Games and activities for promoting executive function in lower primary school

the education hub

School resources

Executive function supports students to control their thoughts, feelings, and behaviours, so it is vital for the cognitive control students need for learning, as well as for social skills and emotional regulation. Students use executive function skills when they need to concentrate, plan, coordinate, make choices, solve problems or achieve tasks and goals[1]. Specifically executive function skills comprise:

- **attention and inhibition:** the ability to focus and concentrate, to ignore distractions, and to control impulses and instead choose appropriate behaviours
- **working memory:** the ability to hold several pieces of information in mind at the same time, in order to think about them, reason and make decisions
- **cognitive flexibility:** the ability to think flexibly, to switch gear and adapt to changing circumstances or demands when necessary, and to apply different rules in different settings[2] [3].

These skills are crucial to most learning activities in school, enabling students to prioritise and sequence different behaviours to attain a goal. Executive function enables students to inhibit dominant or familiar behavioural responses (so that, for example, they raise their hand to speak rather than blurt out an answer), remember and keep in mind information relevant to the attainment of a task (such as a list of information for solving a maths problem), avoid distractions (listening to the teacher rather than looking out of the window), switch between tasks (such as scanning a text for information and then recording it)[4], and to keep track of what they are doing as they are working. Executive function is also needed for the ability to wait for a turn, cooperate well with others, and deal with difficult emotions such as anxiety, frustration, or anger without hitting out[5].

Executive function skills are essential for learning to read and perform basic mathematics. For example, when reading, children use selective attention to focus on the meaning of the text, and inhibition to suppress the influence of interfering information, such as the alternative meanings a particular word may have in other contexts. They use working memory to remember previously read text and to anticipate upcoming text. Finally, cognitive flexibility enables children to make the mental shifts required when they encounter different word tenses or shift between known and unknown words[6].

Research has found executive function skills to be more predictive of academic achievement than IQ[7], and to be related to higher achievement in areas such as reading, maths and spelling[8] [9]. Similarly, difficulties in executive function are found to be predictive of learning difficulties[10]. One study shows that children with high levels of executive function make faster progress and can catch up with peers even if they are initially behind[11], and other research suggests that higher levels of executive function protect students from the risk of academic failure associated with a poorer socioeconomic context[12].

However, it is important to note that, while executive function is correlated with higher achievement, there is no research that demonstrates a causal relation. Other characteristics of students, such as high socioeconomic status or high levels of parental education, while linked to higher executive function skill, could be the reason for higher achievement[13].

How to support the development of executive function skills

Executive function skills depend on the maturation of particular brain regions but also on stimulation received from the child's social interactions at home and at school[14]. Research shows that it is possible to improve executive function skills through practice and training, although it is not clear from the research that this improvement translates to an improvement in academic and social skills[15]. It is likely, however, that students with strong executive function skills will be able to make better decisions more often, and to function effectively in a range of situations, with positive consequences for learning and wellbeing throughout life[16].

Using card and board games to promote executive function

Playing card and board games requires students to hone their executive function skills in a variety of ways.

- **Card games such as *Pairs*** (also known as *Memory)* challenge students to remember the locations of cards they have uncovered, and in this way support the development of working memory skills. Other games such as *Go Fish*, *Old Maid*, *and Happy Families* add extra complexity by requiring students to track types of cards as well as remember their locations.
- **Fast-paced games** which promote quick responses are excellent for students to practise attention and inhibition. For example, in a game of *Snap!*, students have to pay careful attention and inhibit the desire to call 'Snap' until a pair is spotted.
- **Games in which rules change** according to the context of the game help students practise cognitive flexibility. For example, games like *Uno* have cards that can be matched according to two dimensions (number and colour).
- **Strategy games that involve planning** several moves ahead, and holding these plans in mind while also adjusting their strategy according to the moves of their opponent, utilise working memory, inhibitory control and cognitive flexibility. Examples include *Connect 4*, *Battleships*, and *Ludo*.

Using physical games and sports to develop executive function

Physical games can also encourage executive function development.

- **Games that encourage children to pay attention** and be ready to respond quickly help them practise attention and inhibition. Examples are *Musical Chairs* and *Duck Duck Goose.* Some games (*What time is it, Mr. Wolf?* or *Grandma's Footsteps*) also challenge children to track others' movements as well, which requires working memory. Games like *Simon Says* encourage selective responses and require children to exercise their skills in inhibition as well as cognitive flexibility.
- **Ball games** such as *Dodgeball* engage children's attention as they require self-control as well as constant monitoring, rule following, and decision-making.
- **Structured physical activities and organised sports** such as soccer have been shown to increase children's attention skills, while mindfulness activities such as yoga or Tae Kwon Do help children to develop self-control, inhibition, and attention.

Using word games and songs to support executive function

Songs and word games can be very challenging, and help to develop students' working memory and inhibition.

- **Call-and-response songs**, such as *Boom Chicka Boom*, and songs that build additional content or actions with each subsequent verse, require high levels of working memory.
- **Singing in rounds** challenges students' working memory and inhibition. A simple song to start with is *Row Row Row Your Boat*.
- **Copying complex clapping rhythms** stretches students' working memory, cognitive flexibility and inhibition. You can also teach students clapping games to try in pairs, such as *Miss Mary Mack*.
- **Word games** such as *Packing for a Picnic* (which begins with the first person saying 'I am going on a picnic and I will bring…' and each subsequent person adding an item while remembering everything that has been said before) build students' working memory.

Using puzzles and problem-solving games to build executive function

Puzzles and problem-solving challenges are also good for exercising working memory and cognitive flexibility.

- Simple puzzle ideas include **mazes, word finds and matching games**. There are also many puzzle games that involve logic and reasoning so that children have to apply flexible thinking with rules about what is possible (*Rush Hour* or *Gravity Maze* by ThinkFun are good examples).
- **Guessing games**, such as *20 Questions* or *Animal, Mineral, Vegetable*, require working memory and cognitive flexibility as students need to develop and rule out potential theories and hold in mind previous responses. *I Spy* or books based on finding things in the illustrations are excellent as they require students to use selective attention to search for a particular type of object.
- **Sorting and matching games** in which children have to sort by one attribute and then by another are good for working memory and cognitive flexibility. Students have to remember and adjust to changing rules, and inhibition, as they inhibit the impulse to sort by the previous rule[17].

Endnotes

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2 Left Brain Buddha

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13 Jacob & Parkinson (2015)

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15 Kassai et al. (2019)

16 ENGAGE (2020).

17 Activities taken from Centre on the Developing Child at Harvard University (2014) and Left Brain Buddha

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