ISSN: 2358-1271. Int. J. of Alive Eng. Educ. (IJAEEdu). (Online). Goiânia, v. 2, n. 5, p. 41-47, July/Dez. 2018.

PETEEECS • EnAEn • EMC • UFG

Flipping the Classroom: Applying the Circuit in Foundation Design

Patrick Borges Rodrigues[*]

[*]Departamento de Ciências Exatas e Tecnológicas, Universidade Estadual de Santa Cruz, Ilhéus, Brazil.
E-mail: pborgesr@outlook.com

Phillipe Oliveira Novaes[♦]

[♦]Departamento de Ciências Exatas e Tecnológicas, Universidade Estadual de Santa Cruz, Ilhéus, Brazil.
E-mail: ph15oliveira@gmail.com

Stephanny Conceição Farias do Egito Costa [▲]

[▲]Departamento de Ciências Exatas e Tecnológicas, Universidade Estadual de Santa Cruz, Ilhéus, Brazil.
E-mail: scfecosta@uesc.br

Abstract

The assessment of the student's academic results is one of the most challenging tasks in education because it may be subjective, lack clarity and goals. In addition, many professors and institutions have a deficient comprehension of the assessments' purpose and have used the students' grades to determine the reach of the educational objectives. Trying to address that question, the Circuit is an alternative form of assessment based on the interaction and cooperation between students that aims to verify the results of the learning process through ludic activities. This paper presents the results of applying the Circuit in Foundation Design, an undergraduate course of the 5th-year of Civil Engineering at the Universidade Estadual de Santa Cruz (UESC), in Ilhéus, Brazil, in 2017. The professor decided to use the Circuit in this course as an attempt to enable the students to interact and share what they have learned with their classmates. By doing so, the professor considered the concept of the Zone of Proximal Development, from Vygotsky, assessing the students' ability to deal

Article history: Received on 31 August 2018. Accepted on 6 November 2018. Published online on 28 December 2018.
Digital Object Identifier (DOI): Pending number

with problems with the help of their peers and learn with them. The method, although containing many rules, was easy to apply. The students, divided into groups of three, were expected to create two reports based on data for one Standard Penetration Test – SPT and one Cone Penetration Test (CPT). Each member of the group played a different role on the activity: the "Engineer" produced the report; the "Technician" completed the missing data of the tests; the "Manager" corrected the final reports. After completing the activity, each student gave feedback on its negative and positive aspects and this information was used to compose the results. From the results, the method showed to be effective because more than half the students pointed out that it developed their sense of responsibility and was innovative. Conversely, it may have failed with respect to the distribution of time, what may have affected the results of the groups. Therefore, the method proved to be promising, but it still demands some improvements for subsequent applications.

Keywords: Assessment, Circuit, Engineering, Foundation Design, Zone of Proximal Development.

1. Introduction

The assessment of the students' academic results is one of the most challenging tasks of the educational system[1]. The subjectivity of corrections, the lack of clarity and objectives in the applied evaluations and a deficient comprehension of the assessment process' intentions reveal that challenge. Even though many people may believe that the traditional evaluation systems are objective, especially on the application of written tests, it can be perceived that these systems tend to be subjective. This subjectivity, which has its own merits, reflexes the culture and experiences of the professor on his actions but is still impregnated by the logic of classification and selection[2]. Accord to Noizet & Caverni, these tendencies demonstrate the subjectivity of the evaluation process:

- A tendency of the professor to overestimate the first tests and underestimate the last ones (order effect);
- A tendency to attribute the same grade to a student considering his performance on previous tests (assimilation effect);
- A tendency to consider the academic and social status of the student during the correction (origin effect)
- A tendency to correct the test based on the behavior of the students and the formal aspects of the test like presentation and spelling (halo effect); and
- A tendency to use the "extremes", positive and negative, as a reference for correction (contrast effect).

Regarding the lack of clarity and objective on the evaluations, what can be observed is that the school has used the tests' results as a mechanism to determine the reach of the educational objectives[4]. Therefore, the failure of the students in the assessment process may be a result of a deficient practice in the construction and clarification of the criteria used in the evaluation. In this way, the assessment process has as its purpose to verify whether the proposed objectives have been achieved, measuring, somehow, the distance between the students and the predetermined intentions[3,5].

Besides, for many times the professors have a positivist perspective on education and the evaluation systems. In such cases, they tend to consider that only what is mensurable deserves to be investigated and that the evaluations must be an objective measure of the academic performance. As a result, they tend to consider education as a technological process and neglect some educational and developmental aspects of the students learning process[5,6].

For many times, such tendencies tend to compromise the quality of the educational process. As the positivist perspective refers to only one valid explanation for a given phenomenon, the "correct" answer is overrated. The loss of quality in education, then, can be explained by a frenetic seek for grades and credits to the detriment of the true comprehension of the contents and their meanings[5].

In that manner, the professors must promote forms of assessment that allow the students to become aware of their learning process, what overcomes the traditional evaluation models, which are classificatory and authoritarian. In this way, the assessments become a tool that reflects the intentionality of the educational process, not being them the objective of the educational process[2,7]. In this sense, the assessment turns into a procedure to comprehend the advancements, the limits and the difficulties of the educational process in a provocative action of the professor that challenges the student to reflect upon what he is learning and his lived situations in order to achieve scientific learning[8,9].

Therefore, this paper presents the results of applying the Circuit, an alternative form of assessment, in a Foundation Design class, a 5th-year Civil Engineering undergraduate course at the Universidade Estadual de Santa Cruz (UESC), in Ilhéus-BA, Brazil.

2.The Circuit

Education is a social and socializing phenomenon whose purpose is to promote people's development[10]. This social characteristic of education demonstrates that the assessment process represents a collective activity that occurs in various ways and with various objectives[2]. Collaborative and cooperative learning have been used in academic level given their potential to promote active learning that stimulates critical thinking, the interaction between students and problem-solving skills. Such proposal recognizes the learning process as a social practice and not as a transfer of information from the professor to the student[11].

The Circuit is a form of evaluation based on the interaction and cooperation between the students that aims to verify the results of the learning process through ludic activities. The students are divided into groups, and they must solve the proposed problems at the same time they assess the solutions proposed by their peers.

Presented as a successful pedagogical intervention, the circuit has been applied in Calculus classes on the tests referring to integral by substitution, for example[8]. The students of each group go, one by one, to the blackboard and try to solve questions drawn by them. In the case one of the students is not convicted of his answers, he can request help from their group mates at the cost of a percentage of the grade of the activity. In the end, the other members of the group assess the answer given by the first student and only then the professor corrects their final answer. If the first student asked for the help of his mates and/or the corrections made by the other members are wrong, the professor deducts some points. Consequently, the final grade of the group depends on both the ability of a student to solve the problem and the group to correct the answer if it is incorrect.

In this sense, the circuit reinforces the idea of the Zone of Proximal Development, from Vygotsky. Customarily, we tend to think that the mental development is related exclusively to the ability to solve problems independently, what is in the so-called Actual Developmental Level, disregarding the ability to deal with these problems with the help of the professors or the colleagues, what is the Zone of Proximal Development. In Vygotsky's words, the Zone of Proximal Development "is the distance between the actual developmental level as determined by independent problem solving and the level of potential development as deter-

mined through problem solving under adult guidance or in collaboration with more capable peers"[12].

In this manner, the Actual Developmental Level indicates the retrospective mental development while the Zone of Proximal Development indicates the prospective mental development, i.e., the potential of the student to learn, what can be achieved through socialization[12]. This concept of the actual developmental level is widespread and perpetuates in the academic setting since professors generally tend to use assessment systems that measure exclusively the ability to solve problems independently as an indicator of the level of mental development and neglect the potential to deal with other problems considering skills still evolving.

3.Methodology

In this Foundation Design course (Fall 2017) the Circuit was applied in the first examination of the semester. The class of 15 students was divided into five groups of three students each, and the examination was divided into two main parts. In its first part, each group had to write and assess a report for a Standard Penetration Test (SPT) and in the second part they had to write and asses a report for a Cone Penetration Test (CPT).

The groups were initially divided considering the alphabetical order but, between the first and the second parts, each of them changed one of its members. Each student in the group performed a different role in the activity. The first student was called the Engineer and was responsible for producing a complete report for a SPT, or a CPT, in 30 minutes. He had to produce the report based solely on the data provided by the Professor.

If the Engineer considered that some information was missing, he would request help and the second student, called the Technician, would have to provide the missing data in up to 15 minutes. The Engineer could not use any info that was not provided by either the Professor or the Technician. In this case, the Technician would have to provide consistent data, i.e., provide a value of N for SPT within the range expected for each type of soil, for example.

Finally, the third student, the Manager, was responsible for assessing the produced report, which would either be accepted if he considered it was correct or rejected because of incomplete information. After the verdict of the Manager, the Professor assessed the report considering the completeness of the work of the Engineer, the data provided by the Technician and the verdict of the Manager.

The three members of each group could neither meet nor discuss during the activity, except if the first student requested it. In this case, the group would give up on part of the final grade.

When the class was finished, the Professor provided each student with a sheet of paper in which they had to add some comments about the examination. The students were not required to identify themselves, so they could express their actual thoughts about the process. Finally, these answers were collected, grouped, and analyzed based on the number of similar answers. Figure 1 presents a summary of the methodology applied.

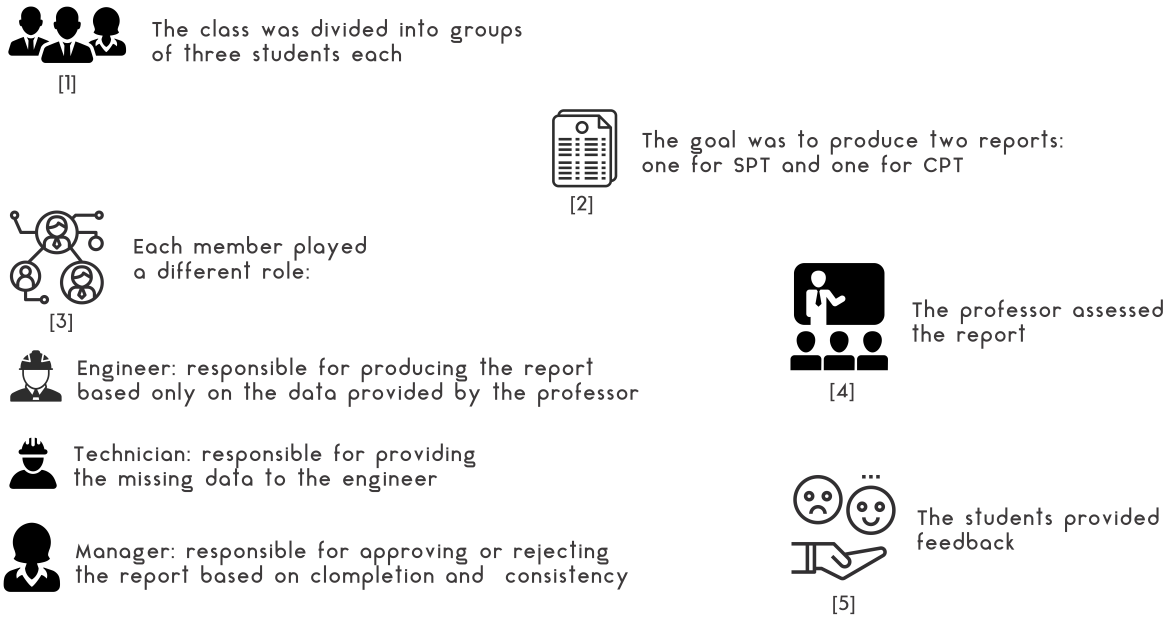
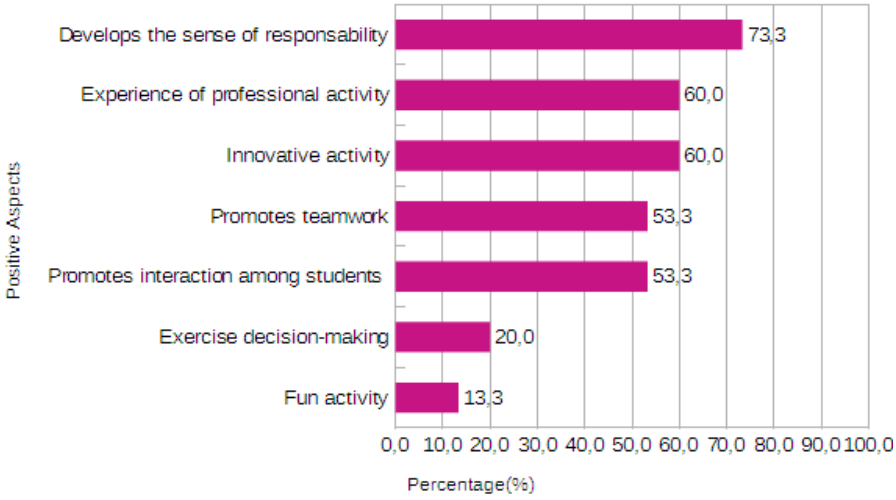


Figure 1. The Circuit.

4. Results and Discussion

Considering the results obtained from the feedback, the answers were grouped into positive and negative aspects. Graphic 1 presents the percentages of each of the positive aspects mentioned in the feedback.

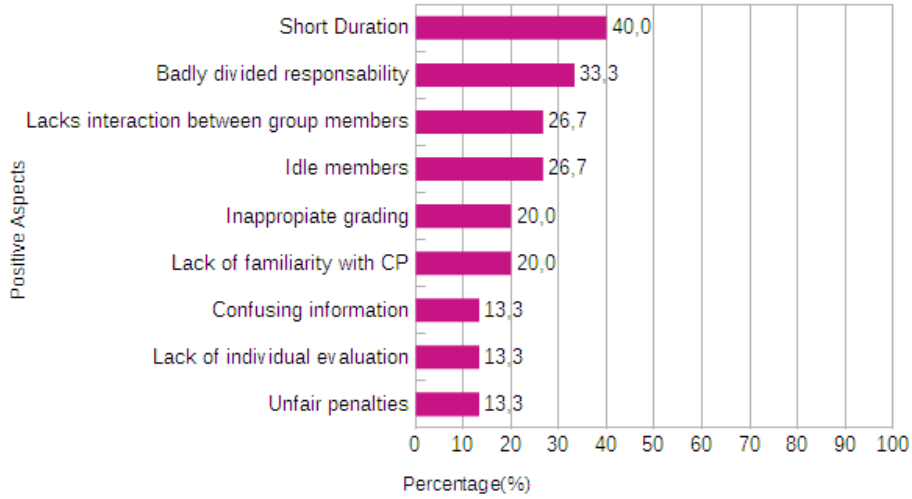


Graphic 1. Distribution of positive answers.

As it can be seen in the Graphic 1, most of the students, 73,3 %, considered that the

activity developed their sense of responsibility and more than half the students considered that the activity promoted an experience of the professional practice, teamwork, interaction between them, and was innovative.

The students pointed out some negative aspects of the activity as well, what is shown in Graphic 2.



Graphic 2. Distribution of negative answers.

As it is shown in the Graphic 2, 40 % of the students considered that the activity had a limited duration and some of them considered that the responsibilities among the members of the groups were badly divided, the activity lacked interaction between group members, there were idle members in some parts of the activity and the grading system was inappropriate.

To the opinion of the professor who applied the Circuit, the method proved promising. It could be noticed that the students were engaged in the activity and worked collaboratively to decide which role each student would play in the assessment. In addition, they assessed their level of confidence in their answers, asking, or not, for the help of their peers when they were not sure of their answers.

Regarding the negative aspects pointed out by the students, it will help on subsequent applications of other entertaining and engaging forms of assessment. As it was the first time the professor tried something so unusual on an examination, it is still open to changes and improvements.

5.Conclusions

Education is a social and socializing phenomenon whose purpose is to promote people's development. At the same time, the evaluation systems applied in many institutions may have been summarized in the task of grading, what may classify and select students based exclusively on their performances of written examinations. Therefore, it is critical to develop and use alternative methods of assessments that explore different skills of the students and the social aspect of education and learning processes.

The Circuit, an alternative evaluation exercise, has been shown as a promising activity that promoted both interactions between students and their sense of responsibility. As the

results of this paper show, the students in Foundation Design at the Universidade Estadual de Santa Cruz in the Fall semester 2017 considered the method promising because it explored their sense of responsibility, was innovative, promoted interaction between them and teamwork[13]. Conversely, the students pointed out that the method applied still lacks some features that may be improved in subsequent applications.

Acknowledgment

To the Universidade Estadual de Santa Cruz and to the Foundation Design class of 2017, which made this paper possible.

Reference

1. PACHECO, J. A.; ZABALZA, M. A. (Org.). A Avaliação dos Alunos dos Ensinos Básico e Secundário. In: Colóquio Sobre Questões Curriculares, 1, 1995, Braga. *Proceedings...* Braga: Instituto de Educação e Psicologia da Universidade do Minho, 1995. p. 39-49.
2. FERNANDES, C. O.; FREITAS, L. C. *Indagações Sobre Currículo: Currículo e Avaliação.* Brasília: Ministério da Educação, Secretaria de Educação Básica, 2008. 44 p.
3. PACHECO, J. Avaliação da Aprendizagem. In: Leandro Almeida e José Tavares (Org.). Conhecer, aprender e avaliar. Porto: Porto Editora, 1998. pp. 111-132.
4. TYLER, R. W. *Princípios Básicos de Currículo e Ensino (Trad.).* Porto Alegre: Editora Globo, 1981.
5. RIBEIRO, L. R. C.; ESCRIVÃO FILHO, E. Um Sistema de Avaliação no Ensino de Engenharia: A Visão dos Alunos em uma Experiência com o PBL. In: CONGRESSO BRASILEIRO DE EDUCAÇÃO EM ENGENHARIA, 35., 2007, Curitiba. *Procedings...* Curitiba: UFPR, 2007. Available in: <http://www.abenge.org.br/cobenge/interna.php?ss=12&ctd=78>. Acessed on: 14 mai. 2018.
6. SACRISTÁN, J. G., GÓMEZ, A. P. *La enseñanza: su teoría y su práctica.* Ediciones Akal: Madrid, 1989.
7. DARSIE, M. M. P. Avaliação e Aprendizagem. *Cadernos de pesquisa*, São Paulo, n. 99, p. 47-59, 1996. Available in: <https://dialnet.unirioja.es/servlet/articulo?codigo=6208689>. Acessed on 30 mar. 2018.
8. LODER, L. L. et al. Intervenções Pedagógicas Bem-Sucedidas em Cursos de Engenharia. In: Oliveira, V. F. et al. (Org.). *Desafios da Educação em Engenharia: Formação em engenharia, Internacionalização, Experiências Metodológicas e Proposições.* Brasília: ABENGE, 2013. p. 164-231.
9. HOFFMANN, J. Experiências em Avaliação Mediadora na Universidade a Partir do PAAP. In: MORAES, V. R. P. (Org.). *Melhoria do Ensino e Capacitação Docente: Programa de Atividades de Aperfeiçoamento Pedagógico.* Porto Alegre: UFRGS, 1996.
10. COLL, C. Un marco de Referencia Psicológica para la Educación Constructivista del Aprendizaje y de la Enseñanza. UPN. In: *Corrientes pedagógicas contemporáneas. (Antología Básica)*, SEP-UPN. México, p. 28-44, 1994.
11. TORRES, P. L.; IRALA, E. AF. *Aprendizagem Colaborativa: Teoria e Prática. Complexidade: Redes e Conexões na Produção do Conhecimento.* Curitiba: SENAR-PR, 2014.
12. VYGOTSKY, L. S. *Mind in Society: The Development of Higher Psychological Processes.* Harvard University press: Cambridge, 1980.
13. RODRIGUES, P. B.; NOVAES, P. O.; DO EGITO COSTA, S. C. F. Flipping the classroom: The application of The Circuit as an objective evaluation action in foundation design. In: INTERNATIONAL CONFERENCE ON ALIVE ENGINNERING EDUCATION, 2018, Puerto Iguazú. *Electronic Proceedings...* Goiânia: Dr. Jr., 2018. Available in: <https://icaeedu.emc.ufg.br/up/920/o/ICAEEdu-2018-Proceedings-Online-Resource-version-3.0.pdf>. Acessed on: 10 nov. 2018.