PROMOTING METACOGNITIVE AND INCLUSIVE TEACHING THROUGH GAMIFIED ACTIVITIES: THE ESCAPE ROOMS EXPERIENCE

PROMUOVERE UNA DIDATTICA METACOGNITIVA E INCLUSIVA ATTRAVERSO ATTIVITÀ LUDICHE: L'ESPERIENZA DELLE ESCAPE ROOM

Gianluca Amatori
Università Europea di Roma
gianluca.amatori@unier.it

Roberta Rosa
Università Europea di Roma
roberta.rosa@unier.it

Luca Giuseppe Ingrosso
Università Europea di Roma
lucaingrosso@hotmail.com

ABSTRACT

In specific relation to the educational field, the interactive experience of the Escape Room overpasses mere entertaining purposes, rooting deep into knowledge, strategy, and skill fields.
Escape Room in teaching fields could then unveil multidisciplinary scenarios that can be connected to topics, specific knowledge and skills, disciplinary tools all heading towards the consolidation of learning by encouraging metacognitive thinking as a study method.

In ambito didattico, l'esperienza dell'Escape Room supera i meri scopi di intrattenimento, radicandosi in profondità nei campi della conoscenza, della strategia e delle abilità. Le Escape Room in ambito didattico potrebbero quindi svelare scenari multidisciplinari collegabili ad argomenti, conoscenze e competenze specifiche, strumenti disciplinari orientati al consolidamento degli apprendimenti favorendo il pensiero metacognitivo come metodo di studio.

KEYWORDS
Metacognitive teaching; escape room; study method
Didattica metacognitiva; escape room; metodo di studio

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1. Metacognitive processes: a theoretical framework

The term metacognition, coined at the beginning of the 1970s by Flavell (1971), refers to the ability to reflect on one's mental processes (which concern introspection and the ability to look inside oneself), includes everything that concerns cognitive styles, the possession of strategies, knowledge relating to cognitive functioning as well as control, monitoring and self-assessment mechanisms (Cornoldi, 1995) and is understood as the "set of knowledge about cognitive processes" (Flavell, 1999; Schneider, Pressley, 1997).

Beginning in the late 1970s, researchers extended their studies in the field of cognitive psychology applied to education, also focusing their attention on the ways that lead the subject to an awareness of the mental processes implemented, going beyond the simple analysis of the cognitive processes required to achieve certain learning.

Through the elaboration of various explanatory models (Flavell, Wellmann, 1977; Antonietti, Cantoia, 2000; Wellman, 1983; Brown, 1987; Borkowski; Muthukrishna, 1992; Cornoldi, Caponi, 1991), an attempt has been made to highlight the different cognitive, motivational, personal and situational variables that intervene to condition the reflection on learning processes (Cottini, 2017).

Currently, the concept of metacognition refers to both metacognitive knowledge (the subject's awareness of his or her own cognitive processes) and metacognitive control processes (the activity of control exercised over these same processes), thus taking on a broader meaning (Flavell, Wellman, 1977).

Cornoldi and De Beni (2015) point out that metacognitive knowledge refers to the ideas an individual has developed about mental functioning and includes impressions, intuitions, notions, feelings, self-perceptions. Metacognitive control processes, on the other hand, relate to all cognitive activities underlying any cognitive functioning and include prediction, evaluation, planning, monitoring, i.e., the ability to check one's activity as it unfolds and to implement particular strategies appropriate to the resolution of the task.

Metacognitive self-reflexivity, by identifying the underlying thoughts and mental states, enables students to reflect on their own learning process, influencing cognition (learning strategies and problem-solving strategies). A recent study (Zhao, Teng, Li, Wang, Wen, Yi, 2019) has shown that, through metacognitive teaching, the student is able to acquire an active and responsible attitude towards

learning, as he/she becomes able to understand and reflect on his/her own perceptions, sensations, beliefs, feelings, discomforts.

The metacognitive learner, through questions and investigations (problem making), acquires an approach aimed at problem solving (problem solving), realising his or her own intellectual baggage by becoming aware of what and how he or she does.

Such an approach therefore has an immediate impact on self-perception, self-esteem (Cornoldi, De Beni, 2015) and motivation, as the learner, being aware of the strategies he or she uses, is able to autonomously identify the most functional, economical and productive ways to achieve educational success (Lisimberti, Montalbetti, 2014).

Scientific evidence has recognised the fundamental role of metacognitive components as variables capable of conditioning the ways in which an individual learns.

Positive results on the efficacy of metacognitive teaching have been verified in various fields, both for the refinement of transversal skills (such as attention, memory, study method) and for the learning of more strictly curricular skills (such as reading and text comprehension, mathematics, writing) also with pupils with special educational needs.

Metacognitive strategies, by means of pathways applicable in all curricular areas, facilitate the acquisition of skills that mobilise the effective use of personal resources, together with reflection on the procedures implemented and their usefulness in fostering the acquisition of knowledge, skills and competences not only in the curricular sphere but also functional to the development of creative thinking, problem solving, decision making and social skills oriented to foster inclusive processes.

Starting from the original construct (Flavell, 1979), meta-cognition (the ability to self-reflect and self-regulate one's own cognitive phenomena) is transversal to learning processes and has become a crucial tool to support the development of specific study, research and critical and creative thinking skills.

The ability to self-regulate is a relevant aspect of metacognition as it is indicative of a self-directing process by virtue of which the student converts his or her mental abilities into learning skills, understood in terms of a proactive and autonomous process, rather than as a response to stimuli from the teacher (Dettori, Letteri, 2021).

The aim of metacognitive didactics is to promote meta-reflective and critical competence around one's own ways of relating to knowledge: «Metacognition refers to the gaze that a person turns on his or her learning process and involves metacognitive knowledge (of people, of the task and of strategies), the management of his or her mental activity (planning, control and regulation) and awareness of the elements of these first two components [...]. If metacognition is developed, critical thinking is fostered [...], because the learner self-evaluates (self-correction), reacts according to the situation (context-sensitive), checks his solutions (makes judgements)» (Pallascio, Benny, Patry, 2003).

Metacognitive teaching, as it relates to the development of awareness of one's own cognitive processes (thus including attention, memory, and comprehension), is a relevant area in educational and learning contexts.

To address the concept of 'meta-cognition' is to refer to that set of superordinate mental processes that enable one to reflect, organise and control all cognitive and thinking activities. Metacognitive skills not only involve all the knowledge we have of the workings of the human mind but, at the same time, also include the ability to reflect on them in a conscious and controlled manner in order to organise and use cognitive processes strategically to achieve a goal.

The metacognitive approach has interesting educational implications as it aims to offer pupils the opportunity to learn how to interpret, organise and structure information received from the environment and the ability to reflect on these processes in order to become increasingly autonomous in dealing with new situations (Cottini, 2015).

From a metacognitive perspective, the teacher's function is to train those superordinate mental abilities that go beyond simple primary processes (e.g. reading, writing, remembering) in order to develop in each child the ability to be the manager of his or her own cognitive process (actively directing it with personal evaluations and operational indications) by increasing awareness of what he or she is doing, why he or she is doing it, when it is most appropriate to do it again and under what conditions.

The focus of a metacognitive skills enhancement intervention, in the presence or absence of pupils with Special Educational Needs and/or children, starting as early as primary school, becomes not only to optimise the chances of success in the face of school demands by refining instrumental skills in light of a task, but also to promote thought processes that can lighten the load deriving from daily activities

through adequate planning, scheduling and performance review (De Simone, Scassillo, Strollo, 2015)

Thanks to the contribution of the literature of the last twenty years on metacognitive teaching (Ashman, Conway, 1991; Ianes, 2001; Barnes, Burgdorf, Wenck, 1991; De Beni, Pazzaglia, 1991; Cornoldi et al., 1995; Cisotto, 1998; Cottini, Meazzini, 1997; Pilone and Muzio, 2003), the metacognitive approach offers the teacher greater certainty on the knowledge to be conveyed, on the cognitive processes to be triggered, on the type and quality of the interaction that should be established with the pupil in order to favour the implementation of each individual's ability to recognise his or her own strengths and weaknesses and consequently identify which strategies can best suit the pursuit of his or her own objectives.

Within a metacognitive enhancement programme, the teacher can operate by referring to four different levels that are interconnected and from which it follows that the metacognitive approach must be global and integrated (Ianes, 2001; Cottini, 2017):

(a) knowledge related to general cognitive functioning (Theory of Mind);
(b) self-awareness of one's own cognitive functioning (Personal Awareness);
(c) cognitive self-regulation strategies (Self-regulation and problem solving);
(d) underlying psychological variables (locus of control, self-efficacy, self-esteem, motivation).

Metacognitive teaching has also been tested with interesting results with pupils with special educational needs. Some studies have shown that subjects with learning disorders benefit from the metacognitive approach by improving their ability to use appropriate strategies to solve the task (Ashman, Conway, 1991). It is important for intervention aimed at pupils with special educational needs to develop the metacognitive attitude, i.e., the propensity to use strategies and the acquisition of a greater awareness of the objectives of the task and the skills needed to perform it and the ability to complete it. An experiment with cognitively impaired children between the ages of 5 and 12 showed that it was possible to satisfactorily modify the knowledge of mental processes possessed by these subjects through metacognitive improvement, which had positive effects on their general ability to learn (Vianello, 1998).

"Learning to learn" represents one of the fundamental goals of basic education and is one of the key competences for lifelong learning towards which the National Curriculum Directions for pre-school and first cycle education - 2012

(Recommendations of the European Parliament, 2006; 2018) Learning to learn is a key competence characterised by several aspects being able to persevere in learning, organising one's acquisitions also through effective time and knowledge management, being aware of one's own learning process and needs, being able to identify available opportunities and being able to cope with obstacles in order to learn effectively (Dettori, Letteri, 2021).

Adapting to changes with flexibility, creativity, entrepreneurship are declinations of the key competence - learning to learn - therefore the aim of the metacognitive approach is to make learners acquire the transversal competence of "learning to learn" through the conscious activation of all those skills and procedures aimed at acquiring effective learning, expendable in different contexts and in new situations.

Guilford's theory (1950) identifies divergent thinking as a peculiarity of the creative individual's way of reasoning, attributing it four characteristics: fluidity (the ability to quickly come up with many ideas or solutions), flexibility (the ability to tackle a problem in different ways), originality (the ability to come up with new and unexpected ideas), and elaboration (the ability to organise, detail, and bring an idea to fruition) (Rosa, Tafuri, 2022).

A metacognitive approach enables an active, responsible, competent and autonomous role of the subject. Therefore, there is a profound link between metacognitive processes and performance related to a learning activity, which can be adjusted according to the enhancement of appropriate ways of acting on the task (Albanese, Doudin, Martin, 2011).

A *strategic learner* (Hadwin et al., 2001) can be defined as a learner who critically self-observes his or her own work, self-organises activity goals, knows and chooses which strategies and methods to apply and critically formulates and self-assesses not only the achievement or non-achievement of the goal but also the process that led to success or failure. A pupil who, by experiencing and experimenting in the first person, especially in cooperative workshops, can acquire more and more confidence in his own abilities - self-efficacy (Bandura, 1996) and volitional abilities and constantly measure himself with the other members of the group by facing and managing the various dynamics that are created in respect of all the elements that are useful for teamwork and working together to achieve a common goal (Rosa, Cusano, 2020).

Co-operative learning, a mode of study carried out in groups and based on mutual co-operation (Johnson, Johnson, Holubec, 1996), and metacognitive teaching, a didactic approach that teaches pupils to become aware of the cognitive processes

at play during learning, are two teaching methodologies that lend themselves well to mutual interpenetration.

Both go beyond the classic frontal lecture approach and redefine the teacher's role, making him or her more like a tutor (supervisor), thus favouring an increase in student autonomy in 'learning environments' in which the student, favoured by a positive relational climate, transforms each learning activity into a 'group problem solving' process, achieving objectives whose realisation requires the personal contribution of all.

Both cooperative learning (in which each learner makes his or her own personal contribution to the group work) and metacognitive teaching (which encourages self-awareness) consider different learning styles as a resource to be exploited.

The cooperative-metacognitive approach creates the conditions for an engaging educational environment suited to the needs of students if within small learning groups students develop certain social skills and competences, understood as a set of "interpersonal skills that are indispensable for developing and maintaining a qualitatively high level of cooperation.

Co-operative learning fits well with the metacognitive approach in that the members of the learning group must periodically monitor their learning activity, applying metacognition not only to themselves, but to the entire group considered as a unicum (extended metacognition).

Training in self-regulated learning at school makes people capable not only of functioning effectively with lifelong learning (life-long learning) but also of developing the capacity for learning in everyday life activities (work, leisure) (Rosa, Cusano, 2020).

2. Escape rooms and metacognition in education

Escape rooms are environments (real or virtual) in which, through cooperative teamwork, it is necessary to hunt for trans-media elements (enigmas, clues and solutions) that are useful to achieve the 'final key' thanks to which one can escape from the room characterised by a specific theme in a predefined time (Vizzari, 2022; Nicholson, 2015). Although existing since the first decade of the 2000s in the world of video games, their origins lie in traditional games (such as treasure hunts), role-playing games and point-and-click adventure games.

The use of Escape Rooms in education is rather recent. In general, we know how learning is facilitated by playful settings: in this sense, gamification represents a very attractive learning technique for students "that transfers the mechanics of the game to the educational field, in order to achieve better results, whether to internalise knowledge, improve abilities or to reward certain actions" (Montoro et al., 2020, p. 12). Beyond the approach, which is undoubtedly engaging, their fruition and, above all, their design and realisation require the use of skills of a different nature that recall metacognitive aspects in a rather direct way, promoting, moreover, communication, team-working, problem-solving and critical thinking skills, as well as attention to detail and lateral thinking (Nicholson, 2018). In particular, the qualities appear to be related to:

a) Social skills: students are given the opportunity to cooperate in solving puzzles, making use of everyone's knowledge and insights. In the design phase, the main focus must be on creating activities that cannot be solved by a single person in such a way that players must communicate and cooperate each to the best of their abilities (thus recalling the basic principle of cooperative learning).
b) Problem solving: the different types of puzzles, codes, and brain teasers to be solved present a multiplicity of stimuli that allow for exploring solutions and developing different approaches to them.
c) Resilience and resistance to stress: the various attempts to solve allow for education in resilience, the ability to find the right approach to frustration and to develop creativity, inventing different and original solutions.
d) Lateral thinking: some of the proposed activities require them to think differently from conventional thinking and to combine objects and ideas in alternative ways. Promoting this type of thinking is the right support for creativity and innovation.
e) Time management.
f) Cooperation and involvement.

The metacognitive dimension is particularly solicited during the enjoyment of the Escape Room, in order to understand how best to continue the experience, and after the enjoyment, by identifying strengths and weaknesses of the individual and the group as a whole (skills, competences, strategies). To solve the puzzles, in fact, (as well as to construct them in the design phase) skills of planning, forecasting, controlling results and transferring and generalising are employed. It is, therefore, a matter of identifying the most 'economical' (in terms of time) procedures for

solving the problem through forms of collaboration that proceed by trial and error, also significantly affecting the locus of control.

There are various forms of Escape Rooms that can be employed in the educational environment. In particular, Escape boxes are particularly effective in the school context as they represent a smart and portable version of the Escape Room: they are kits containing elements to be opened or unlocked, clues and puzzles for codes or keys, distractors. The kits are self-contained, because the key is found through clues contained within the kit itself. The realisation, therefore, is easier than that of a traditional Escape Room, while maintaining the main characteristic of being associated with a specific theme.

In addition to what has been said so far, the use of Escape Rooms in education allows for flexibility in the levels of school use. In fact, it is possible to adapt the difficulty level of the Escape Room according to the use to be made of it, thus making it a modular resource. Each escape, whether analogue or virtual, can be reusable, adaptable and customisable. It is then possible to work on the acceptance of difficulty: in escape routes, a collaborative climate is created in which obstacles are tackled, resisting stress side by side. Language and communication skills are also activated through walk-throughs, i.e., detailed procedures that students must be able to interpret and apply, as well as contributing significantly to the verification and assessment processes, carried out by systematically observing the pupils during the development of an escape route, taking into account both the skills activated and the disciplinary knowledge involved, thus also making the restitution moment particularly engaging.

3. Metacognitive teaching with an escape box in a primary school classroom

The acquisition of transversal skills is an important evolutionary factor for every child and, in parallel with the achievement of soft skills, it is crucial for their complete and integrated development.

Knowledge, skills and attitudes are key tools towards active citizenship, social inclusion and employability. A mindset that keeps distance from a personalist perspective, in favour of a more open and global one.

As educators, we have the responsibility to bring innovation to our teaching paradigms, so as to propose educational experiences that have a positive impact to

the construction of complete and complex profiles of competence, starting from early childhood.

3.1 The experiment

Within a teaching-learning framework inspired by these key principles for life-long learning, we put and test what was anticipated in our research directly in a school context, in order to better understand which experience has such a driving force towards the development of metacognitive processes, also favourable for the structuring of a more organized study method.

Inspired by few elements identified by Csikszentmihalyi (2012) concerning learning processes through the experience of the Escape Room, we have pinpointed key factors for the success of such teaching experience, as listed below:

- Explicitly define and specify the goal;
- Concreteness of the objective;
- Adequate balancing of the difficulty level;
- Team work;
- Creation of an atmosphere of collaboration and motivation;
- Provide ongoing feedback to support and help struggling students;
- Make students protagonists of the experience;
- Final self-assessment.

3.2 The class

We brought the experience of the "Escape room" into a second class of a Montessori primary school in Rome (pupils aged between 7 and 8 years) converting the experience in a smarter format, through a series of puzzles and problems that need to be solved in order to proceed in the challenge, all placed inside three small Mystery boxes contained in a larger Escape box – one for each group. The main topic was Science, specifically natural habitats, consolidating what was taught in class during regular daily teaching.

Within the class group there are no children with certified disabilities, but there are four pupils with special educational needs who have been equally distributed in four groups of five children each. Furthermore, within each group, the presence of a pupil with greater praxico-manipulative skills and a pupil with a more introverted temperament was studied. The rest of the members were attributed by exclusion.

3.3 The Activity

Once the class had been divided into groups, the activity was introduced through a **poem** read by the teacher, providing the students with the framework of the activity and the final goal of the game.

Each child was also provided with a paper form to be filled in – which acted as a guide through the different phases of the experience.

Each box has been designed according to an inclusive perspective, through the use of different communicative languages (Augmentative Alternative Communication – AAC; tactile and sensory experiences) proposed either to exploit methods accessible to all, and to configure themselves as challenges and enigmas to be overcome, as well.

The four boxes presented an enigma in AAC to be deciphered in order to be opened and reveal the main theme: Savana habitat, Jungle habitat, Marine habitat, Polar habitat.

During this **first phase**, groups activated themselves according to their own internal communication management methods. The only clue provided by the teacher was to read the puzzle focusing not only on what was actually represented, but on the concept underlying the image, too.

Despite the difficulty of the enigma, some members of the groups had such flexibility of thought as to be able to grasp the first clue with ease, consequently managing to stimulate the reflection of the rest of the group on the remaining AAC tiles. In particular, then, a child with SEN proved to be particularly skilled in being able to understand what the AAC tiles of his box, generating in him a strong sense of self-efficacy. Other children have intercepted what was said in other groups, accommodating it on their own box and eventually managing to solve it. What immediately became clear were the cooperative methods implemented spontaneously by the groups.

Once this enigma had been solved and the result reported on the guide sheet, each member of the group had to blindfold themselves to proceed to the **second phase** and reveal what was contained in Mystery box 1. The animals of the habitat of their box were placed on the table, with an "intruder" belonging to one of the habitats of the boxes of the other groups. The children were invited to understand, with the sole use of touch, which animals they were and to understand which, among these,

was the intruder. There was a general correspondence in the early identification of the intruder by those children with marked praxico-manipulative skills.

The correct resolution of this problem allows access to the **third phase**, i.e., revealing the content of Mystery Box 2. For one child in particular, the purpose of this activity was immediately understandable: to produce sounds that could calm down and make feel at home the poor intruder animal.

With what was given in the box and allowing the children to integrate it with body percussion and any other small objects present in the classroom - each group created a melody consistent with the peculiarities of the habitat of the intruder. It was very interesting to observe how a harmony of concordant sounds was generated very naturally, without prior agreement, simply by letting yourself be carried away by the melody and by the "magic of the group", as a child will later point out during the moment of self-assessment.

Fourth phase was probably the most difficult for the students. A structured activity marked by steps converging in a perspective of action planning and designing. Each child, blindfolded again, is asked to understand the contents of Mystery box 3, i.e. Lego bricks, their quantity and type.

Once this step had been done, they could draw the bricks on the guide sheet. This is followed by the design on paper of the model to be built and, finally, its realization.

This last phase, in particular, has generated conflicts within some groups, presumably due to the easy mixing of the playful aspect with that required by the activity.

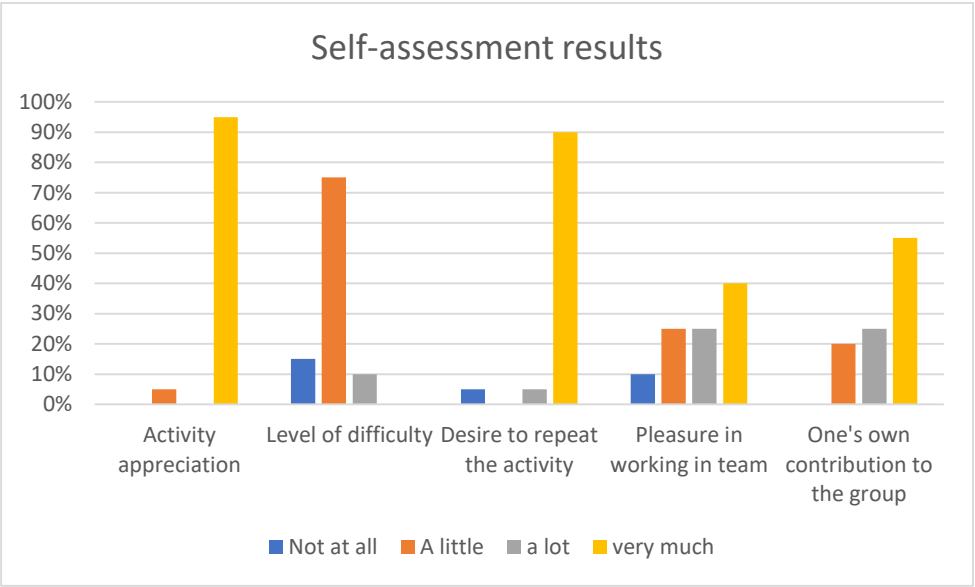
In particular, deep frustrations were recorded by the more introverted children who subsequently verbalized their difficulties in imposing themselves in doing their part in the work, emphasizing how some members of the group had centralized the activity in their own hands.

The final moment of the experiment was that of **self-assessment**, the data of which were collected both in quantitative form (Likert scale questionnaire) and qualitative form (interview).

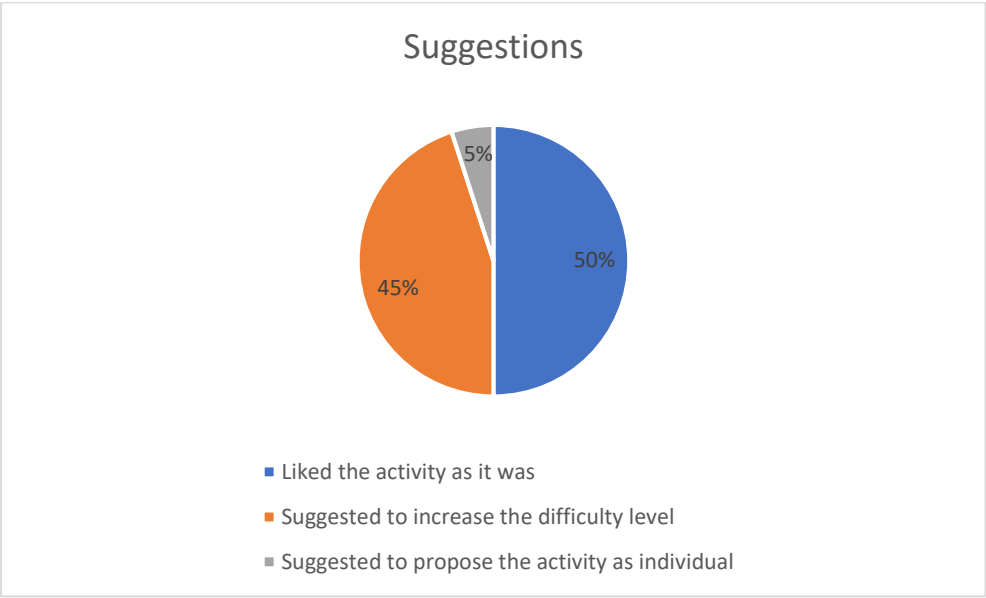
As far as the questionnaire is concerned - on a Likert scale having the following values: not at all, a little, a lot, very much - the answers found are:

- activity appreciation: 5% little, 95% very much;

- level of difficulty: 15% not at all, 75% a little, 10% a lot;
- desire to repeat the activity: 5% not at all; 5% a lot; 90% very much;
- pleasure in working in a group: 10% not at all, 25% a little, 25% a lot, 40% very much;
- one's own contribution to the group: 20% a little, 25% a lot, 55% very much;



Finally, an open-ended question was asked for any suggestions and/or changes to be made to the activity: 50% of the participants stated that they liked the activity as it was presented; 45% suggested increasing the overall difficulty level of challenges by expanding the number of problems to solve; 5% suggested proposing the activity as individual.



The interview – aimed at detecting what cognitive processes were activated and the strategies applied by the students to solve the problems – provided interesting contributions about the aspects we detected in our theoretical hypothesis.

Few participants underlined how **teamwork** had a positive influence on the achievement of the goal, essentially for two reasons: a lower perception of difficulty and the value of collaboration, though not for everyone.

The value of mutual help was dominant with children with SEN, for whom teamwork was an important means in overcoming the difficulties related to reading and filling in the guide-sheets, allowing them to face the task with greater serenity.

Another important element that emerged has been the importance of **sensory experience**. Most participants underlined the importance of using all senses in solving puzzles. The exploration of the world through sensory experience is a fundamental cognitive tool and students have been able to understand its relevance in their cognitive processes.

Other students remarked how **designing and planning** their own actions was a great help in completing the task. Specifically, the winning strategy seems to have been for them to divide the task into progressive and sequential objectives in order to be able to proceed with the resolution of the problem with greater organization.

Added to this is the value of patience and taking the time to analyse things thoroughly so as not to risk giving a hasty answer, to reflect and also rely on **mental representations** to better identify what might be the best strategy to apply to solve the puzzle.

Finally, **changing point of view** in order to solve the puzzles also emerged, highlighting what De Bono asserted about lateral thinking and, therefore, abandoning a linear perspective to observe the problem from different perspectives, then find creative and alternative solutions to accomplish a task.

Therefore, we can reasonably assert that gamification could actually contribute to a change in teaching, where learning scenarios can benefit from innovative factors that leverage students' intrinsic motivation and allow the development of skills on different levels: disciplinary, relational, emotional and metacognitive.

4. Conclusions and perspectives

The experience presented so far, without any claim to exhaustiveness or generalisation of results, has had the sole purpose of taking the form of an initiatory and exploratory attempt to pragmatise the studies we have conducted on the use of escape rooms as a teaching strategy within a metacognitive architecture, in order to convey, in a transversal manner, inclusive messages and contents of accessibility.

It is no coincidence, in fact, that we chose to involve a second class of the primary school: this stage of the path of the first cycle of education is characterised by a specific singularity, straddling the start of the standardised processes of reading-writing and calculating in the first class and the start of the study method, typical of the third class with the proposal of the disciplines of history, geography and science.

The main objective of the survey we conducted was to take the form of a try-out phase in order to then proceed, in the coming years, to a decisive enlargement of the sample so as to be able to continue in a longitudinal perspective to understand whether and to what extent the use of escape rooms in education can represent an effective mediation in the transition from the assimilation of learning strategies to their generalisation in time and space.

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