DIDACTICA MATHEMATICA, Vol. 42 (2024) , pp. 67–70

GAMIFICATION IN CALCULUS: WORKSHEETS FOR TOPOLOGY

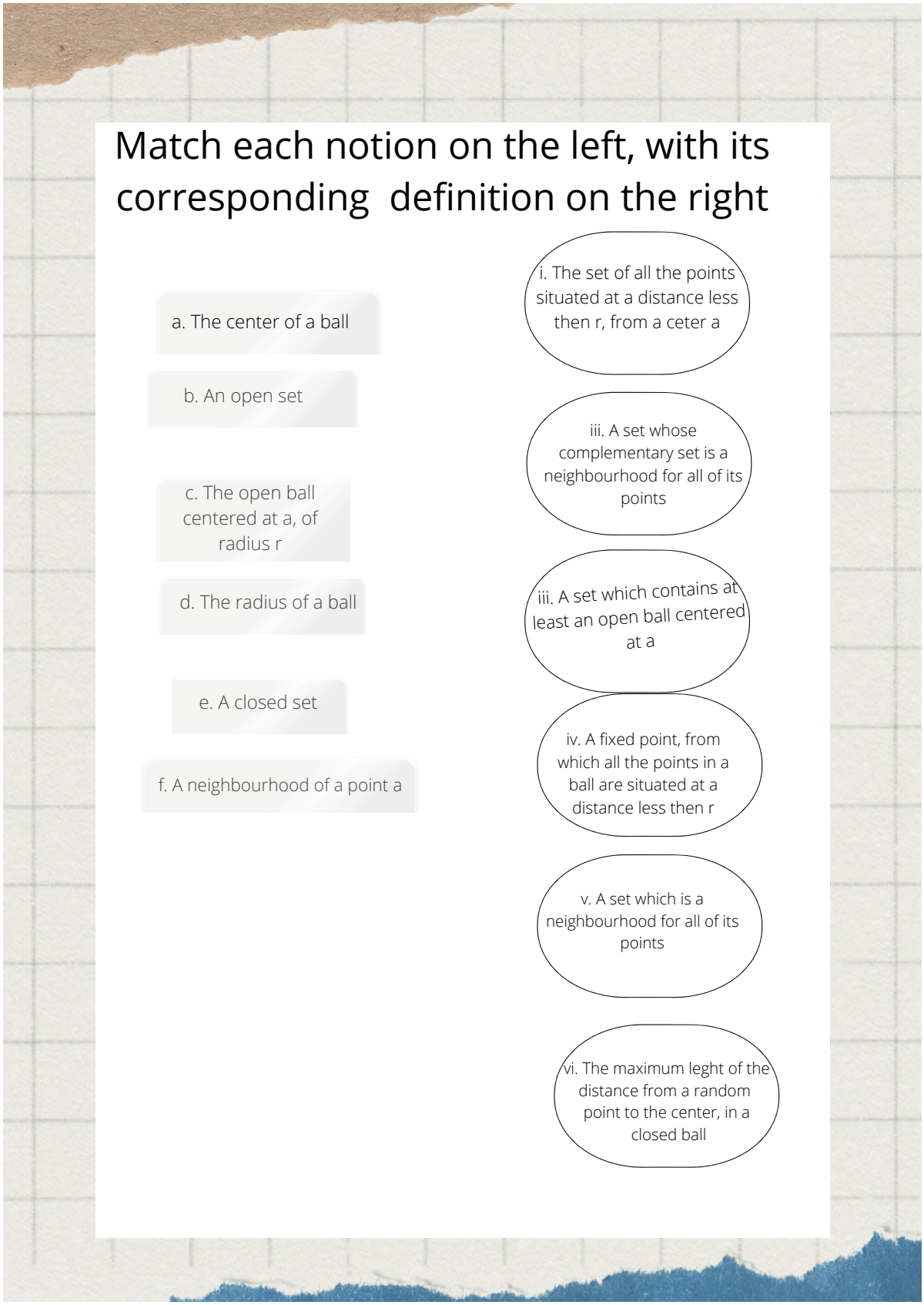
Anca GRAD

Abstract. Thorough understanding of basic notions in the topology on $\mathbb{R}$ is fundamental for a large variety of fields in mathematics. Even tough basic topology notions are supposed to be introduced even to high-school students studying calculus, we, those who teach students in unviersity, often find ourselves faced with the sad reality, namely the students' lack of understanding of such notions. To overcome such a drawback a solution might be found in gamification, especially since topology is such an appealing field for visual aids in learning. Following up the article [3], where the reader was offered an example of an entire lecture and seminar build with the help of visual aids having gamification as a backround, this article comes as a completion by presenting not only two examples of worksheets addressed to those interested in a though understanding of basic notions in topology on $\mathbb{R}$, but also the online tool used to create them.

1. EXPLICIT WORKSHEETS FOR TOPOLOGY

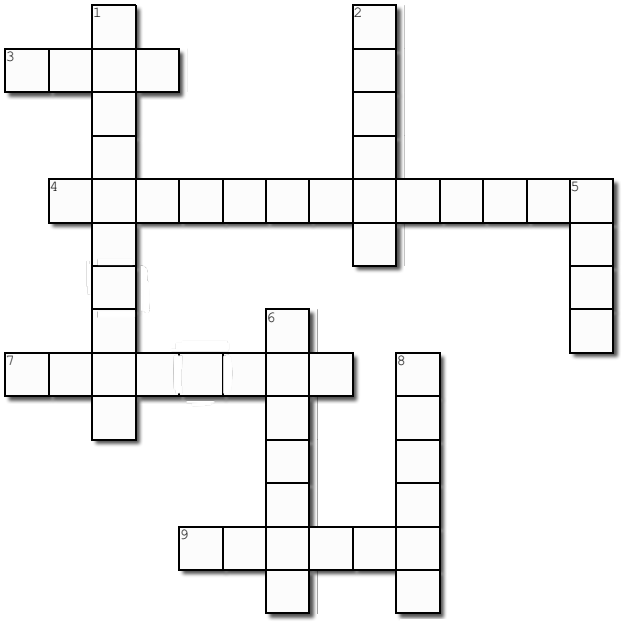
Learning something produces a change in the amount of knowledge an individual posses, following a processing stage. It can be either reproductive or deep. As teacher, we should all aspire towards the deep understanding. Multimedia learning is supposed to help along the process, by making use of both verbal and visual ais, as mentioned in [6]. Active processing of information is done by selecting and organizing relevant information followed by its integration in the long term memory. The more we stimulate the processing and blending, the better the knowledge transfer becomes.

In the following we present two types of worksheets as a follow up of the lecture presented in [3], whose theory was inspired by [1], having in mind the use of visualization tools in teaching mathematics in college of education emphasized also in [5] and [4].


Match each notion on the left, with its corresponding definition on the right
a. The center of a ball
b. An open set
c. The open ball centered at a, of radius r
d. The radius of a ball
e. A closed set
f. A neighbourhood of a point a
i. The set of all the points situated at a distance less then r, from a ceter a
iii. A set whose complementary set is a neighbourhood for all of its points
iii. A set which contains at least an open ball centered at a
iv. A fixed point, from which all the points in a ball are situated at a distance less then r
v. A set which is a neighbourhood for all of its points
vi. The maximum leght of the distance from a random point to the center, in a closed ball

Name: Topology

Complete the crossword puzzle below



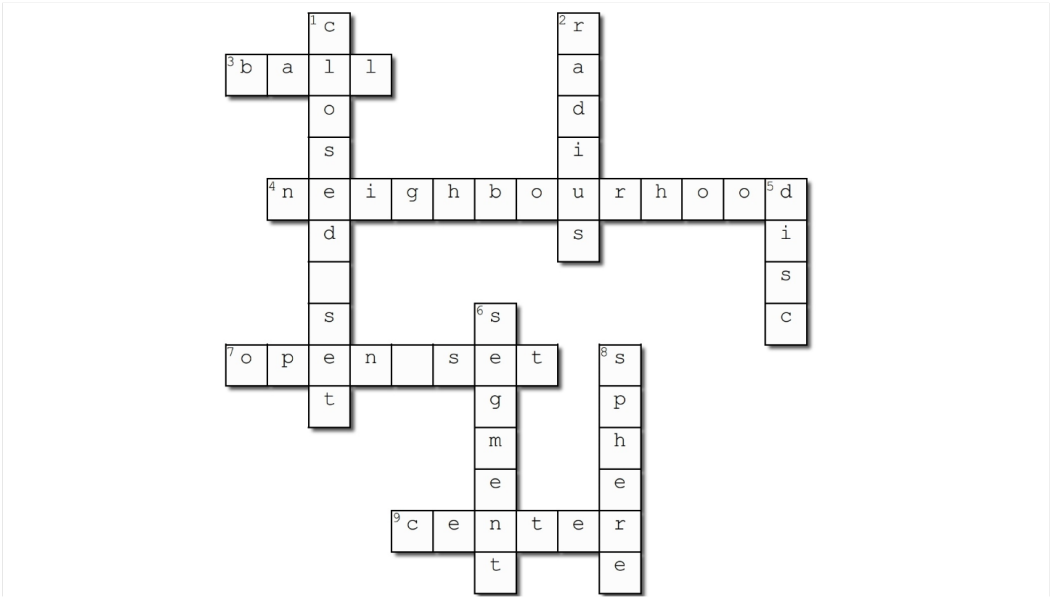
Created using the Crossword Maker on TheTeachersCorner.net

Across

3. The set of all the points situated at a distance less (or less or equal) than r, from a center a
4. A set which contains at least an open ball centered at a
7. The set of all the points situated at a distance less then r, from a center a
9. A fixed point, from which all the points in a ball are situated at a distance less then r

Down

1. A set whose complementary set is a neighbourhood for all of its points
2. The maximum lenght of the distance from a random point to the center, in a closed ball
5. A two-dimensional closed ball
6. A one-dimensional closed ball
8. A three-dimensional closed ball



The older the students get, the less worksheets are offered to them to support their deep learning. It is automatically assume that a certain level of maturity should be enough to guide them through the university learning process. However, nowadays students come with a psychological background marked by he changes produced in our lives by the pandemic where they majority of learning was done online, by using multimedia tools. Their attention span is sometimes limited and lecturing style has to be adapted to these needs.

There are a lot of tools availabe to produce such teaching additional material. The one used in order to create the ones above can be used free of charge at www.teacherscorner.net .

REFERENCES

[1] D. I. Duca: *Analiză matematică* (vol I), Casa Cărţii de Ştiinţă, Cluj-Napoca, 2013

[2] A. Grad: *Abordare metodică a separării topologice a mulţimilor* $\mathbb{Q}$ *şi* $\mathbb{R}\backslash\mathbb{Q}$, Didactica Mathematica, vol. 35, pp. 33-44, 2017

[3] A. Grad: *Gamificarea in lecţia de analiză matematică*, Didactica Mathematica, vol. 41, pp. 45-56, 2022

[4] B. Joaler: *Mathematical Mindsets: Unleashing Students' Potential through Creative Mathematics, Inspiring Messages and Innovative Teaching (Mindset Mathematics)*, Jossey-Bass, 2022

[5] M. O. Fokuo, N. Opoku-Mensah, R. Asamoah, J. Nyarko, K. D. Agyeman, C. Owusu-Mintah, S. Asare: *The use of visualization tools in teaching mathematics in college of education: A systematic review* , Open Access Research Journal of Science and Technology, 2023, 09(01), 001–009

[6] Mayer, R.E.: *Multimedia learning*, Psychology of Learning and Motivation, vol. 41, pp. 85–139, 2002

Departamentul de Mateamtică
Facultatea de Matematică şi Informatică,
Universitatea "Babeş-Bolyai", Cluj-Napoca
e-mail: anca.grad@ubbcluj.ro