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## USING TECHNOLOGY DRIVEN FLIPPED CLASS TO PROMOTE ACTIVE LEARNING IN ACCOUNTING<sup>1</sup>

### O USO DA TECNOLOGÍA DIRECCIONANDO AULAS INVERTIDAS PARA PROMOVER APRENDIZAGEM ATIVA EM CONTABILIDADE

### UTILIZANDO LA TECNOLOGÍA EN CLASES INVERTIDAS PARA PROMOVER UN APRENDIZAJE ACTIVO EN LA CONTABILIDAD

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## ABSTRACT

The flipped classroom is a pedagogical model that occurs when students become active learners and study the class content previously as homework. The new generation of students is more engaged with the intensive use of technology and increased collaborative learning. However,

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there are few studies about the flipped classroom method which uses technology and active methodologies resulting in better engagement and improvement in student performance. This study aims to investigate the performance gain during the class and the students' perception of the use of the enhanced flipped classroom approach. Two accounting undergraduate classes with the same curriculum content, attending the research methodology course, had four classes using the flipped classroom approach. The sample consisted of 78 students from a public university in Brazil. Each flipped class began with a homework assignment; in addition, students should post and vote for their difficulties related to the assignment before class. In each class, there were two tests based on the most voted questions and collaborative activities between them without the help of the professor. The test results showed that in all flipped classes, there was a vast improvement after the collaborative activity being included as part of the process of knowledge construction. In addition, a survey was conducted with students and the results showed that they approve the use of enhanced flipped classroom as an appropriate teaching strategy. Universities should encourage the use of active methodologies and technological resources as a means of improving the educational processes.

**Keywords:** Inverted classroom, Flipped classroom, Undergraduate education, Accounting.

## RESUMO

A sala de aula invertida é um modelo pedagógico que ocorre quando os estudantes se tornam aprendizes ativos e estudam os conteúdos da aula previamente como tarefas de casa. A nova geração de estudantes é mais engajada com o uso intensivo de tecnologia e maior aprendizagem colaborativa. No entanto, há poucos estudos sobre o método sala de aula invertida utilizando tecnologia e metodologias ativas que resultaram em um melhor engajamento e melhoria no desempenho dos estudantes. Este estudo objetiva investigar o ganho de desempenho ao longo da aula e a percepção dos estudantes sobre o uso da abordagem sala de aula invertida expandida. Duas turmas de graduação em contabilidade com o mesmo conteúdo curricular, cursando a disciplina de metodologia de pesquisa, tiveram quatro aulas invertidas. A amostra foi composta por 78 estudantes de uma universidade pública no Brasil. Cada aula invertida começou com uma atividade extraclasse e, em adição, os alunos deveriam postar e votar em suas dificuldades referentes à tarefa antes da aula. Em cada aula, havia dois testes baseados nas dúvidas mais votadas e atividades colaborativas entre eles sem a ajuda do professor. Os resultados dos testes demonstraram que, em todas as aulas invertidas, houve uma ampla melhoria depois da atividade colaborativa como parte do processo de construção do conhecimento. Adicionalmente, foi feito um levantamento com os estudantes e os resultados demonstraram que estes aprovam o uso de sala de aula invertida aprimorada como uma estratégia de ensino apropriada. As universidades deveriam encorajar o uso de metodologias ativas e recursos tecnológicos como meios para melhoria dos processos educacionais.

**Palavras-chave:** Sala de aula invertida, Flipped classroom, Educação na graduação, Contabilidade.

## RESUMEN

La clase invertida es un modelo pedagógico que ocurre cuando los estudiantes se convierten en estudiantes activos y estudian el contenido de la clase previamente como tarea. La nueva generación de estudiantes está más comprometida con el uso intensivo de la tecnología y el aumento del aprendizaje colaborativo. Sin embargo, hay pocos estudios sobre el método de la clase invertida usando tecnologías y metodologías activas resultando en un mejor compromiso

y mejoramiento en el desempeño estudiantil. Este estudio tiene como objetivo investigar los logros del rendimiento sobre la clase y la percepción de los estudiantes sobre el uso del enfoque mejorado en clase. Dos clases de contabilidad con el mismo grado y el mismo contenido en el currículo, que asisten al curso de metodología de investigación, tenían cuatro clases invertidas. La muestra consistió en 78 estudiantes de una universidad pública en Brasil. Cada clase invertida empezó con una tarea, además, los estudiantes deben publicar y votar por sus dificultades relacionadas con la atribución antes de la clase. En cada clase, hubo dos testes basados en las preguntas más votadas y actividades colaborativas entre ellas sin la ayuda del profesor. Los resultados de las pruebas mostraron que, en todas las clases invertidas, hubo una gran mejora después de la actividad colaborativa como parte del proceso de construcción del conocimiento. Además, se llevó a cabo una encuesta con los estudiantes y los resultados, los cuales mostraron que aprobaban el uso de una clase invertida como una estrategia de enseñanza apropiada. Las universidades deben encorajar el uso de metodologías activas y recursos tecnológicos como medio para mejorar los procesos educativos.

**Palabras clave:** Clase invertida, Flipped classroom, Educación de grado, Contabilidad.

## 1 INTRODUÇÃO

Enhancing student's engagement in learning is a critical task for higher education institutions, and the use of active methodologies has proven to be a good alternative available to these institutions to drive students to reach higher levels of learning. The active learning awakens students to exercise their role as active and key players to build their own knowledge (AL-ZAHRANI, 2015). The literature makes use of publications on the effectiveness of active methodologies in teaching accounting, for example, the use of teaching cases (WEIL et al., 2001; WEIL; FRAMPTON, 1999) supported by Problem Based Learning (PBL) mechanisms and the flipped classroom (ALROWAIS, 2014).

Technological advances afforded the emergence of alternative resources useful to educational process involving professors and students interactively, favoring the control, evaluation and feedback of school activities that can be within or outside the classroom. This leads to optimism about the use of active methodologies, since learning management systems (LMS) are a technological tool that offers opportunities to gather known elements in their scholar lives. They are quite similar to those students became familiar in their daily lives through the smart devices. The key point about these elements is that activities can happen in an asynchronous mode.

This technological capability turned feasible to deliver content to students before in-class activities. Technology as a teaching medium has led to the flipped classroom phenomenon. After having access to educational material, engagement with the content occurs in-class (BLAIR; MAHARAJ; PRIMUS, 2015).

The self-discovery process of students as responsible for their own learning, underlines the practice of exchanging experiences that may occur among themselves, which also promotes the process of construction and consolidation of knowledge. These interactions that may occur inside or outside the college setting and allow also the use of technological resources. There is evidence that the engagement Obtained from the interaction not only Among students but between instructor and them has been increasing gradually (HOLMES et al., 2015).

The literature review presents clear signs about positive relation between the use of flipped class and students' engagement. It showed that learning is enhanced through a better use of in-class time (WONG; CHU, 2014). The main characteristic of flipped class is to deliver content before in-class activities to use in-class time to better development of student skills. Flipped proves to be a capable tool to providing a higher quality learning through the development of theoretical and practical skills (BLAIR; MAHARAJ; PRIMUS, 2015).

As a result, of accounting convergence to International Financial Reporting Standards (IFRS), a new qualification style, focused on exercise of judgments, estimates and choices now required to accounting professionals. In this context, efforts have been directed towards updating the professionals already working through continuous education practices, as well as improve the training of undergraduate students. Thus, IFRS Education also operates in the production of material aimed at the development of these new professional skills, among which we highlight the active methodologies.

As international accounting standards are in constant review process, it is necessary for professionals to be able to update themselves and take responsibility for their own continuing education. Thus, the use of Flipped and technologies in undergraduate proves to be an important way for students strengthening their capacity to learn through their own experiences of research, individual studies and interactions among their peers.

This study contributes to a widening of discussions on the use of flipped and how to operationalize it in order to clarify that as important as the previous contact of students with the content is driving to improve the learning process. Thus, although there is evidence that students can achieve better learning level through Flipped Classroom, the key point of this research is to measure whether the addition of technology resources and moments of interaction and collaboration among students to traditional Flipped can improve the level of learning.

The motivation for the present study is on the fact that traditional methods of teaching, professor-centered are still prevalent in Brazil, although there are indications in literature in which active methodologies can lead to better results. Moreover, the generation of digital natives is more conducive to the use of technologies than traditional reads and classes (ROEHL; REDDY; SHANNON, 2013). Due to the fact the technology is present and exerts great influence in daily school life (ENGIN, 2014), implementation of new technology resources to Flipped Class can be beneficial and favorable to the development of skills and creativity, although the institutions, especially public, still present limitations on the availability of computers, internet and professor training (ROEHL; REDDY; SHANNON, 2013).

For the purpose of exemplifying the main characteristics of traditional and inverted classes, shows the Figure 1.

**Figure 1 - Comparison between traditional and inverted classes**

| <b>Tradicionais classes</b>  | <b>Flipped classes</b>   |
|--|--|
| <i>Center</i>  |  |
| Professor  | Learner  |
| <i>Before the class</i>  |  |
| No activity  | Readings, videos, individual or group activities, etc.         |
| <i>During the class</i>  |  |
| Professor continuously explains  | Discussions and debates, solving problems, clarifying doubts.  |
| Students take note and occasionally ask questions                            |  |
| <i>After the class</i>   |  |
| Individual or group activities   | Individual or group activities                                 |
| <i>Student positioning</i>   |  |
| Passive subject  | Active subject   |
| <i>Process dynamics</i>  |  |
| Professor holds knowledge and transfers to student                           | Student builds his knowledge through experience                |
| Emphasis on spoken classes   | Research and construction of knowledge                         |
| Emphasis on visual elements  | Greater possibilities of using technological resources         |
| <i>Skills required for the student</i>                                       |  |
| Retention of information, memorization, attention focused on the explanation | Pro activity, initiative, autonomy, responsibility, engagement |
| <i>Skills required for the professor</i>                                     |  |

|   |  |
|---|--|
| Good oral communication                   | Creativity, involvement, ability to motivate                         |
| Detention of knowledge                    | Leadership   |
| <i>General attributes of the method</i>   |  |
| Most synchronous activities               | Most asynchronous activities.  |
| Class in the classroom, exercises at home | Class at home, exercises in the classroom.                           |
| <i>Most common materials and methods</i>  |  |
| Power point presentations or similar      | Videos, online materials, open content on the internet, free search. |

Likewise, given the benefits that active learning can provide trained accounting professionals or training, particularly in a context of convergence of financial accounting to international normative standard, breaks out the problem of this research, which is the proposed combination between the model flipped classroom, intensive use of technologies and some techniques of collaborative learning. This formula was defined here as Enhanced Flipped class and consists at the junction of the traditional method of Flipped Class incremented by technology that enhance the collaboration between professor and student and among students, as well as dispensing, during class, longer time for mutual support among students than for any intervention by the professor.

Previous studies deal with the use of flipped classroom in different areas and courses (LARSON; YAMAMOTO, 2013) so, this research attempts to analyze whether the method can also be effective teaching in accounting undergraduate, in the first instance, the research methodology course. Although the literature presents the benefits regarding the use of each one of these resources (Flipped, technologies for learning and collaborative learning), we do not identify studies that investigated the joint application of all of them, either, applied to the accounting department.

This study builds upon previous works by providing an empirical data that explores whether previous contact directed to produce questions that can drive the in-class lecture is an effective way to improve learning and engagement. One of the key points highlighted here is that by producing questions about doubts the students have to get in touch with the material. This homework can be supported by the LMS to register the questions and represents a good way to infer on which dimension students acquires the previously content.

The main objective of this research is to find whether the use of Enhanced Flipped class may results learning gains and positive students' perceptions to the research methodology course of accounting students in an undergraduate program.

## 2 PREVIOUS RESEARCH

Active learning has its foundations on constructivist theories, based on experience. In this terms, through Dewey's Theory of Experiential Learning "knowledge is a way of experiencing" (DEWEY, 1981, p. 242) and that "things, whatever, are what they are known to be" (DEWEY, 1981, p. 240). Hence, the foundations for pedagogical discussions about experience emerged, according to which the author states that "education must be conceived as a continuous reconstruction of experience" (DEWEY, 1981, p. 442) and that must occur from the birth, through the formation of consciousness, habits, training of ideas and arousing feelings and emotions. It is an individual and gradual process that occurs through stimulation.

In this line of thinking, the flipped class is the experiential and active learning method, in which students can learn the course content at their own pace, through preliminary readings and activities developed before the matter is discussed by the professor. This feature makes the student experience in the classroom is a chance to go beyond the earlier material provided (ALROWAIS, 2014; BOUWMEESTER et al., 2015; DAVIES; DEAN; BALL, 2013). As a result, there is a change of students' attitudes towards learning through engagement for it rather

than making teaching a central part of the process. In addition, Flipped learning promotes also peer interaction and collaboration skills (ALROWAIS, 2014).

One of the primary needs for the adoption of the reversed room is the preparation of the students. If they are well prepared for their in-class participation for the flipped schema really achieves its learning goal. While watching video lectures is a self-regulation study strategy, the selection of reading text as a preference is a regulation effort or rehearsal learning attitude (BOUWMEESTER et al., 2015).

In addition, all learning material should be carefully thought out and designed to promote generation of creative ideas and problem solving skills. Evaluations should allow the measurement of the reach of a wide range of skills and competencies, such as achievement, creativity and critical thinking. There is also, it is found that the students have several disciplines at the same time, therefore, care must be taken with the possibility of overloading them with too many activities (AL-ZAHRANI, 2015).

The flipped class offers more opportunities for students to learn together with their peers, as it leads to an active and social process. This is a consequence of face-to-face time promoted in the process to discuss the content of agenda items to class. Therefore, the instructor can cover the material with new opportunities for problem-based activities as well as to provide feedback and guidance to students (MORAROS et al., 2015).

The study of Alrowais (2014) demonstrated positive effects of using flipped class by the students as well as their attitudes toward their course. The aim of the research was to understand the level of engagement of students, but to measure their learning through activities in the classroom. This investigating was operationalized using a control group that employed traditional teaching methods compared to using the flipped class. Another study found that Flipped class learning English proved to be effective and attested that the students agreed that the model reinforced the understanding of teaching content, increased motivation and provided performance improvement Alrowais (2014).

Also, when in-class activities is perceived to be better for critical thinking development in an attitude of sharing information and working together, an increase of communication during class was detected. Previous contact with the content in maths helped the learning of solving problems through procedural steps (WASSERMAN et al., 2015). Although flipped classroom method is becoming popular, there is also the argument that flipping does not motivate students to do the previous tasks before the class with instructor. This difficulty can compromise the results of the method, as to the success of flipped is fundamental that students get in touch with the content previously to the class. The causes of this limitation could be related to the low reading culture as this habit is considered by Alrowais (2014) as one of the pillars of Flipped Class.

The self-practice and homework enables the exchange as interactions involving students and instructors later at school as a natural consequence (HWANG; LAI; WANG, 2015). However, this fact is based on the concrete experience taken before in-class meeting. A key factor for this schema where instructional material is available before in-class activities is that students access it properly.

From the point of view of the instructors, there are evidences that they are willing to use flipped class since it allows to strategize on optimizing student learning (BLAIR; MAHARAJ; PRIMUS, 2015). The opportunity to instructors cover a wider range and depth of course related material is clear (Moraros, et al., 2015). However, evidences are not clear about how much instructors' time and efforts are necessary to do such optimization. At this point is should be evaluated whether the additional efforts of professors with prior preparation enable the use of the flipped classroom method.

According to Al-Zahrani (2015) time in class should be used to carry out targeted discussions, problem solving and for the professor to fill in learning gaps demanded by the

students. In addition, the author points out that the evaluations of students in achieving Flipped Class shall include the activities before and during the class (AL-ZAHRANI, 2015).

This finding indicates that more than one level of evaluation should be done to investigate the efficacy of the model. After an entire actuarial course with the flipped class structure student's views became far more positive compared to traditional approach. The perception that performing an activity is more effective for learning than reading and listening (DIRIENZO et al., 2014). The interest on research about students' perception under the flipped class learning as an alternative structure is not new and the general conclusion is that students prefers it (BUTT, 2014; WAYNE et al., 2006).

Papers that investigated the use of Flipped in accounting courses are not common in the literature despite accounting students are open to learn by doing than by listening and show to be open to the idea of flipped classes. This was a finding focused on millennial students and showed that their contact with this approach already happens (PHILLIPS, CYNTHIA; TRAINOR JOSEPH, 2014). The research Findlay-Thompson and Mombourquette (2014) compared two groups of business course and found that there were no statistically significant differences between the performance class that used this methodology and that she did not. Still, from interviews with students, the authors concluded that students perceived as positive the use of Flipped and expressed an interest in returning to use it as active learning mechanism.

#### *Research questions and hypotheses*

Research Question 1: Is flipping classroom an effective method to teach research methodology class for accounting undergraduate students?

For the first question, was derived the following hypothesis:

H1: There is a statistically significant difference in research methodology skills using enhanced flipped classroom as measured by scores on initial and final in-class quizzes.

At the same time, the interest on students' perception about the approach is relevant and suggests the second research question:

Research Question 2: What is the students' perception about the effectiveness of using the Enhanced Flipped to teaching research methodology course in undergraduate program in accounting?

### **3 MATERIALS AND METHODS**

The present study is the result of an inverted classroom application experiment, whereby employed the descriptive method to assess the learning and students' perception from intensive use of technology to enhance the flipped class approach.

The study population came from two different blended courses with the same syllabus offered by the same instructor for two similar accounting undergraduate programs. The content of both courses are about introduction to methodology research. The population was comprised of accounting undergraduate students from a public university in Brazil. There were 78 enrolled students in both classes, where 60% of the participants are male and 40% are female. There are no significant differences in age between participants.

The final activity of the course was a capstone project similar to an academic article that should contain the introduction, literature review, and materials & methods for a research topic of their own interest.

#### **3.1 Study Procedures for the Enhanced Flipped approach**

A particular class procedure was used in order to promote a full integration among previous, in-class and after-class activities. The whole research process begins in the previous week to class, becomes intense during the class and ends late at night after class.

All steps of the experiment are shown in **Figure 2** and detailed below.

Among the technology resources used in the model proposed and discussed in this study is the Learning Management System called Moodle™. In it were available all materials required for the course, including texts and videos. In addition, all learners were free to search other sources they deemed necessary.

The four classes that used Enhanced Flipped approach where about the use of several tools to support the capstone project like Web of Science™ (WOS), Excel™ (EXC), Mendeley™ (MEN), and HistCite™ (HIS). For each tool, there were several materials/tutorials available in the Moodle™ space.

The data collected during WOS class should be managed by Mendeley™ and analyzed by Excel™ and Histcite™ tool.

Before these four classes, the students attended two classes in order to train how to use this new flipped class approach. In these two training classes, the students had to understand how to create an academic abstract. Besides these 6 classes, the students had additional seven traditional classes to support the students with the capstone project. As traditional classes, those centered on the professor are characterized, which occur predominantly through explanations or discussions led by the professor (COTTELL; MILLIS, 1992).

WOS is an academic database that concentrates articles from many journal publications and has specific search engines to explore explore the citation universe across subjects and all over the world.

In WOS class, the students should do a search of at least 300 relevant articles related to their research topic of interest. It is important to have a high number of articles to improve the quality of the citation analysis using the Histcite™ tool.

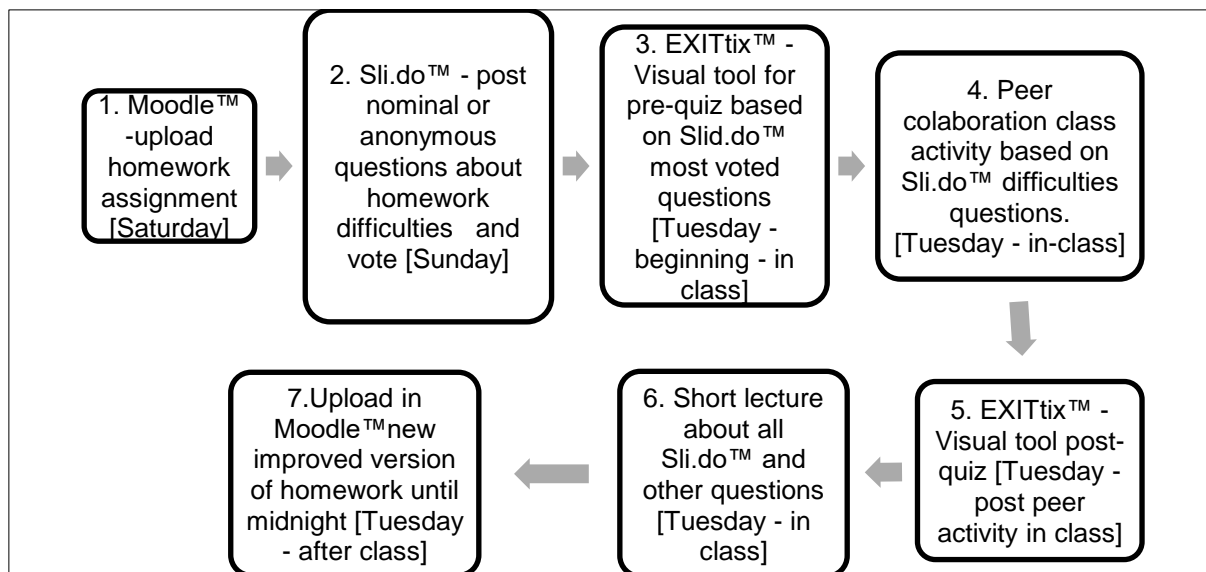
The Excel™ class consists in building a chart with data about authors and journals longitudinally extracted from the 300 article collected during the WOS class. The purpose of this activity was to do an analysis of the number of articles per author, regardless of the amount of citations. It is important for the students to compare the number of articles per author with the citation analysis.

MEN is a free reference manager that allows the generation of your citations and bibliography in the style of your choice.

The Mendeley™ class will enable the students to manage the articles to be used in the final capstone project. Besides managing the article, the students may highlight, annotate the pdf, and learn how to cite inside word™.

HIS a free tool used for bibliometric analysis and information visualization. It is used to make citation analysis based on the output of WOS class.

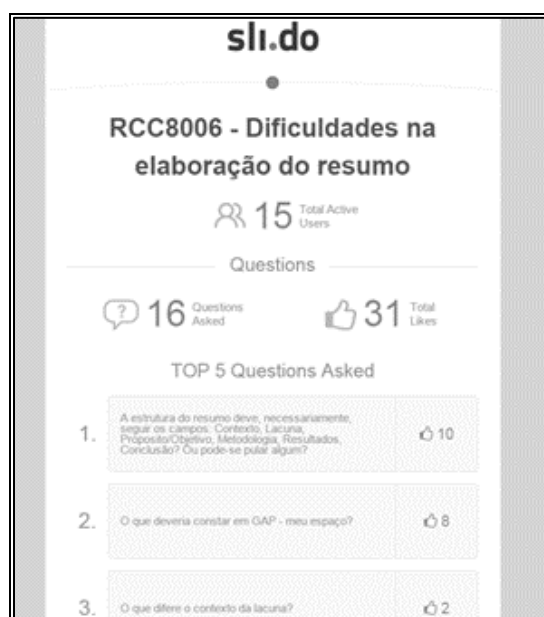




**Figure 2 - Procedure for all 4 flipped classes**

Step 1 – The student had to study using the content available in the web and in the moodle™ to do the homework due Saturday.

Step 2 - The free software Sli.do™ was used by the students to register the vote for questions after the homework was done (Figure 3). After posting the questions, that could be anonymous, the students should vote for the best questions.



**Figure 3 - Sli.do™ Software Screen**

Step 3 - The purpose of this step was that the instructor knew beforehand the main questions of the whole class, allowing him/her to direct your class to clarify the main difficulties pointed out by the students themselves. Insofar as students sent their doubts and voted in the most important, the instructor and student could follow in real time the ranking of the most voted questions through Sli.do™. In addition, the instructor used these questions to prepare the quizzes that were administered during the class.

The EXITtix™ tools was used to apply the quiz at the beginning of class The tests consisted of /four five multiple choice questions, in which students had to mark the incorrect

choice among the available alternatives. The value for this step ranges from 0 to 10. Through this program, it is possible to accompany, in real time, the results for each student and the class performance for each question, which were followed by the instructor vision using EXITtix™.

The students did not see the same screen as provided by the software to the instructor. A simplified set of data is shown to the students as projected in-class (Figure 4).



Figure 4 - EXITtix™ screen as projected in-class to students

Step 4 – During this time, the student should try to collaborate with each other regarding the quiz and other question about the difficulties they had during homework. This activity last about 20-30 minutes without the instructor intervention.

Step 5 - The EXITtix™ tools was used to apply the same quiz after the peer collaboration. The order of the questions was not the same of the previous quiz.

Step 6 - The next step was a mini lecture and a full explanation about the all the question posted in the SLi.do™ tool. The instructor also addresses other questions not considered the most important, as others pointed out during class. With this step, the activities of the class ended.

Step 7 - After class, all the students have another chance to redo the tasks that were delivered three days before class and should post them in the Moodle™ until midnight of the same day of class. This approach not only was a chance to prove themselves about the capabilities learned in the process, as well represents a way used to engage them in the full learning process.

The last version should be improved by their individual studies, interactions among colleague's class and after the instructor's short lecture.

Except for steps 2, 4, and 6, all the steps were graded for all fours flipped classes. Each flipped class had a grade that combined all graded steps. In case the students did not upload the step 1 or step 7, a zero was assigned to the flipped class grade.

## 4 RESULTS AND DISCUSSION

### 4.1 Research Question 1

**Erro! Fonte de referência não encontrada.** presents descriptive statistics of grades of the pairs quiz pertaining to each flipped class. The results show huge differences between the initial and final quiz for all flipped classes.

**Table 1 - Descriptive statistics**

| Flipped class   | Quiz based on SLI.do™ questions   | Average | N  | Standard Deviation |
|-----------------|---|---------|----|--------------------|
| Class 1-<br>WOS | Quiz:WOS1A - Initial quizt in the classroom about the difficulties on WOS homework                            | 7.46    | 63 | 2.494              |
|                 | Quiz:WOS1B - Final quiz in the classroom about the difficulties on WOS homework after peer collaboration      | 9.143   | 63 | 1.5119             |
| Class 2-<br>EXC | Task:EXC1A - Initial quiz in-classroom about the difficulties on the EXCEL homework                           | 6.438   | 64 | 2.4029             |
|                 | Task:EXC1B Final quiz in the classroom about the difficulties on EXCEL homework after peer collaboration      | 9.031   | 64 | 1.7455             |
| Class 3-<br>MEN | Task:MEN1A - Initial quiz in-classroom about the difficulties on MENDELEY homework                            | 5.333   | 60 | 2.3482             |
|                 | Task:MEN1B Final quiz in the classroom about the difficulties on MENDELEY homework after peer collaboration   | 7.833   | 60 | 2.0598             |
| Class 4-<br>HIS | Task:HIS1A – Initial quiz about the difficulties on HISTCITE homework   | 4.893   | 70 | 2.9315             |
|                 | Task:HIS1B - Final quiz in the classroom about the difficulties on HISTCITE homework after peer collaboration | 7.786   | 70 | 2.5375             |

In order to make the results more relevant, the quiz delivered in pre and post moments class were analyzed using

Use also used the t-test to check whether two sets of measures are essentially different or not (**Erro! Fonte de referência não encontrada.**). We do not apply a multivariate test covering four class simultaneously because we have only 43 participants who delivered all activities. So, we chose to analyse each class separately and then compare the progress between initial and final quiz.

We note on **Erro! Fonte de referência não encontrada.** that in all pairs (initial and final quiz) have significant difference ( $p < 0.001$ ) between initial and final quiz applied during the class. This result confirms the H1 established for the research question 1.

**Table 2 - Comparison Values before and after for each test: t test for paired samples**

| Pairs  | Tasks                         | Average | St. deviation | Inf.    | Sup.    | t      | p     |
|--------|-------------------------------|---------|---------------|---------|---------|--------|-------|
| Pair 1 | Task: WOS1A and Task: WOS1B   | -1.683  | 2.388         | -2.284  | -1.0811 | -5.592 | 0.000 |
| Pair 2 | Task: EXC1A and Task: EXC1B   | -2.594  | 2.408         | -3.1954 | -1.9921 | -8.616 | 0.000 |
| Pair 3 | Task: MEN1A and Task: MEN1B   | -2.500  | 2.594         | -3.1701 | -1.8299 | -7.465 | 0.000 |
| Pair 4 | Task: HIS1A and - Task: HIS1B | -2.893  | 3.175         | -3.6498 | -2.1359 | -7.624 | 0.000 |

Note: C.I. 95% for difference

In order to analyse the effect size for the paired test regarding the strength of the increase of learning, we estimate the effect size of Cohen, whose results for each pair of tasks were: WOS = 0.797, EXC = 1.229, MEN = 1.141 and HIS = 1.078. The effect size gives an indication if something is practically significant. The data interpretation was done using using Cohen (1988) and Hattie and Timperley (2007) presented in **Erro! Fonte de referência não encontrada.**

**Table 3 - Interpretations of Cohen Test effects**

| d     | r*  | $\eta^2$ | Interpretation sensu Cohen (1988) | Interpretation sensu Hattie (2007) |
|-------|-----|----------|-----------------------------------|------------------------------------|
| < 0   | < 0 | -        |                                   | Adverse Effect                     |
| 0.0   | .00 | .000     | No Effect                         | Developmental effects              |
| 0.1   | .05 | .003     |                                   |                                    |
| 0.2   | .10 | .010     | Small Effect                      | Professor effects                  |
| 0.3   | .15 | .022     |                                   |                                    |
| 0.4   | .2  | .039     |                                   |                                    |
| 0.5   | .24 | .060     | Intermediate Effect               | Zone of desired effects            |
| 0.6   | .29 | .083     |                                   |                                    |
| 0.7   | .33 | .110     |                                   |                                    |
| 0.8   | .37 | .140     | Large Effect                      |                                    |
| 0.9   | .41 | .168     |                                   |                                    |
| ≥ 1.0 | .45 | .200     |                                   |                                    |

Cohen (1988) reports the following intervals for r: .1 to .3: small effect; .3 to .5: intermediate effect; .5 and higher: strong effect. These terms "small", "medium" and "large" relates to the size of the effect. Cohen's conventional criteria for these sizes depends on its substantive context and its operational definition.

Analysing the Cohen test results in light of Cohen (1988) it is observed that the responses before and after interventions from the professor to the question related to WOS suffered from intermediate variation effects. For all other issues (EXC, MEN and HIS) the effects can be considered as great.

The highest observed effect, according to Cohen test was in the Excel activity. This result reinforces the findings of Larson and Yamamoto (2013) that the Flipped Class leads to gains in learning about the use of spreadsheets in Excel. In turn, based on Hattie and Timperley (2007) all tests have evolved from the pre to the post in order to meet the desirable effects. It can thus be concluded that, based on both references presented in **Erro! Fonte de referência não encontrada.**, are considered positive developments between the responses of students in pre and post-tests. This result shows that there was effective use of the presented teaching strategy.

In order to compare the differences between the four flipped classes, we have created a variable that measures the percentage improvement for each class (if the student's grade was 5 and 8 after, his improvement was 60%). This analysis is presented in **Erro! Fonte de referência não encontrada.**

**Table 4 - Improvement for each Task**

|         |         | WOS     | EXC     | MEN     | HIS     |
|---------|---------|---------|---------|---------|---------|
| N       | Valid   | 62      | 62      | 57      | 64      |
|         | Missing | 16      | 16      | 21      | 14      |
| Mean    |         | 42,419  | 57,177  | 58,333  | 85,026  |
| Median  |         | 25,000  | 33,333  | 33,333  | 50,000  |
| Minimum |         | -33,330 | -20,000 | -33,330 | -66,670 |
| Maximum |         | 400,000 | 400,000 | 400,000 | 300,000 |

To analyse the differences in detail, six comparisons was done and presented in **Erro! Fonte de referência não encontrada.**, where we compared the variables (tests) between themselves, two by two as pairs of individuals. Different tests have been matched to each other so that the individuals were not the same for each comparison. After that, the samples were paired and analyzed by the t test.

**Table 5 - Analysis of alternating pairs of Activity**

| Pairs  | Pairs – flipped class | t      | p     | N  | Correlation | p     |
|--------|-----------------------|--------|-------|----|-------------|-------|
| Pair 1 | WOS & EXC             | -0.909 | 0.368 | 53 | 0.057       | 0.685 |
| Pair 2 | WOS & MEN             | -0.916 | 0.364 | 47 | -0.179      | 0.229 |
| Pair 3 | WOS & HIS             | -1.893 | 0.064 | 53 | -0.098      | 0.483 |
| Pair 4 | EXC & MEN             | -0.847 | 0.401 | 49 | -0.171      | 0.240 |
| Pair 5 | EXC & HIS             | -1.474 | 0.146 | 57 | -0.144      | 0.285 |
| Pair 6 | MEN & HIS             | -1.442 | 0.156 | 50 | 0.037       | 0.796 |

The sequence presented in the second part of **Erro! Fonte de referência não encontrada.**, was made Bonferroni correction, without which differences between pairs (flipped class) were identified. Note that there is no significance better than another pair. It is noticeable that there is no correlation among the pairs. To have better performance in anyone does not implies that the same happens in any other pair.

The findings of this study shows that there is an increase of learning when the in-class activities are driven by the students' doubts resulted as part of their previous homework. This means that not only flipped class is good for performance increase but that the inclusion of a class activities structured from their needs increase learning as well.

## 4.2 Research Question 2

A group of 63 students answered to questions about their experience with the enhanced flipped class (**Erro! Fonte de referência não encontrada.**). The composition of these two courses are 43% male students and 57% female students. Student's self-declared perception about the flipped class confirm previous researches showing that flipped class has a positive attitude among students (ALROWAIS, 2014).

According to study done by Findlay-Thompson and Mombourquette (2014), most students said they would enroll in another course or would do another activity using the flipped class approach. Although the results of the study of by Findlay-Thompson and Mombourquette (2014) have not shown significant differences between the performance of students who experienced the method and those in the control group, the findings about the benefits of the method were praised.

Participants also stated that the exchange of knowledge from the interactions with classmates was fruitful, as well as the findings of the study (ENGIN, 2014).

Observing the responses of all survey questions, we note that most students perceive as positive the use of Enhanced Flipped Class. In addition, students rated how beneficial the material prepared and made available on Moodle in addition to some resources found using some other database available in the Internet. According to the students' perception, the methodology was appropriate for the learning of the proposed content and also provided favorable effects of previous studies, awakening to the responsibility of construction of knowledge itself.

**Table 6 – Student's perception about the enhanced flipped class**

| Questions / Answer Options  | Strongly disagree | Totally disagree | Disagree | Don't agree nor disagree | Agree | Totally agree | Strongly agree | Response Count |
|---|-------------------|------------------|----------|--------------------------|-------|---------------|----------------|----------------|
| I had to prepare myself to the class to be successful in the activities | 1                 | 1                | 6        | 9                        | 31    | 7             | 8              | 63             |
| Having studied before (flipped class) favors my learning                | 1                 | 2                | 3        | 6                        | 22    | 19            | 10             | 63             |
| The available material found from the LMS was adequate                  | 1                 | 1                | 6        | 7                        | 33    | 7             | 8              | 63             |

|  |   |   |   |    |    |    |    |           |
|--|---|---|---|----|----|----|----|-----------|
| to develop the required activities   |   |   |   |    |    |    |    |           |
| The material found from Google Search was adequate to develop the required activities                | 1 | 0 | 1 | 17 | 29 | 10 | 5  | 63        |
| The in-class interactions with other colleagues helped in the development of the required activities | 1 | 2 | 3 | 4  | 31 | 14 | 8  | 63        |
| I took part in discussing with colleagues in-class   | 1 | 1 | 5 | 11 | 25 | 16 | 4  | 63        |
| The instructor expositive classes helped to develop the required activities                          | 0 | 0 | 2 | 7  | 21 | 18 | 15 | 63        |
| I believe the knowledge/abilities developed along this course can be relevant to my future           | 1 | 1 | 0 | 2  | 20 | 22 | 17 | 63        |
| I am confident to apply my knowledge/abilities developed along this course                           | 2 | 1 | 0 | 3  | 31 | 14 | 12 | 63        |
| I would do another course using flipped class  | 3 | 0 | 3 | 10 | 23 | 13 | 11 | 63        |
| <i>answered question</i>   |   |   |   |    |    |    |    | <b>63</b> |
| <i>skipped question</i>  |   |   |   |    |    |    |    | <b>0</b>  |

## 5 CONCLUSIONS

After analysis and discussion of the results, we believe to have achieved the goal of research in concluding that the use of Enhanced Flipped Classroom resulted learning gains to undergraduate students in accounting.

Furthermore, this methodology innovates by proposing an application format that enables the professor to measure the progress of student learning every step of the process, such as preliminary studies, group studies and interventions of the professor. From the point of view of the students, we observe that was perceived a gain on learning through the intensive use of technology and collaborative action.

The adding of a tool whose students could go along on real time the answers of all class was quite ludic from the point of view that many showed their interest on having better results at each step. In this sense, the use of EXITtix™ proved, too, as a device of motivation to student participation in class.

Regarding Instructors, this study is beneficial for to show that when the class lecture is prepared according to the students' needs can have better learning outputs. In addition, through the use of the tools like Sli.do™ and EXITtix™, instructor was able to support the activities of peer interaction to the contents that students have demonstrated greater difficulties and this turns out to be one of the major contributions of this research.

From the point of view of the school, the didactical approach of having homework useful in-class as topics to drive lecture seems to be good for higher order skills development.

The findings of our study can be applied in teaching accounting and in higher education in general, and present the results of use of the teaching methodology known as flipped classroom and concomitant use of technologies that can be useful to the teaching processes. This method and its application provided students with the development of active and collaborative learning, increasing engagement and improving performance. It also increases the motivation of students and enhances the ability to communicate between colleagues and with the professor.

The research findings indicate that universities should encourage the use of active methodologies and technological resources as a way of improvement of educational processes and invest in training instructors on the use of techniques that favor active and collaborative learning.

Another contribution of this research is in the results of the intentional use of student interaction (collaborative learning) as part of the knowledge construction process. An innovation presented here is also related to more time devoted to the interactions among students reducing the time devoted to the class lecture. Finally, the intensive use of technology stands out as an engaging factor for students, especially those from the digital generation.

One limitation to this study is related to difficulties in motivating students to meet preliminary activities to class.

As a recommendation, we suggest carrying out experiments with control groups, so that you can verify the isolated effects of the use of enhanced flipped approach on the level of learning and student performance.

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