'Sick faculty. We seek to compare the learning adherence of undergraduate students who study in lecture halls (large group classes) with their Master's peers, who study in classes of smaller size; in other words, we seek to highlight the relationship between class size and student academic engagement based on the cognitive and behavioral dimensions of the latter.

The influence of class size on school performance, achievement, and engagement has been the subject of a considerable amount of academic research and study. Drawing on some of this research, we hypothesize the following:

H1: Group size influences the behavioral engagement of higher-education students.
H2: Group size influences the cognitive engagement of higher-education students.

5   METHODS

5.1   Sampling

Our sample consisted of 234 students from the Faculty of Science at Ben M'Sick, divided into 94 students enrolled in the first and second year of the master's program and 140 students enrolled in the bachelor's program in the branches of physics, math, and chemistry.

5.2   Data-collection system

The research design includes a written questionnaire administered to students of the Faculty of Science in Ben M'Sick.

We opted for a quantitative approach, which consisted of collecting a lot of factual information. The questionnaire allowed us to interview a larger number of individuals, this method also allowed for the collection of data from several sources. Out of 280 questionnaires distributed, only 234 students responded to our survey.

We were inspired by known commitment scales, such as that of Parent [41] used in his doctoral thesis. He developed his own student-engagement scale in behavioral, emotional, and cognitive dimensions, and the scale of student engagement in higher education [42]. We developed a new student-engagement questionnaire based on different scales reported in the scientific literature. Our questionnaire consists of 29 items, including 28 Likert items ranging from 1 (always) to 5 (never) and one item in the form of a closed question (check box) that presents the independent variable of our search (large group or small group). These items are divided into two distinct sub-scales: "cognitive engagement" and "behavioral engagement."

The first subscale of our questionnaire consists of 17 items for the measurement of cognitive engagement of students, while the second is made up of 11 items for the measurement of cognitive engagement in general. All these items were measured in relation to the size of the class—large group or small group—in order to verify the influence of group size on these two types of engagement: cognitive and behavioral.

The measure of internal consistency between the items in the first part of our questionnaire shows that there is a strong association between them, as well as the items in the second part, with good internal consistency indices (Cronbach's α of 0.899 and 0.922, respectively, for items that measure cognitive engagement and those that measure behavioral engagement) (Table 1).

Table 1. Reliability statistics

Variables	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	Number of Items
Cognitive engagement	.899	.904	17
Behavioral engagement	.922	.922	11

6   RESULTS

We used the Mann-Whitney U test to answer the research hypotheses. Table 2 shows how group size influences cognitive engagement, while Table 3 shows how it influences behavioral engagement.

Table 2. Cognitive engagement test

Items	Size of Group	N	Mean Rank	Sum of Ranks	Mann-Whitney U	P
I wonder if my methods are effective	large group	140	132.64	18,569.00	4461.00	0.000
	small group	94	94.96	8926.00		
	Total	234				
I ask myself if my academic results match my expectations	large group	140	128.33	17,966.50	5063.500	0.002
	small group	94	101.37	9528.50		
	Total	234				
I ask myself what causes my successes and failures	large group	140	137.04	19,185.50	3844.500	0.00
	small group	94	88.40	8309.50		
	Total	234				
I ask myself if I have achieved the goals I set	large group	140	142.59	19,963.00	3067.000	0.00
	small group	94	80.13	7532.00		
	Total	234				
When I finish an assignment, I check my mistakes	large group	140	129.72	18,161.00	4869.000	0.001
	small group	94	99.30	9334.00		
	Total	234				
I ask myself if I am up to date with my work and studies	large group	140	136.18	19,064.50	3965.500	0.00
	small group	94	89.69	8430.50		
	Total	234				
I make sure I understand what I am studying	large group	140	144.85	20,279.00	2751.00	0.00
	small group	94	76.77	7216.00		
	Total	234				
I try to define a strategy before I start my homework or study	large group	140	138.89	19,444.00	3586.00	0.00
	small group	94	85.65	8051.00		
	Total	234				
I am committed to the tasks in my lessons	large group	140	136.69	19,136.00	3894.00	0.00
	small group	94	88.93	8359.00		
	Total	234				
I mentally organise different information from the course in an order that makes sense to me	large group	140	145.21	20,329.00	2701.00	0.00
	small group	94	76.23	7166.00		
	Total	234				
I mentally connect the new knowledge I am learning with the knowledge I already have	large group	140	141.28	19,778.50	3251.500	0.00
	small group	94	82.09	7716.50		
	Total	234				

(Continued)

Table 2. Cognitive engagement test *(Continued)*

Items	Size of Group	N	Mean Rank	Sum of Ranks	Mann-Whitney U	P
If I have difficulty with an assignment, I persevere until I understand it	large group	140	132.59	18,562.50	4467.500	0.00
	small group	94	95.03	8932.50		
	Total	234				
I learn certain rules by heart by repeating them several times	large group	140	136.48	19,106.50	3923.500	0.00
	small group	94	89.24	8388.50		
	Total	234				
I spend more time on lessons and homework	large group	140	132.09	18,492.50	4537.500	0.00
	small group	94	95.77	9002.50		
	Total	234				
I am so involved in my lessons that I forget everything else around me	large group	140	137.67	19,273.50	3756.500	0.00
	small group	94	87.46	8221.50		
	Total	234				
I want to learn as much as I can in class	large group	140	130.87	18,322.00	4708.000	0.00
	small group	94	97.59	9173.00		
	Total	234				
When I am in class, I only pretend to work	large group	140	92.38	12,933.50	3063.500	0.00
	small group	94	154.91	14561.50		
	Total	234				

The influence of group size on cognitive engagement was tested using the Mann-Whitney U Test. Based on the findings presented in Table 1, the size of the group had a considerable influence on cognitive engagement where it relates to the following items: I wonder if my methods are effective [Mann-Whitney U=4461.00; P=0.000<0.05], I ask myself if my academic results match my expectations [Mann-Whitney U=5063.500; P=0.002<0.05], I ask myself what causes my successes and failures [Mann-Whitney U=3844.500; P=0.00<0.05], I ask myself if I have achieved the goals I set [Mann-Whitney U=3067.000; P=0.000<0.05], when I finish an assignment, I check my mistakes [Mann-Whitney U=4869.000; P=0.001<0.05], I ask myself if I am up to date with my work and studies [Mann-Whitney U=3965.500; P=0.000<0.05], I make sure I understand what I am studying [Mann-Whitney U=2751.00; P=0.000<0.05], I try to define a strategy before I start my homework or study [Mann-Whitney U=3586.00; P=0.000<0.05], I am committed to the tasks in my lessons [Mann-Whitney U=3894.00; P=0.000<0.05], I mentally organise different information from the course in an order that makes sense to me [Mann-Whitney U=2701.00; P=0.000<0.05], I mentally connect the new knowledge I am learning with the knowledge I already have [Mann-Whitney U=3251.500; P=0.000<0.05], if I have difficulty with an assignment, I persevere until I understand it [Mann-Whitney U=4467.500; P=0.000<0.05], I learn certain rules by heart by repeating them several times [Mann-Whitney=3923.500; P=0.000<0.05], I spend more time on lessons and homework [Mann-Whitney U=4537.500; P=0.000<0.05], I am so involved in my lessons that I forget everything else around me

[Mann-Whitney U=3756.500; P=0.000<0.05], I want to learn as much as I can in class [Mann-Whitney U=4708.000; P=0.000<0.05], when I am in class I only pretend to work [Mann-Whitney U=3063.500; P=0.000<0.05].

Table 3. Behavioral engagement test

Items	Size of the Group	N	Mean	Sum of Ranks	Mann-Whitney U	P
I talk to other students about the course	large group	140	131.85	18459.50	4570.500	0.00
	small group	94	96.12	9035.50		
	Total	234				
I give explanations and help to other students to understand the course	large group	140	134.35	18809.00	4221.00	0.00
	small group	94	92.40	8686.00		
	Total	234				
I feel that my point of view is taken into consideration by other students	large group	140	132.36	18530.00	4500.00	0.00
	small group	94	95.37	8965.00		
	Total	234				
I feel connected to the group of students in the course	large group	140	130.82	18315.00	4715.00	0.00
	small group	94	97.66	9180.00		
	Total	234				
I interact with and receive feedback from my teachers	large group	140	125.59	17582.00	5448.00	0.00
	small group	94	105.46	9913.00		
	Total	234				
I ask teachers for explanations about the course and assessment	large group	140	131.93	18470.00	4560.00	0.00
	small group	94	96.01	9025.00		
	Total	234				
I discuss the course content with my teachers after class	large group	140	139.51	19531.50	3498.500	0.00
	small group	94	84.72	7963.50		
	Total	234				
I look forward to participating in a group discussion in class	large group	140	132.75	18585.00	4445.00	0.00
	small group	94	94.79	8910.00		
	Total	234				
I dare to ask questions in front of the group	large group	140	126.63	17728.00	5302.00	0.009
	small group	94	103.90	9767.00		
	Total	234				
I raise my hand to answer questions in class	large group	140	125.17	17524.00	5506.00	0.00
	small group	94	106.07	9971.00		
	Total	234				
I feel excited about class work	large group	140	127.68	17875.00	5155.000	0.004
	small group	94	102.34	9620.00		
	Total	234				

The Mann-Whitney U Test was used to test the effect of group size on behavioral engagement. According to the data shown in Table 2, the size of the group had a significant impact on behavioral engagement in the following items: I talk to other students about the course [Mann-Whitney U=4570.500; P=0.000<0.05], I give explanations and help to other students to understand the course [Mann-Whitney U=4221.00; P=0.000<0.05], I feel that my point of view is taken into consideration by other students [Mann-Whitney U=4500.00; P=0.000<0.05], I feel connected to the group of students in the course [Mann-Whitney U=4715.00; P=0.000<0.05], I interact with and receive feedback from my teachers [Mann-Whitney U=5448.00; P=0.000<0.05], I ask teachers for explanations about the course and assessment [Mann-Whitney U=4560,00; P=0.000<0.05], I discuss the course content with my teachers after the course [Mann-Whitney U=3498.500; P=0.000<0.05], I look forward to participating in a group discussion in class [U de Mann-Whitney=4445.00; P=0.000<0.05], I dare to ask questions in front of the group [Mann-Whitney=5302.00; P=0.009<0.05], I raise my hand to answer questions in class [Mann-Whitney U=5506,00; P=0.000<0.05], I feel excited about class work [Mann-Whitney U=5155,000; P=0.004<0.05].

7 DISCUSSION

This research aims to investigate the influence of class size on students' cognitive and behavioral engagement in a university context. The previously mentioned results of this study in Table 1 (items to test cognitive engagement) and Table 2 (items to test behavioral engagement), showed that the P-value is less than 0.001 for the majority of the items and less than $\alpha=0.05$ for the other items. This proves that the results were highly significant and that the two hypotheses stated in Section 4 are confirmed and that there is an influence of large-group teaching on the cognitive and behavioral commitments of university students. This confirms what several authors have said about the concepts of class size (large group/small group), cognitive engagement, and behavioral engagement. More than that, the benefit of the large group is on the list of motives influencing students' cognitive and behavioral engagement in a university context. Based on a review of a dozen papers on the influence of large groups on learning, Cuseo [43] finds that the "massification" of students requires teachers to adopt the lecture as a teaching strategy. This teaching practice has become widespread and dominant in large groups of students, leading to cognitive passivity, little or no interaction with the teacher and peers, and a lack of feedback on learning, resulting in lower success rates. Furthermore, large-group teaching leads to surface learning and does not engage students in their studies, which is confirmed by the present study [44]. Most importantly, other studies [43], [45] have found that "large class teaching reduces student motivation as well as the development of cognitive skills in the classroom," which supports our findings.

Behavioral engagement is one of the easiest facets of engagement to observe and measure and includes compliance with academic requirements and participation in aspects of school life. For others, this dimension manifests itself more in behavior towards the social environment, i.e., relationships with peers as well as with teachers [41], and as our study shows in Table 2, we found that P<$\alpha=0.05$ for all items measuring behavioral engagement, Therefore, it is strongly evident that class size has a considerable influence on students' behavioral engagement and that students in the small group engage behaviorally in their learning in contrast to those in the large group.

Other researchers [46] consider that the teacher-student relationship and interaction remain a primary cause of student behavioral engagement. In the same sense, Klem and Connell [47] write that the student engages in his schooling when he feels supported by the teacher. As noted, behavioral engagement is defined in the literature in terms of participation, effort, attention, persistence, positive behavior and absence of disruptive behavior. According to the results of our research, there is a behavioral engagement on the part of the student, designated by their participative and interactional behavior with teachers and peers in small classes but not in large ones, which confirms our hypothesis.

8   CONCLUSION

In this research, we used a quantitative study to highlight the relationship between the size of the teaching group and students' behavioral and cognitive engagement after conducting an exploratory validation of various scales in our questionnaire. Specifically, we tested the influence of group size on cognitive and behavioral engagement. Our main results showed that there is an influence of group size on cognitive and behavioral engagement of university students and that students in the small group are more behaviorally and cognitively engaged in their learning than those in the large group.

Other studies have addressed the topic of student engagement in large groups and have come to conclusions similar to our results, pointing out that the risk of this teaching modality is that the student remains too passive and only superficially engaged in cognitive activities [49].

Based on the results obtained in this study, we are able to make a judgment on the question of this research, which was "What is the influence of class size on the cognitive and behavioral engagement of FSBM students?" The answer is that teaching in a large class size disengages students and makes them more passive and only superficially engaged in cognitive activities.

9   METHODOLOGICAL STRENGTHS AND LIMITATIONS OF THE RESEARCH

The strong point of this study is that it can help teachers to determine one of the causes of disengagement of their students in order to seek solutions to overcome this problem and limit its consequences on the students' performance.

As a limitation of this study, we can mention that the generalization of the results of this study is not really valid for all Moroccan faculties; it is mainly the students of the Faculty of Sciences Ben M'Sick who were questioned. Therefore we cannot project these results one hundred percent on the other faculties.

10   RECOMMENDATIONS AND FUTURE RESEARCH

The results of our research lead us to suggest a few avenues and recommendations for engaging students and making them key players in their learning in a large group context.

It would be advisable for the teacher to:

- Present the objectives at the beginning of each class session to allow the student to be situated in the course and to anticipate the content;
- Include questions in lecture presentations to prompt students to reflect, validate their understanding, and remain attentive;
- Energize his/her lecture by alternating different teaching strategies;

As a first idea for future research related to this study, it might be interesting to train teachers to master facilitation techniques in large classes. Also, the integration of information and communication technologies for education (ICTE) in teaching and assessment may contribute to the increase of student engagement in large groups, which will be the subject of our next academic research.

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