

Class participation and feedback: a bet on the winning horse?

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Abstract

In an educational environment focused on student learning, class participation and feedback are key to improving students' performance. Class participation grading methods are often unclear and subjective, so providing feedback on class participation grades is challenging for lecturers. The Work-In-Class Assessment Tool (WICAT) we designed enables instructors not only to grade class participation clearly and objectively but also to provide students with weekly feedback on this class participation grades. This paper aims to analyze the effect of WICAT class participation grades and weekly feedback on students' final exam performance. We conducted an experiment with 699 accounting students over the 2016-2019 period. Our results show that students whose class participation grade was obtained through WICAT performed better on the final exam. Furthermore, our results suggest that a student assessed by WICAT was 2.28 times less likely to fail the final exam. However, the weekly feedback that WICAT allowed seemed not to affect students' performance. These results have important implications for curriculum designers and teaching staff on how to design course syllabuses and where to focus in-class efforts.

Keywords: Accounting Education; Class Participation; Experiment; Feedback; Student Performance.

1. Introduction

Since the European Higher Education Area (EHEA) was adopted, all stakeholders (communities, professional bodies, industries, employers, regulators, and students) have witnessed a shift towards more continuous assessment that has led to a diversification of evaluation tools (Macfarlane, 2016). Traditionally used as the only assessment task, the final exam is now combined with more complex assessment systems, including coursework assessment. This combination leads to higher grades than exams alone and appears to be preferred by students (Richardson, 2015). Within the concept of coursework, class participation has become a common requirement of many university courses (Xu & Qiu, 2020).

The classic conception of class participation, limited to verbal interactions, has been overtaken by a much broader view, including anything that causes students to be more involved in active learning forms (Orwat et al., 2017). Class participation is a multidimensional concept that comprises many aspects that suggest evidence of student engagement, such as preparation prior to class (Dancer & Kamvounias, 2005; Hard & RaoShah, 2021), attendance (Dancer & Kamvounias, 2005; Fritschner, 2000; Hard & RaoShah, 2021), contribution to class activities and discussions (Dallimore et al., 2010; Dancer & Kamvounias, 2005; Fritschner, 2000; Xu & Qiu, 2020) and frequent small tasks (Tang et al., 2020; Thomlinson et al., 2010). Past research shows that these activities lead to personal and professional growth in students (Jones, 2008), result in a better understanding and retention of the material (Precourt & Gainor, 2019), enable students to demonstrate a broader range of skills (Richardson, 2015) and improve students' performance (Papageorgiou, 2019; Paisey & Paisey, 2004; Precourt & Gainor, 2019). Grading class participation is one of the most popular techniques instructors use to encourage it, as students prioritize graded components in their coursework (Rocca, 2010). Most college courses include class participation as a component of the course assessment in higher education (Lynch & Hennessy, 2015).

Highly connected with students' assessment and class participation is the role played by feedback, which can be defined as "information provided by an agent (e.g., teacher, peer, book, parent, self, [or] experience) regarding aspects of one's performance or understanding" (Hattie & Timperley, 2007, p. 81). Once class participation is graded, this grade should be communicated to students to take appropriate corrective actions (Macfarlane, 2016), as is done with any other graded component of the assessment, such as midterms or final exams. Furthermore, because the assessment occurs throughout the course and not on a single date, this feedback should be given frequently enough so students can take corrective actions in a timely fashion. Instructors should offer feedback on class participation at multiple points to help their students understand what they are doing wrong and how they can improve (Hard & RaoShah, 2021). When class participation grades are issued at the end of the course, students discover too late that their performance is unsatisfactory and have no corrective options (Dancer & Kamvounias, 2005).

Although effective feedback is a critical strategy in education (Evans, 2013; Hattie & Timperley, 2007), grading class participation and giving effective feedback to students on it can be complex tasks for instructors. First, participation grading methods are subjective by nature (Precourt & Gainor, 2019), with grading criteria often unclear and difficult to define (Heyman & Sailors, 2011). This ambiguity in standards leads to a lack of transparency in the process of grading class participation (Xu & Qiu, 2020), which can lead to the use of class participation as a 'fudge factor' to justify an increase in students' final grades (Bean & Peterson, 1998). Second, giving feedback on unclear or subjective actions is challenging for lecturers. A growing concern in higher education regards the effectiveness and purpose served by feedback (Robinson et al., 2013). Although students demand timely (Marriot & Lau, 2008), constant and regular feedback (Watty et al., 2013), they usually complain about receiving grades too late or even never, which does not allow them to make corrections. The lack of frequent feedback concerns students, especially regarding class participation (Rowe & Wood, 2008; Bouilheres, 2015), and requires consideration since prompt feedback could enhance students' weekly engagement (Thomlinson et al., 2010).

Few studies have used a system to measure participation throughout the course in tandem with immediate feedback on that grade and a measurement of the effect of both the system and the feedback on students' final performance. The few that do have certain limitations, particularly in that the system assesses only one component of class participation (e.g., Dancer & Kamvounias, 2005). Meanwhile, class participation is widely known as a multidimensional concept. Another limitation is that the class participation grading system used is qualitative in nature, without instructions about how to combine the different concepts in an overall class participation mark (e.g., Precourt & Gainor, 2019; Tang et al., 2020), which hinders the analysis of class participation's impact on student's final performance. Limitations regarding feedback on class participation consist mainly of giving this feedback only at the end of the course (e.g., Dancer & Kamvounias, 2005). However, even the studies in which feedback on class participation performance is given weekly (e.g., Tang et al., 2020) fail to isolate its effect on students' performance.

Within accounting courses, the first and, as far as we know, the only empirical research about class participation and its effects on exam performance is Precourt and Gainor (2019). In a previous study, they developed a quantified participation method to determine participation grades based on the frequency and consistency of participation as well as attendance (Gainor & Precourt, 2017). Precourt and Gainor (2019) found a strong positive relationship between in-class participation and exam grades. However, the authors acknowledged that their system was to a certain extent subjective since it depended mainly on students' self-assessments of their class participation. Additionally, the authors did not analyze the effect of the feedback on this grade on the students' performance.

In this study, we intend to solve two problems currently present in higher education: first, the lack of a clear, objective, and fair system to assess class participation, which, second, inevitably entails the impossibility of giving frequent feedback to students about their daily classwork in the course. Based on the previous literature, we designed a Work-In-Class Assessment Tool (WICAT) considering several items that can be used to measure students' engagement: attendance (Dancer & Kamvounias, 2005; Fritschner, 2000), contribution to class activities, and discussion (Dallimore et al., 2010; Xu & Qiu, 2020) and frequent small tasks (Tang et al., 2020). Each item is scored using a point system that allows instructors to obtain a weekly participation grade for each student in a clear, objective, and fairway. Doing so facilitates the transparency of the process and offers the ability to give weekly feedback to students on their class participation grades.

The purpose of this article is twofold: first, we analyze whether the application of a clear, objective and fair Work-In-Class Assessment Tool (WICAT) that considers the multidimensional aspect of class participation positively affects student performance. Second, we analyze whether giving weekly feedback on class participation performance leads to better student performance than merely providing feedback about this grade at the end of the course.

At a private, medium-sized university in Spain, we studied the effect of applying the WICAT and giving weekly feedback by conducting an experiment with 699 undergraduate accounting students over four academic years (2016-2019). The participants were randomly assigned into three groups: the control group and one of two experimental groups. In the control group, no WICAT was applied; thus, no weekly feedback was delivered to the students about their class participation grades. In Experimental Group 1, we applied the WICAT but without weekly feedback about the class participation grades, giving information about these grades only at the end of the course. Finally, in Experimental Group 2, we applied the WICAT along with weekly feedback on class participation grades. The results showed that the WICAT had a clear positive and significant effect on the students' final exam grades. The students assessed by the WICAT scored in the final exam, on average, one point (over ten) more than the students not assessed by the WICAT. Furthermore, our results suggest that a student assessed by the WICAT was 2.28 times more likely to fail the final exam than was a student who was not assessed by the tool. However, providing weekly feedback did not seem to have a significant effect on students' final exam grades.

This study contributes to the existing accounting education literature in several ways. We introduce a clear, objective, and fair assessment tool to measure class participation, a problem that has been debated in higher education for decades. This assessment tool can be applied not only in accounting but also to a wide spectrum of disciplines in which attendance, daily work, and students' commitment are crucial to achieving the required learning outcomes. We provide to the accounting education literature an improved class participation grading tool that has positive effects on students' performance while adding an analysis of how weekly feedback on class participation grades can impact students' ultimate performance.

2. Literature review and hypothesis development

2.1. Class participation and performance

Class participation may be defined in its broadest form as student engagement in material across all modalities of instruction (Orwat et al., 2018). It is an active engagement process (Dancer & Kamvounias, 2005) considered essential to learning development by both faculty and students (Fritschner, 2000). As a multidimensional concept, it encompasses all aspects that suggest evidence of student engagement, from attendance to lectures to all kinds of contributions to class activities that can encourage students to learn on an ongoing basis and lead to improvements in their performance (Precourt & Gainor, 2019; Tang et al., 2020; Xu & Qiu, 2020).

Lecture attendance reflects students' course engagement level and is critical to student success (Moore et al., 2019). Attendance generally enhances the learning process through direct interaction with instructors and peers and is considered an important predictor of a student's academic performance (Al Hazaa et al., 2021). Several studies have investigated the relationship between attendance in lectures and student performance, and while some studies have reported a moderate effect (Clark et al., 2011; Sund & Bignoux, 2018), others have clearly identified a strong positive link (Al-Shammari, 2016; Nyatanga & Mukorera, 2019). Some have even shown that when students attend lectures more frequently, they obtain greater benefits from attending (Chen & Lin, 2008). The results in accounting education have also shown that lecture attendance has a significant influence on students' overall performance at the undergraduate level (Alagiah et al., 2001; Paisey & Paisey, 2004). Although early studies found a low and not very meaningful relationship (Schmulian & Coetzee, 2011), recent research has suggested that attending lectures is critical in accounting for student performance (Matsoso & Iwu, 2017; Papageorgiou, 2019).

Nevertheless, 'attendance *per se* does not ensure that learning takes place' (Rodgers, 2002: 265). Whether students attend class may not be as important as how they attend to class in terms of class engagement (Büchle, 2021). This aspect is especially relevant in accounting education, where a focus on technical details often leads students to perceive accounting as a difficult and boring subject (Geiger & Ogilby, 2000) and diminishes their interests in its further study (Park et al., 2019). Efforts are needed to increase student interest and class engagement, as studies have shown that when students participate more actively in-class activities, their learning in accounting is more effective (Dallimore et al., 2010; Park et al., 2019) and that class participation is positively and significantly associated with the final grade (Pérez-López & Ibarrondo-Dávila, 2019; Precourt & Gainor, 2019).

Therefore, students' contribution to class activities should be encouraged with more opportunities for students to participate offered by instructors (Hard & RaoShah, 2021). Frequent small tasks promote engagement and can help students keep up with the material delivered (Thomlinson et al., 2010). Studies have shown that intense weekly participation grading schemes can increase participation and overall course grades (Tang et al., 2020).

Considering all of this evidence, a class participation grading system based on attendance and students' contribution to class activities, with frequent small tasks that encourage students to learn on an ongoing basis, could be positively linked to their academic performance. However, the challenge is not simply to design a class participation system that considers all these dimensions but also to establish a clear and objective grading system through which a fair participation grade can be obtained for all students. This task does not seem easy, especially considering that participation-rating methods have traditionally been subjective in nature (Precourt & Gainor, 2019), with unclear and difficult-to-define rating criteria (Heyman & Sailors, 2011) and characterized by a lack of transparency (Xu & Qiu, 2020).

We designed a system to measure class participation that considers all these issues: the WICAT assesses the three aforementioned dimensions (attendance, contribution to class, and frequent small tasks), establishing a point system to evaluate each dimension in a clear, objective, and fairway. The system is clear in the sense that it is explained in depth to students on the very first day of class. It is objective in that each evaluable concept is assigned a certain number of points to add or subtract, leaving no room for the teacher's subjectivity. It is fair in that it applies equally to all students. We predict that, under these conditions, the WICAT may be positively related to student performance. Thus, our first hypothesis can be stated as follows:

Hypothesis 1: Class participation performance measured by the WICAT positively affects students' exam grades.

2.2. Feedback from class participation and performance

Class participation encourages students to learn on an ongoing basis (Trotter, 2006), enables the provision of feedback to students on their learning (Isaksson, 2007), and helps students decide what to pay attention to (Gibbs & Lucas, 1997). Studies in other disciplines have shown that class participation can support student learning through feedback and increase students' motivation for learning (Hernández, 2012); furthermore, students can achieve substantially higher marks (Prowse et al., 2007; Tawafak et al., 2019). Instructors should offer feedback on class participation at multiple points to help their students understand what they are doing well and how they can improve (Hard & RaoShah, 2021). Several studies have shown that formative feedback on class participation midway through the semester and summative feedback at the end of the course have a significant impact on students' grades (Dancer & Kamvounias, 2005) and that students who experience more intense weekly participation grading schemes have significantly higher participation rates and overall course grades (Tang et al., 2020).

However, despite this relevance, the accounting discipline lacks frequent feedback (Dean et al., 2020; Hart & Wang, 2016; Watty et al., 2013), especially regarding class participation (Bouilheres, 2015; Rowe & Wood, 2008). Providing timely feedback about class participation acquires greater relevance in subjects such as accounting, which can be considered scaffolded subjects, in which the internalization of new information should be built on prior knowledge (Azih & Nwosu, 2011).

In the accounting discipline, a wide range of studies demonstrate an improvement in student performance due to the regular and immediate feedback provided on a specific task. These studies use simple (Eining, 2013; Massoudi et al., 2017; Stuart, 2004) or more sophisticated tools to provide feedback (Marriot & Teoh, 2012; Perera et al., 2014; Shoulders & Hicks, 2008). Despite the difference in the feedback tools used, all studies agree on the importance of prompt and timely feedback on student performance: feedback features that allow the student to value their knowledge correcting the most limited aspects of their learning in the future. When feedback is returned faster and clearer to students, its effect on learning is stronger (Narasimhan, 2001).

However, none of these studies provided feedback on students' class participation and therefore on the different concepts included within it: this is the main contribution of this research. We developed an individual, iterative, and weekly feedback system for students' class participation grades, provided periodically throughout the whole term. We think, as many other authors have highlighted in other disciplines (e.g., Dancer & Kamvounias, 2005; Prowse et al., 2007; Tawafak et al., 2019), that this feedback type could impact students' final exam performance. Therefore, our second hypothesis is stated as follows:

Hypothesis 2: Weekly feedback on class participation performance positively affects students' exam grades.

3. Materials and Methods

3.1. Work in Class Assessment Tool (WICAT) and feedback system

In Spain, Introduction to Accounting and Financial Accounting are subjects usually taught in the first and second years, respectively, of the Degree in Business Administration program. At our university, each of these two subjects is taught for one semester (14 weeks), with two face-to-face sessions of two hours per week and two additional hours of voluntary tutoring upon the students' request. Approximately 50 students were enrolled in both courses.

Although the contents differed, both subjects followed the same assessment model,

$$FG = 60\% FE + 30\% MT + 10\% CP \quad [1]$$

where the final exam (FE) represents 60% of the final grade (FG), while the midterm (MT) and class participation (CP) account for 30% and 10%, respectively. The mandatory nature of class participation (10%) is intended to motivate the student to prepare for classes, but it is weighted so as not to cause discomfort among them towards the requirement to participate (Gainor & Precourt, 2017).

Traditionally, the instructors have had no homogeneous criterion for assessing class participation. Our university's accounting instructors tracked class participation by noting which students attended class, answered questions, or completed exercises regularly, focussing only on the number of the interventions, the accuracy of the responses, and those students who stood out from their peers in regards to their consistency. This subjective method of assessing class participation also entails a high risk of "losing" those students who are more shy or insecure. No clear, objective and fair tool measured students' class participation, so clear feedback could not be given on their performance on a day-to-day basis. Unfortunately, this lack of transparency in the class participation grading process led to this grade being sometimes used as a 'fudge factor' (Bean & Peterson, 1998) to justify an increase in students' final grades.

To solve this lack of clarity, objectivity, and fairness, accounting instructors developed, based on the previous literature, the WICAT. The WICAT is a multidimensional system that allows accounting instructors to track students' participation in each class period. On the first day of class, the WICAT rules and point system were fully explained to the students, so they knew exactly what their instructors expected and how they would be assessed. At the start of the course, students had 50 of 100 points, so they all started with a "pass" (i.e., 50 over 100, or 5 over 10, is the cut-off value for a pass), and they could improve or worsen their grade by adding or subtracting points based on their performance along the different class participation dimensions assessed. The number of points to add or subtract for each dimension was discussed by the instructors based on their teaching experience and long careers in higher education until a consensus was reached. Details of the WICAT design are shown in Table 1.

Table 1. WICAT design

| Dimension | Concept | Detail | Tracked points |
|----------------------------------|---|--|---|
| Attendance and active listening | Attendance | In each class session, students' full signatures were required to track who did and did not attend class. | Each absence: subtract 3 points |
| | Active listening | Two "calls to order" per student were tolerated. The use of mobile devices or laptops for purposes not related to the class was forbidden. | Third "call to order": subtract 20 points Misuse of devices: subtract 30 points |
| Contribution to class activities | Voluntary individual interventions | Voluntary individual interventions in which students either corrected exercises and problems or answered questions posed by the instructor. | Perfectly solved: add 15 points Minor errors: add 10 points Major errors corrected by student: add 5 points Major errors corrected by instructor: add 0 points |
| | Individual interventions assigned by instructor | In the absence of voluntary individual interventions, it was the instructor who assigned the correction of the exercise to a specific student | Perfectly solved: add 10 points Minor errors: add 5 points Major errors corrected by student: add 0 points Major errors corrected by instructor: subtract 5 points |
| Small frequent tasks | Short tests and small assignments | Short tests at the end of each topic through Google Forms or small assignments submitted either individually or in a group setting were carried out. They were taken by almost all students, and not only were they graded upon completion, but their correctness was also assessed. The test and problem solutions were discussed in class. At the end of the semester, each student had approximately 10 small-task marks. | The average of these 10 tasks represented a 0-10 point increase in students' grades assessed by the WICAT. Thus, an average of 5 indicated that the student's score increased by 5 points, and an average of 10 meant the student's score increased by 10 points. |

At the end of the semester, class participation could reach up to 100 points, and some students could even exceed it, but we transformed this mark to base-10. With this system, unmotivated students with poor performance in the class had only test and homework marks, so at the end of the semester, their score assessed by the WICAT would rarely be above 5 of 10 points. Motivated and high-performance students could improve their score assessed by the WICAT to 9 or even 10 of 10 points by working hard in class. To achieve this high grade, they needed at least 5-6 interventions during the semester and to perform well on the regular tests.

Thus, the smooth functioning of the WICAT and its fairness depend largely on the coordination between the accounting instructors. To guarantee fairness and coherence among the groups, the accounting instructors teaching these courses coordinated strongly, with frequent meetings and discussions about the different components of class participation. The instructors lecturing the courses had similar teaching styles, taught the same content in each subject, used the same class materials, and offered the same opportunities for active participation in all groups. The midterm and final exams were also coordinated for all groups and designed for objective correction.

Ensuring student participation opportunities for nearly 60 students in each class is quite difficult. However, each class period had many opportunities for students to participate: answering cold calls, asking additional questions, answering questions, and correcting exercises in a group setting with classmates.

The WICAT is designed to be a multidimensional tool that allows instructors to obtain a weekly class participation grade and to provide students with individual, iterative, and weekly feedback. With this feedback, students may judge their academic performance's evolution throughout the course and take the required measures to improve the learning process.

This feedback is contained in a spreadsheet uploaded in Moodlerooms. Students (individually) can see every week (weekly) how many points they accumulated each day (iteratively). Thus, the WICAT feedback provides a class participation grade in a detailed, integrated, and weighted way. In addition to the class participation grades, this spreadsheet contains the midterm grades, which allows students to perform simulations with hypothetical final exam scores to obtain hypothetical final grades. Appendix 1 shows examples of how this feedback system works.

3.2. Participants and intervention

We conducted an experiment with 699 undergraduate accounting students at a private, medium-sized university in Spain during the period 2016-2019. The students were randomly assigned into three groups: the control group and one of two experimental groups. In the control group, no WICAT was applied; thus, no weekly feedback was delivered to the students about their class participation grades (NO WICAT). In Experimental Group 1, we applied the WICAT but without weekly feedback about class participation grades. Instead, information about these grades was given only at the end of the course, called last-day feedback (WICAT LDF). Finally, in Experimental Group 2, we applied the WICAT with iterative, individual, and weekly feedback about the class participation grades (WICAT WF). The experiment has the approval of the Ethics Committee and all participants provided informed written consent to participate in the experiment.

Table 2 shows the characteristics of the 3 groups considered, including their grades on the university entrance exam (EvAU) and their gender.

Table 2: Basic statistics of the participants included in the experiment

| | # Students | Subject | | % Female | EvAU: mean (sd) | Final exam: mean (sd) |
|------------------|------------|-------------|----------------|----------|-----------------|-----------------------|
| | | Intro. Acc. | Financial Acc. | | | |
| No WICAT | 331 | 233 | 98 | 40.8% | 8.2(1.0) | 5.7(2.1) |
| WICAT | 368 | 204 | 164 | 48.1% | 8.6(0.8) | 7.1(2.0) |
| <i>WICAT LDF</i> | 182 | 101 | 81 | 45.6% | 8.5(0.9) | 7.0(2.2) |
| <i>WICAT WF</i> | 186 | 103 | 83 | 50.5% | 8.7(0.7) | 7.2(1.8) |

4. Procedure and results

4.1. Part 1: Crude analysis

First, a crude analysis of the data was carried out to compare the three groups (NO WICAT, WICAT WF, and WICAT LDF). The Kruskal–Wallis test was applied to the three groups, equivalent to an ANOVA in those cases where the normality assumption is violated.

The Kruskal–Wallis test showed statistically significant differences between the final exam grades in the three groups (NO WICAT, WICAT LDF, and WICAT WF), obtaining a contrast statistic of 71.89 (p -value = $2.45E-16$). A medium effect size was detected ($\eta^2[H] = 0.10$). To examine this difference, a post hoc analysis was developed using Wilcoxon's test with Bonferroni correction (Table 3 and Figure 1). The boxplots in Figure 1 represent the first (lower horizontal line), median (inner horizontal line), and third quartiles (upper horizontal line). The points represent outliers. In this case, the effect size of NO WICAT vs. WICAT LDF was moderate ($\eta^2[H] = 0.08$), as was that of NO WICAT vs. WICAT WF ($\eta^2[H] = 0.11$). Therefore, the control group, in which no WICAT was applied, and both experimental groups, in which the WICAT was applied exhibited significant differences. However, when only the two experimental groups (WICAT LDF; WICAT WF) were compared, no differences were exhibited regardless of the frequency in providing feedback.

Table 3: Post-hoc analysis using Wilcoxon's test with Bonferroni correction.

| Group 1 | Group 2 | n1 | n2 | $\eta^2[H]$ | Statistic | p-value |
|-----------|-----------|-----|-----|-------------|-----------|----------|
| No WICAT | WICAT LDF | 331 | 182 | 0.08 | 19658 | 0.000*** |
| No WICAT | WICAT WF | 331 | 186 | 0.11 | 18680 | 0.000*** |
| WICAT LDF | WICAT WF | 182 | 186 | -0.003 | 16750 | 1 |

Figure 1: Post hoc analysis using Wilcoxon's test with Bonferroni correction.

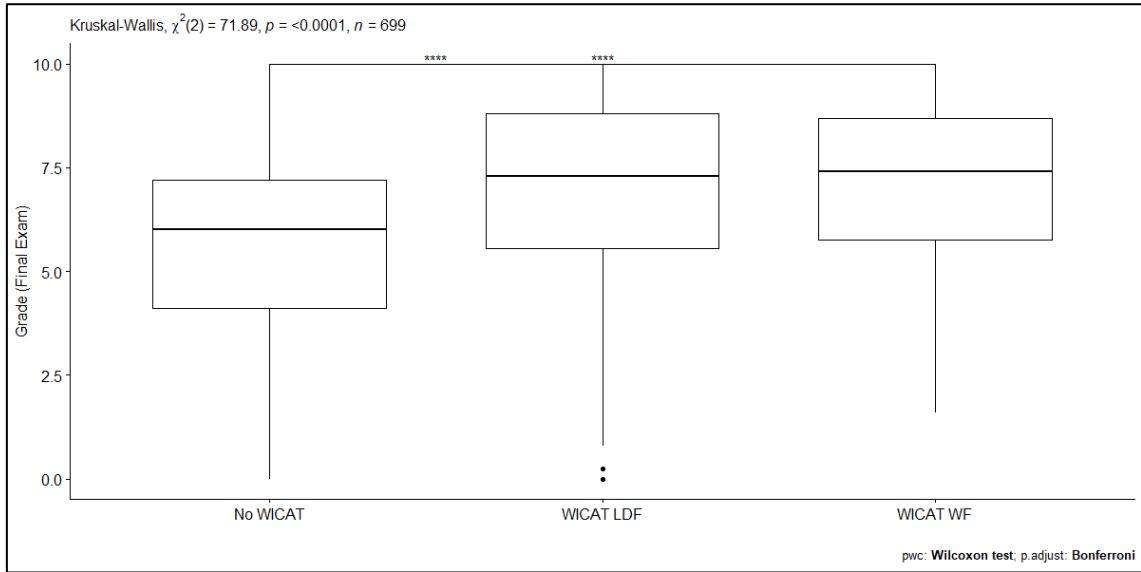
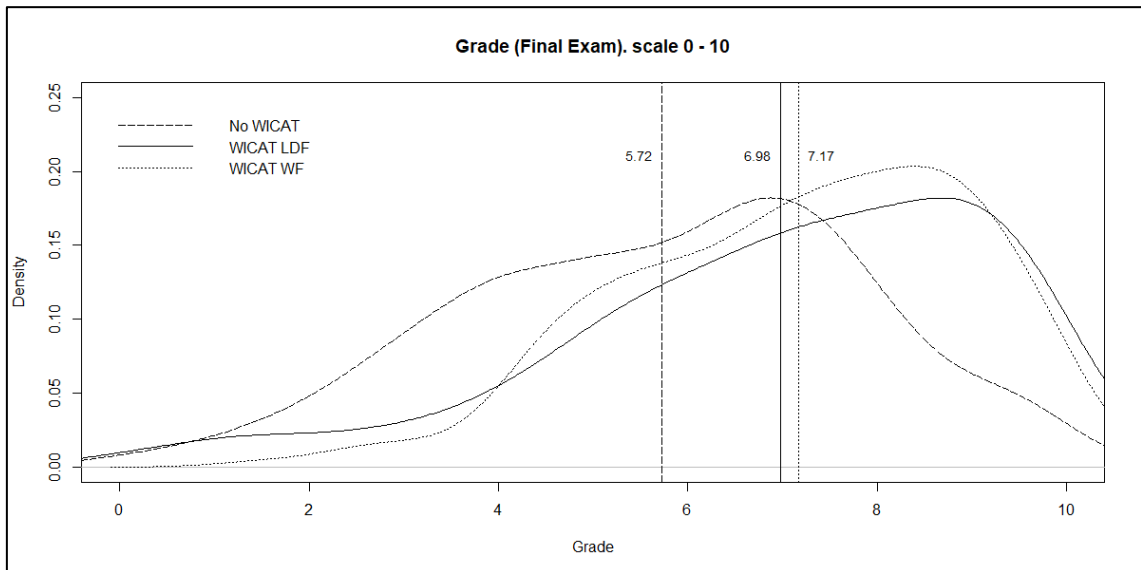


Figure 2 shows the smoothed density distributions of the three groups (smoothing kernel set to “Gaussian”), and the vertical lines represent the average grade in the final exam for each group. Again, the control and two experimental groups differed, but when the WICAT was applied, providing weekly or last-day feedback did not seem to be relevant.

When we focussed therefore on the application of the WICAT and ignored feedback about class participation frequency, the relative risk ratio between the two groups was substantially different. In the Spanish university system, the cut-off criterion for pass/fail is a grade of 5 on a 0-10 scale. With reference to this value, 34.1% of the control group (in which the WICAT was not applied) failed the subject, but only 14.9% of the two experimental groups combined (WICAT groups) scored below 5. Therefore, the relative risk ratio was 2.28, 95% CI [1.71, 3.04], p value=3.12E-09, which means that a student from the control group (NO WICAT group) was 2.28 times more likely to fail the final exam than was a student from one the two experimental groups (WICAT groups).

Figure 2: Smoothed density distributions of the three groups.



4.2. Part 2: OLS Model

In the second part of the analysis and using a multiple linear regression model (OLS), the effect of both WICAT and weekly feedback on final exam grades was evaluated, considering the possible effect of several confounding factors. According to previous studies, students' performance is related to gender (Fritschner, 2000; Gainor & Precourt, 2017), performance prior to university entrance (Gainor & Precourt, 2017; Pérez-López & Ibarrondo Dávila, 2019), and course level (Fritschner, 2000; Gainor & Precourt, 2017). Thus, gender, university entrance exam grade (*Evaluación de Bachillerato para el Acceso a la Universidad*, EvAU, on a 0-10 scale), and subject (introduction to accounting and financial accounting) were included as control variables. We detected the existence of heteroscedasticity; therefore, multivariate linear regression models with heteroscedasticity-consistent standard errors were used.

The results (Table 4) confirmed the conclusions obtained in the crude analysis: there were important differences among the NO WICAT (base level) and WICAT groups (WICAT WF and WICAT LDF) but providing weekly or last-day feedback did not seem to be relevant. The coefficients and their standard errors were almost identical among the groups with weekly (WICAT WF) and last-day feedback (WICAT LDF). The interaction with the EvAU grade was not significant. Regarding the control variables, the university entrance score (EvAU) was significant, which shows its relevance in predicting academic performance. However, gender and subject were not significant ($\alpha = 0.01$).

Table 4: Regression analysis (with heteroscedasticity-consistent standard errors).

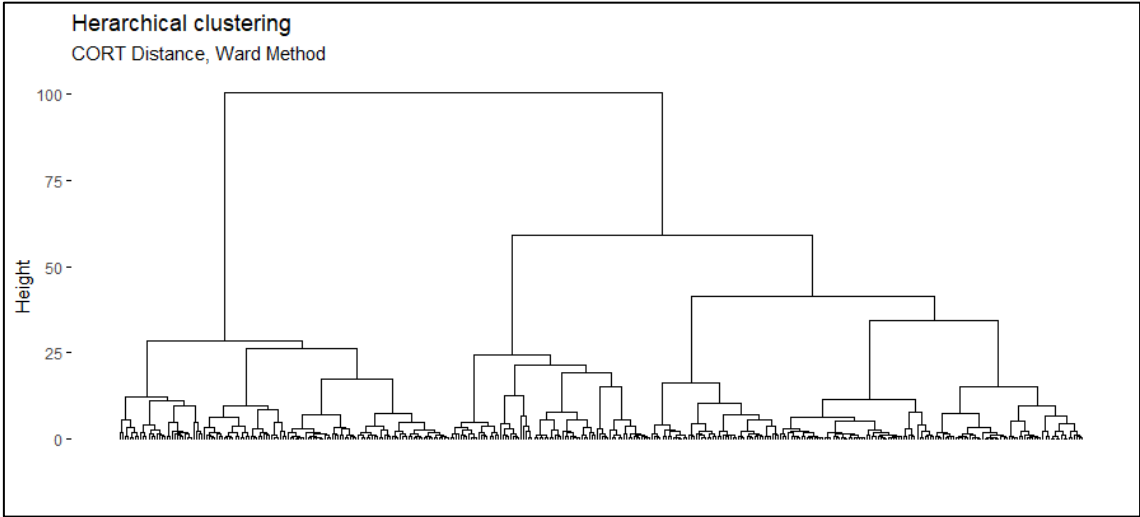
| | Coefficient | Sd | p-value |
|---|--------------------|-----------|----------------|
| Intercept | -0.26 | 0.07 | 0.000*** |
| <i>System (Non WICAT as base level)</i> | | | |
| WICAT WF | 0.48 | 0.08 | 0.000*** |
| WICAT LDF | 0.48 | 0.09 | 0.000*** |
| <i>Subject (Financial Acc. as base level)</i> | | | |
| Introduction to Accounting | -0.08 | 0.07 | 0.263 |
| <i>Gender (male as base level)</i> | | | |
| Female | 0.05 | 0.07 | 0.497 |
| <i>Pre-university performance</i> | | | |
| EvAU | 0.32 | 0.05 | 0.000*** |
| <i>Interactions</i> | | | |
| WICAT WF : EvAU | 0.10 | 0.07 | 0.195 |
| WICAT LDF : EvAU | 0.12 | 0.11 | 0.258 |
| Adjusted R-squared: 0.23 | | | |

4.3. Part 3: OLS model considering the exploitation of the WICAT

In the third part of the analysis, we developed a similar OLS model but including each student's achievement level as assessed by the WICAT. Instead of considering only the overall class participation grade obtained by applying WICAT, we grouped the students according to their development throughout the 14 weeks of the course, using the complete class participation grades time series. The objective was to verify whether the degree of taking advantage of the WICAT influenced the final exam grade. The groups were calculated using clustering techniques, frequently employed to classify students in previous education studies (e.g., Cobo et al., 2010; Howard et al., 2018; Meehan & McCallig, 2018; Wook et al., 2009).

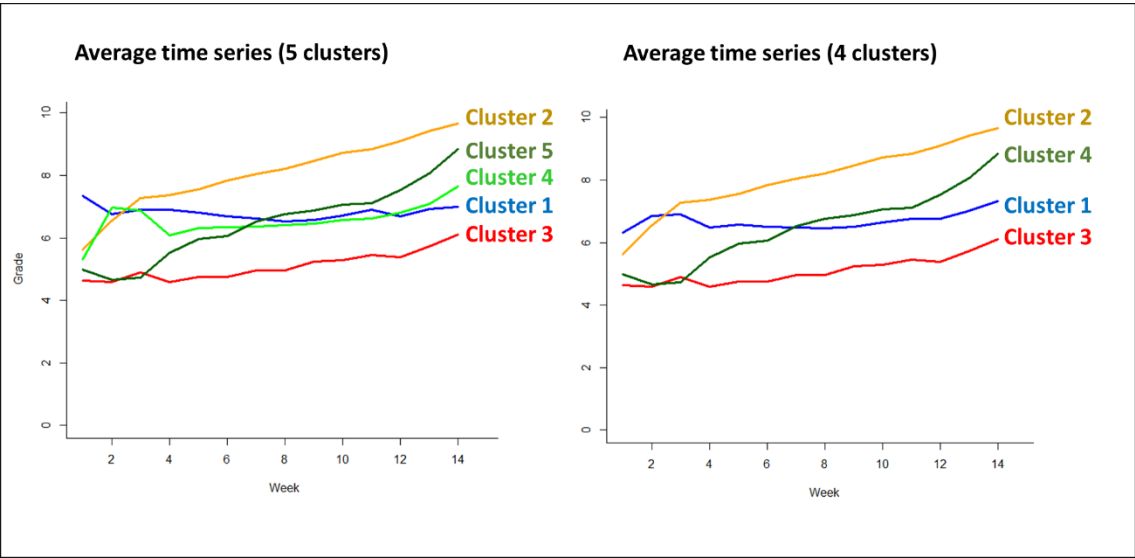
First, the cluster analysis allowed us to identify four or five different groups of students in relation to class participation performance (see dendrogram in Figure 3). The vertical axis of the dendrogram represents the dissimilarity between the clusters, and the horizontal axis represents the clusters. The splitting of a vertical line into two vertical lines represents the fusion of the two clusters.

Figure 3: Dendrogram and identified clusters



To determine whether it was more appropriate to consider 4 or 5 clusters, the average series in both scenarios was calculated (Figure 4). As seen, Clusters 1 and 4 (left side) behaved very similarly, so for interpretation purposes, the figure on the right, with 4 clusters, seemed more appropriate.

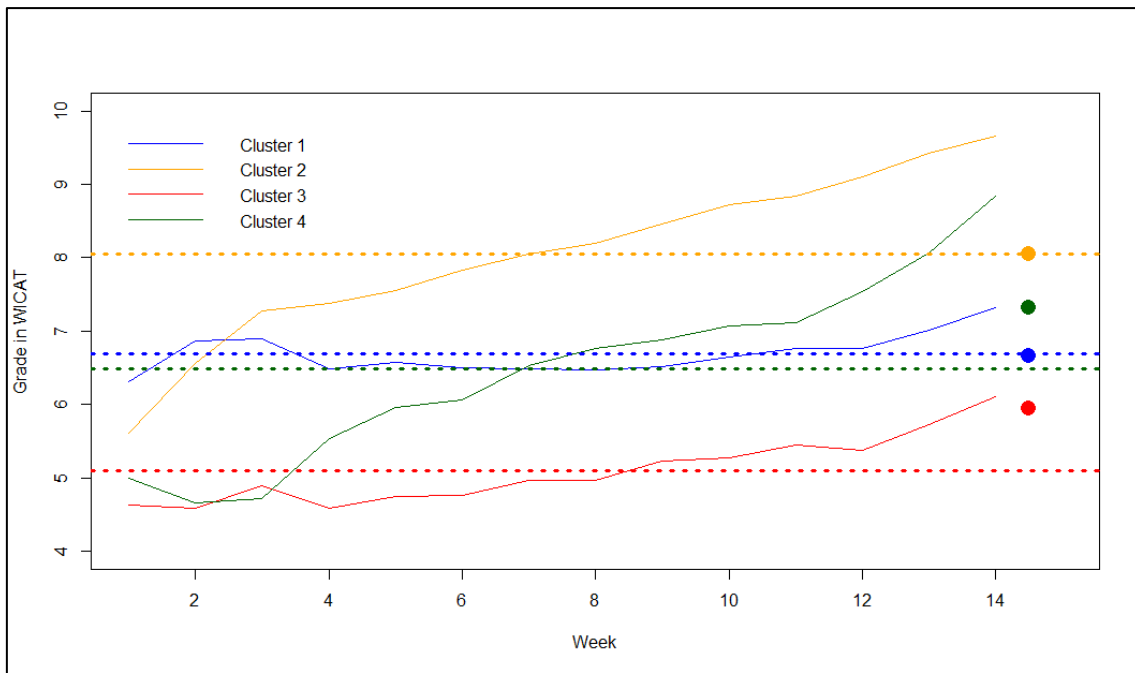
Figure 4: Average time series for the identified clusters (five and four clusters)



Regarding the four clusters, as shown in Figure 6, each cluster had a relatively different class participation performance. Cluster 1, composed of 116 students (32% of the WICAT group), had a moderate performance, with an average score throughout the semester close to 6.7 (on a scale

from 0 to 10) that hardly evolved over time. Cluster 2, composed of 126 students (34% of the WICAT group), included the best-performing students. Their average score was slightly over 8, and the time series showed a positive trend throughout the 14 weeks, so they ended the semester with a final assessment very close to 10. Cluster 3, composed of 77 students (21% of the WICAT group), had a low performance, oscillating around 5, although a very slight positive evolution could be seen. Finally, Cluster 4, composed of 49 students (13% of the WICAT group), had learners who, having started the course with poor performance, improved through the semester. Their average score was slightly below that of Cluster 1 at 6.5.

Figure 5: Average time series of the four clusters, including their mean levels (dashed line)



The solid line indicates the weekly evolution of the grade assessed by the WICAT by cluster. The horizontal dashed line represents the average weekly grade assessed by the WICAT by cluster. Finally, the points show the average of the final exam grade by cluster.

Second, we recalculated the OLS model used in Part 2 incorporating as categorical variables the cluster to which each student belonged (Table 5). We obtained a similar result to that in the previous section, but we added an important nuance: the WICAT works well in Clusters 2 (high performers), 4 (medium performers—good evolution), and 1 (medium performers—stable behaviour). In addition, we observed that the effect proceeded in the following order: highest in the high performers (Cluster 2, $\hat{\beta}=0.89$), followed by the students who had a good evolution (Cluster 4, $\hat{\beta}=0.47$) and lowest in the medium performers with stable behaviour (Cluster 1, $\hat{\beta}=0.39$). Students in Cluster 3 (low performers, 21% of the WICAT group) achieved a score on the final exam similar to that of the students in the NO WICAT group. The final exam grade followed the same sequence as the evolution of the weekly WICAT grade. In fact, in the case of Cluster 2, high achievers, the final exam average was practically the same as that for the weekly WICAT grade average. The same result was found for Cluster 1.

Table 5: Regression analysis considering the WICAT performance (with heteroscedasticity-consistent standard errors).

| | Coefficient | Sd | p-value |
|--|--------------------|-----------|----------------|
| Intercept | -0.22 | 0.07 | 0.001*** |
| <i>WICAT Performance (Non WICAT as base level)</i> | | | |
| Cluster 2 (High performers) | 0.89 | 0.09 | 0.000*** |
| Cluster 4 (medium performers – good evolution) | 0.47 | 0.13 | 0.000*** |
| Cluster 1 (medium performers – stable behavior) | 0.39 | 0.10 | 0.001*** |
| Cluster 3 (low performers) | 0.07 | 0.11 | 0.551 |
| <i>Subject (Financial Acc. as base level)</i> | | | |
| Introduction to Accounting | -0.14 | 0.07 | 0.045** |
| <i>Gender (male as base level)</i> | | | |
| Female | 0.01 | 0.07 | 0.930 |
| <i>Pre-university performance</i> | | | |
| EvAU | 0.34 | 0.04 | 0.000*** |

Adjusted R-squared: **0.27**

Thus, the class participation performance assessed by the WICAT has a positive effect on the final exam grade. The incorporated teaching innovation, based on a clear, objective, and fair class participation grading system, seems to have worked correctly. Nevertheless, individual, iterative, and weekly feedback does not appear to affect students' performance.

5. Discussion and conclusions

Currently, grading class participation clearly, objectively, and fairly and providing feedback to students on this class participation grade are challenges in higher education in general and accounting education in particular. Building on the previous literature and improving on the past empirical research, we developed a multidimensional Work-In-Class Assessment Tool (WICAT) that allows weekly feedback on class participation grades to be provided. This system allows both instructors and students to monitor the evolution of the learning process so they can make decisions in advance. This research aimed to analyze the impact on the final exam of both the WICAT and weekly feedback on student performance. At a private, medium-sized university in Spain, we conducted an experiment with 699 undergraduate accounting students over four academic years (2016-2019).

Our results show that class participation performance measured by the WICAT positively affected the students' exam grades, confirming Hypothesis One. This finding is consistent with previous studies conducted in areas such as quantitative methods (Tang et al., 2020), language courses (Xu & Qiu, 2020), and accounting (Pérez-López & Ibarrondo-Dávila, 2019; Precout & Gainor, 2019). The students in the NO WICAT group were 2.28 times more likely to fail the final exam than were the students in the WICAT group. Therefore, class participation performance measured by the WICAT is a relevant predictor of the final exam score. Built-in teaching innovation, based on a relatively novel class participation grading system, appears to have worked well.

However, this study shows evidence that the WICAT works well with high- and middle-achieving students but unfortunately not with low-achieving students. The WICAT does not reach all students equally and fails to engage underperforming students in daily classwork. Daily classwork becomes essential in scaffolded disciplines such as accounting, where the correct learning of a specific topic is founded on the knowledge of previous topics. These students might perceive that

a contribution of 10% to the final grade is not enough of a reward for the massive effort involved in working on an ongoing basis in a subject such as accounting. In the first years of university, students very commonly find motivation only in their grades and do not consider the implications that constant work has on long-term learning (Wynn-Williams et al., 2016). In fact, in the cluster analysis, we can observe a clear uptick in the participation grade from Week 11 in all four student types, coinciding with the last three weeks of the course, which is very close to the final exam, as previously shown in other studies (Precourt & Gainor, 2019).

Contrary to our expectations, weekly feedback did not have any significant effect on student final exam grades. This finding is not supported by previous research. Studies such as Aisbitt and Sangster (2005), Davis et al. (2001), Einig (2013), and Massoudi et al. (2017) report a statistically significant correlation between immediate feedback from multiple-choice questions or individualized accounting problems and higher exam performance. Stuart (2004) and Johnson et al. (2009) find a similar result in regard to rapid feedback about analytical review tasks and the use of an intelligent tutoring system, respectively.

One possible explanation for this unexpected result could be that students do not check the feedback spreadsheet uploaded in Moodle frequently enough. However, our review of the access logs of the students in Moodle confirmed that the access rate was, on average, 98%. Then, if they accessed the information, why did this feedback not affect their performance? The answer could be that the WICAT rules and the point system were so clear that they felt that the instructors' feedback was not needed since the students could self-assess.

In relation to the control variables and as previous studies have shown, while the university entrance score (EvAU) had a positive and significant effect on the final grade (e.g., Massoudi et al., 2017; Pérez-López & Ibarrondo Dávila, 2019), no relationship was observed for the gender or course level (Beatson et al., 2018; Einig, 2013; Gainor & Precourt, 2018).

In summary, the WICAT is useful for improving students' performance regardless of their gender or the course in which it is applied. The tool is versatile and easy to apply and can be implemented not only in accounting courses but also in finance, science, or languages. In fact, it can be used in any discipline that involves a scaffolding learning process, in which future knowledge is built on previous concepts. Finally, the WICAT allows instructors to provide immediate feedback on student performance. This feedback, although relevant and of great impact, *a priori*, has no real effect on student performance.

The results of this study have important implications for both curriculum designers and teaching staff. The former should consider the positive effect of class participation on students' performance and, therefore, should include class participation as an evaluable concept within course subjects. The latter should focus students' efforts on applying clear, objective class participation grading tools and not on providing feedback, which has been proven ineffective.

Regarding the limitations of our work, first, the sample comes from a single university. Our conclusions may not be directly generalizable to the same degrees at other universities. A second limitation is that the research design did not account for qualitative inputs in relation to student perceptions of the usefulness of this type of assessment and feedback regime. Despite these limitations, our study reveals that in the WICAT–feedback tandem, the WICAT is clearly the winning horse.

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Appendix 1: Feedback dashboard

The Excel spreadsheet on which weekly feedback is delivered is comprised of two sheets:

The first contains the grades assessed by the WICAT during the 14 weeks in terms of attendance; class contribution; and small, frequent tasks. The students started with 50 points of 100 and could add or subtract points, as explained in a prior section. An example of such a sheet follows:

Figure 6: Class participation spreadsheet

| Student ID | Initial balance | ATTENDANCE AND CLASS CONTRIBUTION | | | | SMALL FREQUENT TASKS | | | | CLASS PARTICIPATION GRADE |
|------------|-----------------|-----------------------------------|--------|------|---------|-----------------------|-----------------------|------|------------------------|---------------------------|
| | | Week 1 | Week 2 | | Week 14 | Small frequent task 1 | Small frequent task 2 | | Small frequent task 10 | |
| 2018xxxx1 | | | | | | | | | | |
| 2018xxxx2 | | | | | | | | | | |
| 2018xxxx3 | | | | | | | | | | |
| 2018xxxx4 | | | | | | | | | | |
| 2018xxxx5 | | | | | | | | | | |

The second sheet summarises the overall situation of the students, considering not only class participation but also midterm grades. The sheet allows the students to introduce hypothetical final exam grades to simulate the final grade they could expect to obtain at the end of the course.

Figure 7: Simulated spreadsheet

| Student ID | Class participation grade | Midterms grades | Final exam grade |
|------------|---------------------------|-----------------|------------------|
| 2018xxxx1 | | | |

| FINAL GRADE |
|-------------|
| 0,00 |