CONCEPT MAPS WITH ERRORS FOR ASSESSMENT: THE USE OF AN ONLINE PLATFORM FOR THE DISTRIBUTION OF THE TASK AND INSTANT AND PERSONALIZED FEEDBACK

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Abstract. Concept Maps (CMap) are useful tools for learning assessment because they are able to reveal elements of the structure of conceptual knowledge of the student about a particular subject. When the CMaps are built by students there is a need to be trained in the technique and the teacher must set clearly the way to be prepared. In addition, the correction of maps and the feedback for each student requires a teacher's time what can become time consuming in this process and the use of this tool bit attractive. Thinking about the need to streamline the assessment process, this work proposes an assessment task, located on the platform SERO! and based on the use of conceptual maps prepared by the teacher that includes intentional errors in conceptual propositions for students to identify them. The teacher chooses the concepts and conceptual relations more relevant content for information about students ' understanding. An activity using maps with errors (CMap/E) is applied by up to 20 minutes, allowing the generation of instant feedback and personalized because the teacher lets prepared instructional materials related to each error of the propositions. The use of online platforms facilitates the process of distribution of tasks and feedback, contributing with the inclusion of CMaps in the routine of the teachers. The CMap used in this work to obtain empirical data was part of the formal assessment of the discipline Natural Sciences offered by the University of São Paulo (USP) to students entering the school year of 2017. From it, it was found the percentage of identification of errors that were entered by the teacher and what kind of feedback should be delivered to students in a personalized manner.

***Keywords**:* concept maps with errors, personalized feedback, assessment.

1 Introduction

Concept Maps (CMaps) are graphic organizers very used as an assessment tool for learning (Novak & Cañas, 2010). For the implementation of this type of assessment task must take into consideration the time for the preparation of CMaps, therefore it is necessary to retrieve information, select concepts, establish relationships between them and organize any hierarchical structure. This means that the mapper should dominate the content of the subject and the construction technique of CMaps. The results of the assessment task can be compromised if class time does not fit that and if the teacher does not have a plan that contemplates this moment of learning the technique of mapping (Correia, Cabral & Aguiar, 2016; Aguiar & Correia, 2014). The implementation of CMaps as assessment tools in classrooms offers some logistical challenges hindering your efficiency, preparation, execution and analysis by consuming the time and efforts of professor (McClure, Sonak & Suen, 1999). Because of this, this tool is not widely used.

1.1 Objective

This paper aims to propose the use of CMaps elaborated by professor, as an assessment tool, in order to make the time in the assessment in the classroom more efficient and productive.

1.2 Concept Maps with errors (Cmap/E)

In this new model the teacher develops the CMaps and includes, intentionally, errors in the propositions on the topic under study and the student must identify them. Moreover, can also be requested for students justify these errors (Correia et al., 2016). This approach gives greater practicality logistics to the task (McClure et al., 1999), because there is no need for training students in the technique of concept maps.

In order to try to minimize the logistical challenges that occurs when trying to analyze the structure of the student's knowledge to a subject on which he draws up your own CMaps, this work brings a new form of assessment using this graphic organizer. With the use of online platforms, this process occurs instantaneously, and the student receives the guidance on how to rethink the content that has not yet been understood. This favors for delivery of feedback in higher education is more efficient, because sometimes the teacher very late deliveries or provides these feedback (Carless, 2007; Price, Handley & Millar, 2011).

Figure 1 shows the CMap that was delivered to students during this formal assessment. It contains 27 concepts and 31 propositions, being 12 of them with conceptual errors. The propositions (P) that had errors added by professor are those highlighted by the color gray in CMap All the concepts contained within this CMap were treated in different materials selected by the teacher and used along the lessons of climate change and in this scenario the students should be able to identify these errors because they had discussions and activities on this theme leading up to this assessment.

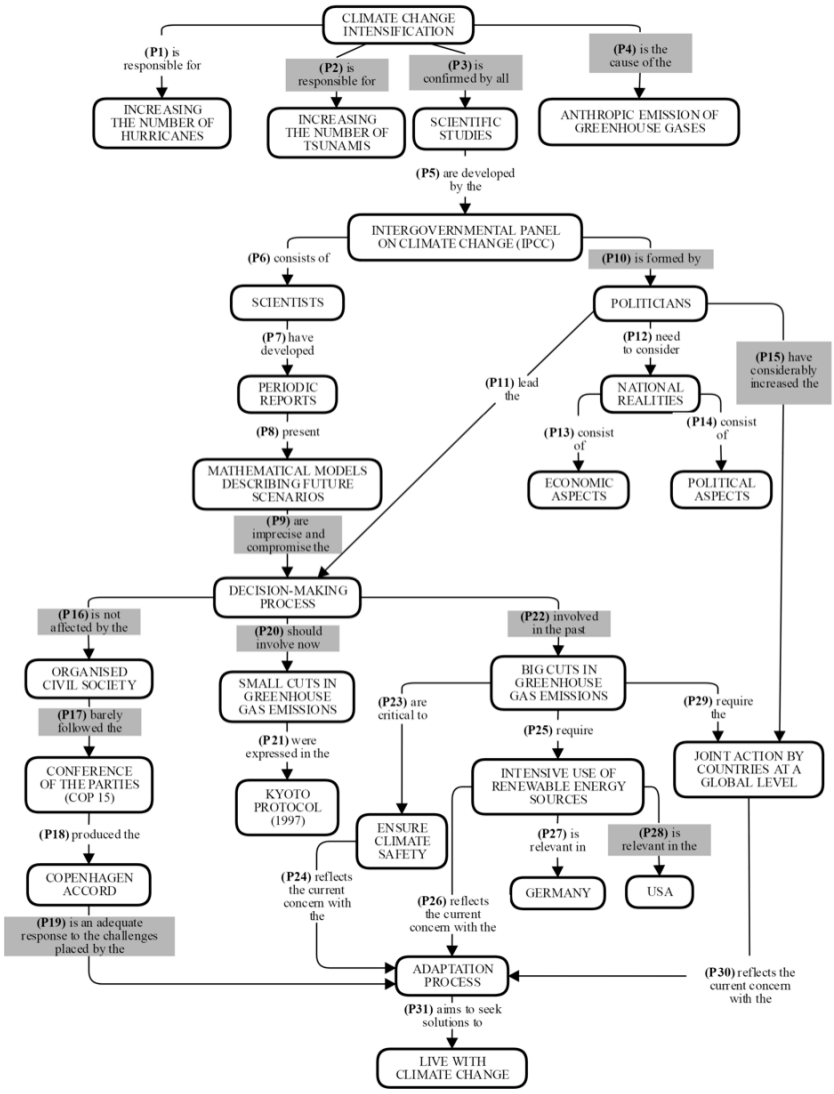

Figure 1. CMap/E (errors are highlighted in grey boxes) delivered to students to assess understanding of climate change. Focal Question: How is contemporary society responding to the intensification of climate change? This map has been translated from Portuguese.

2 Methods

2.1 Context and Collecting

Data collection was carried out with the participation of 86 students, during a formal assessment of the discipline of Natural Sciences offered to students entering the University of São Paulo (USP) in the school year of 2017 and that dealt with the subject of climate change. The task of CMap/E was distributed to students through a virtual platform SERO! (https://www.serolearn.com) that allows the insertion of assessment tasks using CMaps. The material was collected and analyzed empirical data from the assessment that used the CMap/E of Figure 1 and this revealed important information about the understanding of the students in the content of the discipline.

2.2 Assessment process with feedback

In addition to improving logistical practicality, the use of CMap/E can increase the objectivity of the assessment. When elaborating the CMap, the teacher can include the incorrect propositions in specific concepts, which are relevant to the understanding of a certain content. The results that teacher obtains with CMap/E based assessments may reveal specific limitations in the conceptual structure of each student, allowing the teacher to provide an accurate and fast feedback, since he will have a defined correction protocol and instructional materials already selected for each error. Figure 2 summarizes the assessment process using CMap/E and the possibility of indicating instructional material to students according to their performance in the task. The numbers on the lines indicate the content of the propositions and the types of instructional materials (video, text, graphics, and audio) provided to students according to the non-identification of errors. For each proposition the student does not identify as incorrect will result in instructional material.

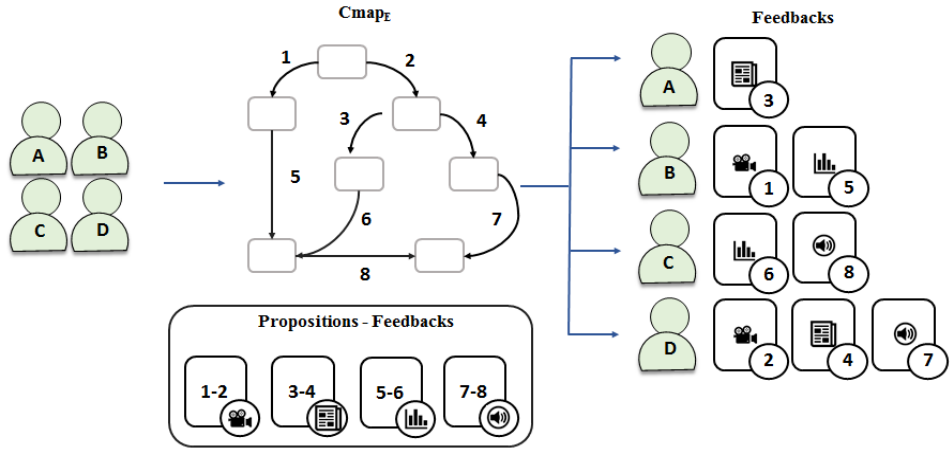

Figure 2. Assessment process with CMap/E, feedback delivery and instructional material for guided study.

Some students may need more and others with less instructional materials for this guided study period. This will allow the student to delve into the content in a more targeted way, then in another moment a new evaluation can be performed to show if there was any recovery in some misunderstood content previously. The possibilities for feedback with instructional material, as well as the form that can be used to assess students after the guided study period, will be illustrated and discussed in the next session.

3 Results and Discussion

From the CMap/E, the performance of the students in the assessment task was obtained, represented by the percentage of identification of the errors inserted in the CMap, which together with the average of correct answers and the levels of difficulties, formulated personalized feedback. By knowing the difficulties of the students in the task of CMap/E, it can be useful for the assessment of the teacher, because it allows him to deliver this feedback with instructional materials in a precise way.

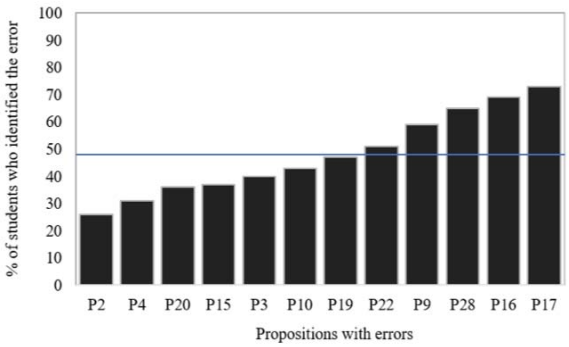

Figure 3. Student performance on the task of CMap/E.

To illustrate the feedback, we will use the case of the propositions P19 and P22 that proved to be with an intermediate level of difficulty and the propositions P16 and P17 were the easiest mistakes to be identified by the students. Table 1 shows the content of each proposition with its respective feedback that should be delivered to the student if he does not identify the error.

P19: The Copenhagen Accord - was a satisfactory answer to the needs of the → process of adaptation; Read the file dealing with the Copenhagen Accord for its purpose and expectation about it.
P22: decision-making process → involved in the past → major cuts in greenhouse gas emissions; Read the first IPCC Climate Report (1990) dealing with cuts in greenhouse gas emissions. This document contributed to deliberations during the Kyoto Protocol in 1997.
P16: decision-making process → does not suffer interference from → organized civil society; Watch again the interview of Carlos Nobre and pay attention to the excerpt: 41m47s - 45m54s on examples of civil society interface.
P17: organised civil society − barely followed the Conference of the parties 15 → (COP 15); Re-read the excerpt of text from Sergio Abranches which deals with the need and difficulties of a global action.

Table 1. Propositions with errors inserted into CMap and examples of feedback.

4 Final Considerations

The results of this work showed that much information is available to the teacher, such as the performance of the students in the task. CMap/E also provides an overview of the class quickly and effectively and student errors can be mediated through personalized feedback that can be presented in different formats.

The theme used in this work is relevant and appropriate for higher education, because it will allow the teacher to check how your student is understanding the most important concepts of the subject in class, regardless of the field of knowledge. The theme climate change served as a model to illustrate how are complex conceptual relations and what the teacher can do in a short time of class when using CMap/E as assessment instrument. These results showed that it is possible to perform the distribution of assessment tasks as well as the delivery of instant feedback and personalized on a large scale. For better research on students learning, will be collected for future studies, data on the effect of delivery of feedback.

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