COMPARISON OF CONCEPTUAL MAPS PRODUCED FROM A TEXT

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Objectives

The intent of this work are: 1) to compare conceptual maps produced from a text passage by udergraduate students; 2) to study different kind of standards to compare conceptual maps.

Sample

38 undergraduate chemistry students were divided into 21 groups and produced a conceptual map based in an introductory text of 254 words taken from the book "General Chemistry" of L. Pauling (1988) that defines what is chemistry.

The conceptual maps were drawing by the software Cmap Tools[2].

We asked to students answer is their maps the focal question: **What´s Chemistry?** The most important concepts were detached in bold in the text.

Standards for comparation

Original Text (OT)

*"The **universe** is composed of **matter** and radiant **energy**. **Matter** (from the latin materia, meaning wood or other **material**) may be defined as any kind of mass-energy that moves with velocities less than the velocity of light, and radiant energy as any kind of mass-energy that moves with the velocity of light.*

*The different kinds of **matter** are called **substances**. **Chemistry** is the science of **substances** – their **structure**, their **properties**, and the **reactions** that change them into other **substances**.*

*This definition of **chemistry** is both too narrow and too broad. It os too narrow because the **chemist** in his study of **substances** must also study raduant **energy**, in its **interaction** with **substances**. He may be interested in the color of **substances**, which is produced by the absorption of light. Or he may be interested in the **atomic structure** of **substances**, as determined by the diffraction of x-rays or by the absortion or emission of radiowaves by the **substances**..."*

Extracted by: Linus Pauling, General Chemistry, Dover, 1988.

Modified Text (MT)

*The **universe** is composed of **matter***
*(The **universe** is composed of) and radiant **energy***
***Matter** (from the latin materia, meaning wood or other **material**) [...]*
*The different kinds of **matter** are called **substances***
***Chemistry** is the science of **substances** […]*
***(substances) -** their **structure**,*
(substances)** their **properties…

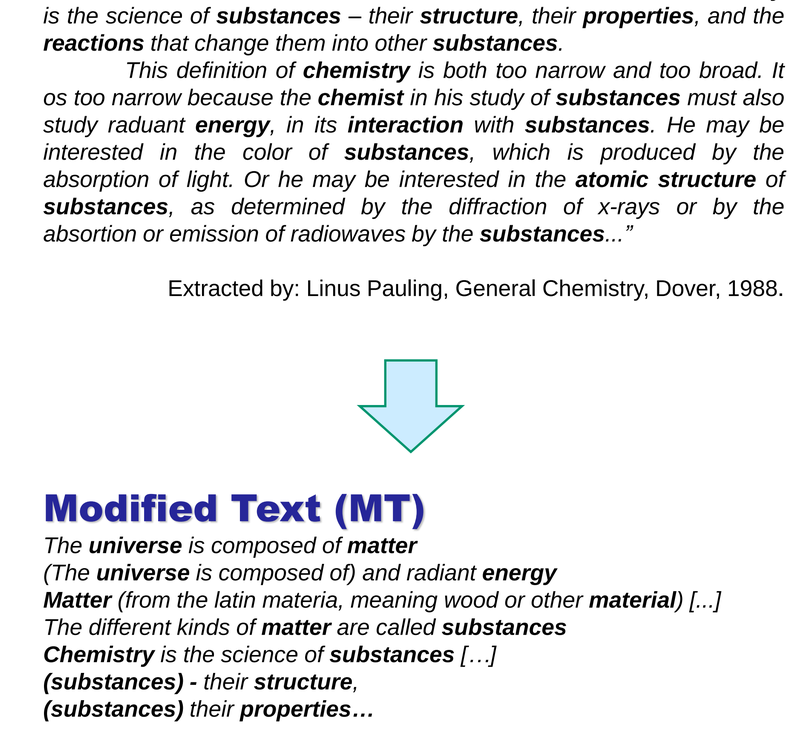

Figure 1: Standard coceptual map (SCM)

Representative Conceptual Map (RCM)

•Was ordered the 20 most used concepts (fig. 2).

•Each conceptual map was converted in a association matrix were for each pair of existent concepts was assigned the value 1.[3]

•The matrices was added (fig. 2).

• A representative conceptual map (RCM) from student's maps was obtained (fig 3). A link between two concepts was considered if it was present in at least 5 (25%) different conceptual maps.

Tabela 1. Resultados da comparação dos mapas conceituais com os padrões.
* Valores de PMC expressos em %. Para r>0,77, p<0,0001.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
ASTROPHYSICIST	1		0	0	7	10	0	0	0	1	0	0	0	0	0	0	0	1	0	2	1
ATOMS	2	0		1	1	1	0	2	1	6	0	0	1	0	1	1	0	0	0	13	0
BIOLOGIST	3	0	1		6	0	0	0	0	0	1	0	0	0	0	8	0	3	0	2	1
SCIENCE	4	7	1	6		1	1	1	0	5	6	1	2	0	3	3	1	13	1	5	0
CELESTIAL BODIES	5	10	1	0	1		0	0	0	0	0	0	0	0	0	0	0	2	0	17	1
ENERGY	6	0	0	0	1	0		0	0	0	0	13	1	0	0	0	0	10	0	6	15
STRUCTURE	7	0	2	0	1	0	0		3	0	0	0	0	0	0	0	2	3	0	18	0
ATOMIC STRUCTURE	8	0	1	0	0	0	0	3		0	0	1	0	0	0	0	0	6	0	9	0
PHYSICIST	9	1	6	0	5	0	0	0	0		0	0	0	0	1	0	0	0	0	1	0
GEOLOGY	10	0	0	1	6	0	0	0	0	0		0	0	1	6	0	0	0	0	3	0
INTERACTON	11	0	0	0	1	0	13	0	1	0	0		2	0	0	0	1	5	0	11	0
MATTER	12	0	1	0	2	0	1	0	0	0	0	2		12	0	0	2	1	0	20	16
MATERIAL	13	0	0	0	0	0	0	0	0	0	1	0	12		0	0	0	1	0	0	0
MINERALS	14	0	1	0	3	0	0	0	0	0	7	0	0	0		0	0	0	0	16	0
LVIING ORGANISMS	15	0	1	8	3	0	0	0	0	0	0	0	0	0	0		0	0	0	17	0
PROPERTIES	16	0	0	0	1	0	0	2	0	0	0	1	2	0	0	0		6	3	22	0
CHEMISTRY	17	1	0	1	15	0	10	4	6	0	0	5	1	1	0	0	6		6	12	0
REACTIONS	18	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	3	6		26	0
SUBSTANCES	19	3	12	4	5	17	6	18	9	1	3	11	20	0	16	17	22	12	26		0
UNIVERSE	20	0	0	0	0	0	16	0	0	0	0	0	16	0	0	0	0	0	0	0	

Figure 2: Final Matrix

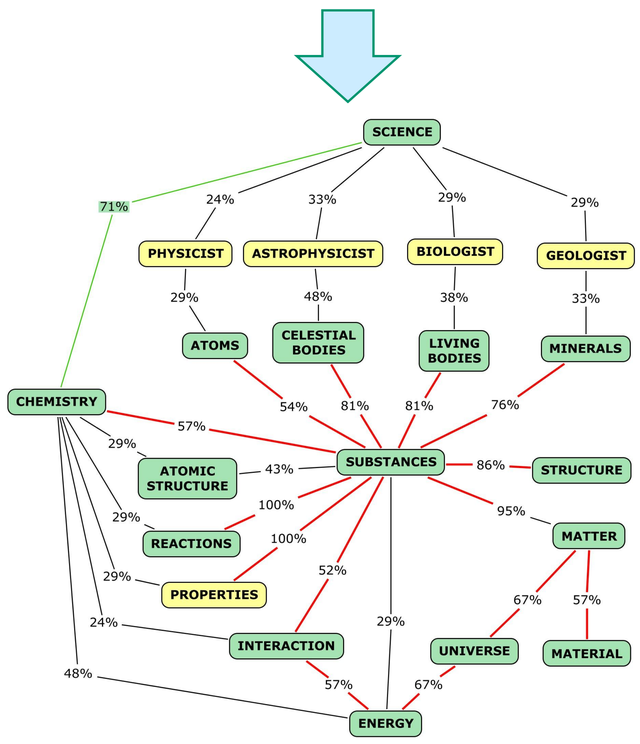

Figure 3: Representative conceptual map (RCM) .

Analysis

The maps were then transformed in computer text-files that list each of its propositions in the form of sentences and were compared with the aid of the software ALA Reader[3], which allowed us to analyze the co-occurrence between each concepts in two different maps. Thus, for each map, was calculated the number of links present and, for each two distinct map, the number of common links.

As a value of similarity between two maps was used the average percentage of concordance (APC), defined as the average number of common links between two maps, divided by the total links of each map.

$$APC = \left(\frac{NL_{m1m2}}{NL_{m1}} + \frac{NL_{m1m2}}{NL_{m2}} \right) . \frac{1}{2}$$

APC = average percent of concordance;
NL_{m1m2} = number of comun links between map 1 and map2;
NL_{m1} ou NL_{m2} = = number of total links for map 1 or map 2.

Results

- The propositions made by the students differed in relation to the links between concepts, denoting differences in the way to represent graphically the same text. The values of APC obtained in the comparison of the maps each other were between 15 and 88% (table 1);
- The comparison of maps OT and MT promoted greater dispersion of values of APC than with RCM and SCM;
- SCM is more similar to the texts (OT and MT) than RCM;
- There is a significant correlation between APC values obtained between students' maps with OT, MT and SCM, but not between these with RMC;
- The APC obtained with the standards are not correlated with the number of links of each map.
- In conclusion, the type of links between concepts, expressed by APC, is useful in the analysis of conceptual maps produced with the objective to represent a written text.

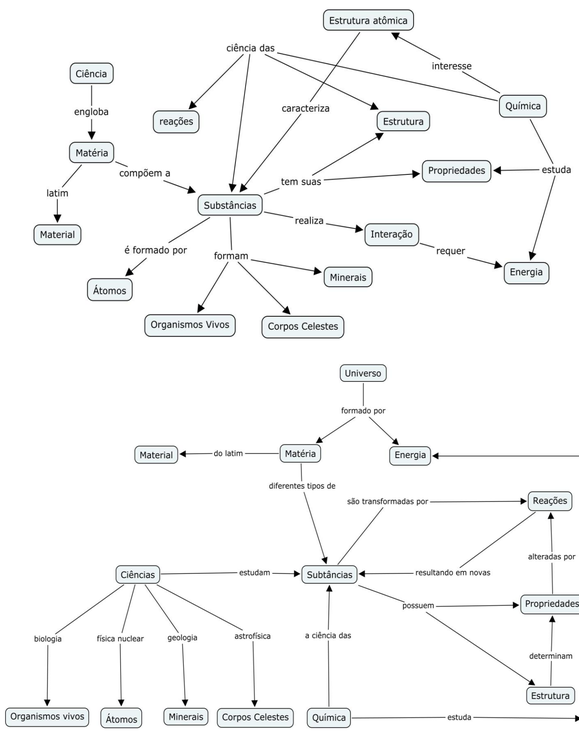

Figure 3: Student's conceptual maps that presented the greather dissimilaties (APS = 15%).

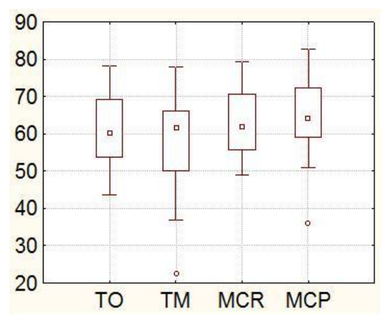

Figure 4: APC values to each standards.

Table 1: Comparisons for different APC values.

	Comparisons between standard maps (PMC)			Pearson's correlation coefficient for APC achieved for different standard.			
	OT	MT	RCM	OT	MT	RCM	SCM
MT	78			0.77			
RCM	69	66		0.45	0.35		
SCM	82	88	75	0.84	0.85	0.53	
NL				0.34	0.27	0.61	0.48

*APC values in %. For r>0,77, p<0,0001.

References

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Acknowledgements

To students from Integrated Chemistry III discipline (2008).

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