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# Explore play

Teachers' Guide by **BOLD** and **Frontiers for Young Minds**

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# Explore play

## Quick overview of this Teachers' Guide pack

BOLD and Frontiers for Young Minds have partnered to bring you this collection of insights into the latest scientific thinking around play.

Included in this package, you will find:

1. Three articles from the BOLD network of researchers and writers, guiding you through the latest theory and science, with links to original research for further information.
2. Links to more resources to explore the topic further on BOLD, including a podcast episode.
3. Three relevant *Frontiers for Young Minds* articles that you can use to explore learning through play with your class or other young learners.
4. Activities from the *Frontiers for Young Minds* team to try with your class to help them consolidate the ideas explored in the articles.

Part 1

# BOLD articles: Learn the science

Three articles from the BOLD network of researchers and writers, guiding you through the latest theory and science, with links to original research for further information

Links to more resources to explore the topic further on BOLD, including a podcast episode

# Protecting children's right to play

Restricting children's opportunities to play risks widening the learning gap.

The COVID-19 pandemic required many children to make an abrupt transition from the school environment to remote learning from home. This unpredictable situation gave rise to anxiety for both adults and children. Many countries are now concerned with helping children catch up on the learning they have missed. But in this focus on academics, are we losing sight of the importance of play in supporting children's learning and wellbeing?

Play promotes children's wellbeing and helps them process hardship. According to the UN Convention on the Rights of the Child, every child has a fundamental right to participate freely in play. In addition to enhancing wellbeing, play has a positive effect on all kinds of learning. Through play, children learn important executive function skills, such as self-control, which in turn support problem-solving and enable children to cooperate with others. Spatial reasoning – the ability to think about our own location and the location of objects, how they look and how they fit into the environment – can be developed through playful, physical exploration. Manipulating objects of different sizes, building a den, or searching for hiding places, for example, are all useful in developing these skills.

It is not only physical play that produces learning benefits. Digital play, too, through video games and online apps, can enhance cognitive skills. For example, playing action video games helps to develop focus and sustained attention. While there are concerns that children may spend too much time on screens, active participation in screen-based activities – for example, playing online

games with parents or caregivers, or cooperative games with friends – is associated with positive outcomes such as imaginative play and improved language development. Although online play allowed many children to socialise with friends during the COVID-19 pandemic restrictions, other children lacked access to digital technology during that period. Some missed out on vital educational and developmental opportunities, further widening the learning gap.

## Play during times of crisis

In times of crisis, play may be threatened – but it can also help children cope with difficult situations. One of the greatest threats to children's play is the humanitarian crisis caused by forced displacement. Almost 90 million people were displaced in 2021, nearly half of them children. Play is disrupted when children are in transit or in temporary accommodation, but finding opportunities to play, even in such precarious situations, can help children create meaning in their everyday lives and develop trustful relationships. Facilitating play during times of crisis can have important benefits.

During the global COVID-19 pandemic, not all children enjoyed the same opportunities to play. For some, school closures and restrictions merely meant that play shifted to home, with family and caregivers and with continued access to hobbies and digital tools. Others, especially vulnerable children, or those with responsibility for caring for family members, had much less freedom to play and faced mounting risks and pressures at home. Although there were some positive experiences, such as discovering new opportunities for play, many children were restricted in their outdoor and cooperative play. Some researchers express concern that the COVID-19 pandemic reduced children's opportunities to play, but they also point out that it has provided an opportunity to emphasise and advocate for children's fundamental right to play.

## Children's opportunities to play should not be compromised

In many countries around the world, the pressure is on to close the learning gap. The UK government, for example, has pledged billions of pounds to support children academically. Parents were encouraged to support catch-up activities in the holidays, too. However, the resources that are being provided focus on tutoring in academic subjects, and while it is imperative to support struggling students as they seek to catch up academically, children must also have time to play, explore and learn freely. Given the important role of play in learning, as well as in dealing with crisis situations, we must avoid limiting children's opportunities to play. Children need to be given a chance to catch up on the developmental opportunities they have missed – including the opportunity to develop the broader skills that can be gained through social play and exploration.

Written by

Kathryn Bates, Post-Doctoral Researcher in Developmental Science, King's College London

# Play is not frivolous

Children need play to learn

Growing up, I was often offered playtime as a reward, to be enjoyed only after sufficient productive learning time was clocked. To play was to take a break from puzzling mathematics and difficult vocabulary – a time for seemingly unproductive fun. Recent research by Michael W. Yogman and his co-authors, however, has found that far from being frivolous, play drives learning by helping young children develop the crucial physical capacities and social-emotional skills needed to thrive in the classroom. Children, in fact, need to play in order to learn.

## Play builds young brains

Play enhances children's brain structures and supports the development of executive functioning skills. These are the building blocks children need to master important skills later in life, such as problem-solving, collaboration, and creativity. When children engage in guided play, for example, the playful learning experience helps to develop their proactive control, providing them with the psychological readiness to explore the unfamiliar and the intrinsic motivation to learn on their own.

This in turn enhances their curiosity, positively affecting their memory and learning.
Play also helps them manage toxic stress and develop socially and emotionally. For example, 3- to 4-year-olds who were anxious about starting preschool exhibited a two-fold decrease in anxiety levels after engaging in playful activities for fifteen minutes, compared with the group that passively listened to a teacher reading a story.

For children facing childhood adversity, playing with parents or caregivers and sharing joy while nurturing these relationships can reduce their body's stress response to a healthy level. If left unchecked, toxic stress can have detrimental effects on brain development in young children, resulting in learning difficulties.

Play also helps children develop skills such as negotiation and cooperation, molding emotionally intelligent learners who are able to interact meaningfully with their peers. These are key attributes that have been linked to future academic success.

Paradoxically, classrooms that do not incorporate playful activities but are typically teacher-directed may be making it harder for young children to learn. When children play, they are curious, attentive, excited, and actively engaged in the learning process. The passive learning environment that is typical of a teacher-directed class, however, could stimulate a contrary physiological response: fear. If present in high doses, this has been shown to result in a decrease in attention and, consequently, to affect children's ability to learn.

This shows that play is not frivolous. "Instead, the biggest barrier to play is the misperception that it is frivolous," Yogman noted.

### Are children today playing enough?

Pediatricians don't think so. Quite the contrary: Preschools are increasingly replacing play activities with more teacher-led activities to prepare children for the rigors of primary school. "The focus in schools on testing and the focus by parents on overscheduling children's free time to be competitive for college robs kids of the opportunity to be creative and curious," added Yogman.

In response to concerns about a lack of opportunities for play, the American Academy of Pediatrics released a comprehensive list of recommendations for pediatricians, outlining ways they can better engage parents, educators, and policymakers to incorporate playful learning at home and in school. Examples include advocating for the protection of children's unstructured playtime in school and helping parents understand that playful learning moments are everywhere – if parents are actively interacting with their children. "Parents and schools are the primary change agents, but pediatricians and policymakers can have a major influence on parents and schools," explained Yogman.

Playtime, therefore, is not simply unproductive time offered to children as a reward – far from it. And until we provide comprehensive support for playful learning at home and in schools, children will not be able to maximize the learning benefits they might derive from play and grow into better learners in the future.

Written by

Aisha Schnellmann, Editorial team, BOLD

# What role does spatial thinking play in STEM?

Improving STEM skills by promoting the development of children's spatial ability.

Thinking about objects and how they relate to one another is an important contributor to success in Science, Technology, Engineering and Mathematics. Teachers can help children to develop these skills by integrating spatial thinking into the curriculum.

We use our spatial abilities every day – fitting items into a cupboard, putting shoes on the correct feet, negotiating around furniture, and giving directions. Spatial ability involves perceiving the location, dimensions and properties of objects and their relationships to one another. In recent years, it has become clear that spatial ability is important for mastering Science, Technology, Engineering and Mathematics (STEM) content. Indeed, spatial ability in childhood correlates with mathematics success, and predicts STEM expertise in adulthood.

Understanding spatial relationships is one key spatial skill in STEM. In science, for example, illustrations depict DNA sequences, cells and the solar system, while the periodic table shows the relationships between elements. In engineering, they show electronic configurations. In mathematics, graphs help us visualise patterns of data. Furthermore, Geologists use topographical maps to extract 3D information from 2D information, whilst expert knowledge of 3D anatomical structures and how they are connected to one another is vital for the study of medicine.

Spatial skills are highly malleable. A meta-analysis of studies that sought to train spatial ability showed that spatial training is effective, durable, transferable, and particularly beneficial for young children. Research from my lab supports those findings. We have demonstrated correlations and relationships over time between spatial ability and mathematics and science in primary school children. We have also shown that spatial training improves mathematical achievement, with further work underway. These associations suggest that spatial training is also likely to improve children's science abilities.

## Spatial ability in school

Despite the importance of spatial ability, at least in England, the current mathematics curricula place little emphasis on the development of these skills. The Early Learning Goal of "Shape, Space and Measure" in the Early Years Foundation Stage (EYFS) curriculum (birth to age 5) is to be removed in the coming academic year, and the most recent "ready-to-progress criteria" for primary school mathematics make no reference at all to spatial thinking (except shape naming).

The EYFS framework states: "... it is important that the curriculum includes rich opportunities for children to develop their spatial reasoning skills across all areas of mathematics." Yet spatial thinking risks not being prioritised, particularly if it does not feature in assessments and if teachers are unaware of opportunities to integrate it into their curricula.

## How to incorporate spatial thinking into the classroom

Teachers can use spatial language, gestures, visualisation, maps, diagrams and graphs to spatialise primary school curricula. Exposing children to spatial words such as "between", "around", "left", and "right" can strengthen their spatial skills. Teachers can select books that use a lot of spatial language, such as "Rosie's Walk", and explicitly include spatial language in lesson plans. Spatial language comprehension can be supported by using hand gestures to demonstrate size or length, and arm positions to illustrate difficult concepts such as "slope" or "horizontal". Gestures work well because they are themselves spatial, and so easily augment the information provided by a word and facilitate the learning of new words.

At playtime, teachers can give children opportunities to create and use scaled toys. This encourages the development of spatial scale and perspective taking, skills that are associated with mathematics and science achievement. When children are playing with construction toys, encouraging them to consult pictorial instructions frequently will help to develop their visualisation skills. This is because guided play elicits more spatial language than free play, and children with more advanced spatial skills make use of pictorial instructions more often.

Teachers can also design their classrooms to create opportunities for spatial thinking. For example, signs made of irregular rather than regular shapes draw children's attention to the defining features of shape categories, encouraging spatial language. Furthermore, using shape outlines to show where toys should be put away shows children the shapes of real objects, and provides opportunities for children to use mental transformation. For example, the child will mentally rotate a toy car to make it fit onto its outline when tidying up.

With the Early Childhood Maths Group (ECMG), we have developed an openly available spatial toolkit. The toolkit is intended for practitioners and teachers of children from birth to 7 years and will be augmented over the coming year. The toolkit enables users to use formal, structured tools as well as informal resources created by children and teachers, in order to embed spatial teaching strategies into the curricula.

Spatial training is clearly effective and has long-lasting benefits. But there are still gaps in our knowledge. Most studies of children have concentrated on the association between spatial thinking and mathematics, with little emphasis on other STEM subjects. Furthermore, there have been very few studies of the impact of spatial training in the early years, and we know little about the durability of such training. Similarly, although studies have shown that parental spatial language is important for children's spatial development, there has been no research into teachers' spatial language. Over the next decade, we will attempt to gain insight into all these things and more. I hope this research has a positive impact in the classroom, ultimately improving children's spatial abilities and their STEM skills.

### Simple ways to encourage spatial thinking

- Use spatial words like "between" and "around"
- Choose children's books that use spatial language
- Use hand gestures and arm positions to support spatial language
- Encourage children to look at pictorial instructions when building toys
- Create opportunities for spatial thinking through classroom design

Written by

Emily Farran, Professor of Cognitive Development, University of Surrey

# Explore more on BOLD

On BOLD you can find more articles, interviews, and podcast episodes covering research, opinions and issues on play. If you're keen to explore more after reading this collection, we recommend starting with these.

## Why learning through play is beneficial at all ages

An episode of Teachers' Voices podcast.

Listen to the episode ›

## The benefits of adventurous play

Freedom to play outdoors may allow children to learn important life skills.

Read the article ›

## How do games affect children's development?

Board games and video games can be fun and educational.

Read the article ›

You can keep up to date with the latest from BOLD by signing up to our newsletter and following us on Twitter, Facebook, and Instagram.

Part 2

# Explore play with kids

Three relevant *Frontiers for Young Minds* articles that you can use to explore learning through play with your class or other young learners.

Activities from the *Frontiers for Young Minds* team to try with your class to help them consolidate the ideas explored in the articles

# Articles for kids

*Frontiers for Young Minds* have published articles about play, written by top researchers and peer-reviewed by kids aged 8-15 to be engaging and accessible. These are an excellent basis for class reading and discussion, as well as general interest reading for young people at home.

## Does Construction Play Help Math Skills?

How does our brain learn math? It's related to visuospatial memory (memory of shapes, colors, and locations) rather than verbal memory (memory for words). Maybe building Lego models could improve the brain processes needed for learning math!

Read the article ›

## How Does Playing Pretend Help Kids' Brains?

One of the most common forms of play is pretend play (creating an imaginary version of our world), which allows us to explore social skills such as empathy. So which is more effective: playing pretend alone, or with a friend? And which type of pretend: with dolls and toys or a tablet?

Read the article ›

## What Does Playing Video Games Do to Your Brain?

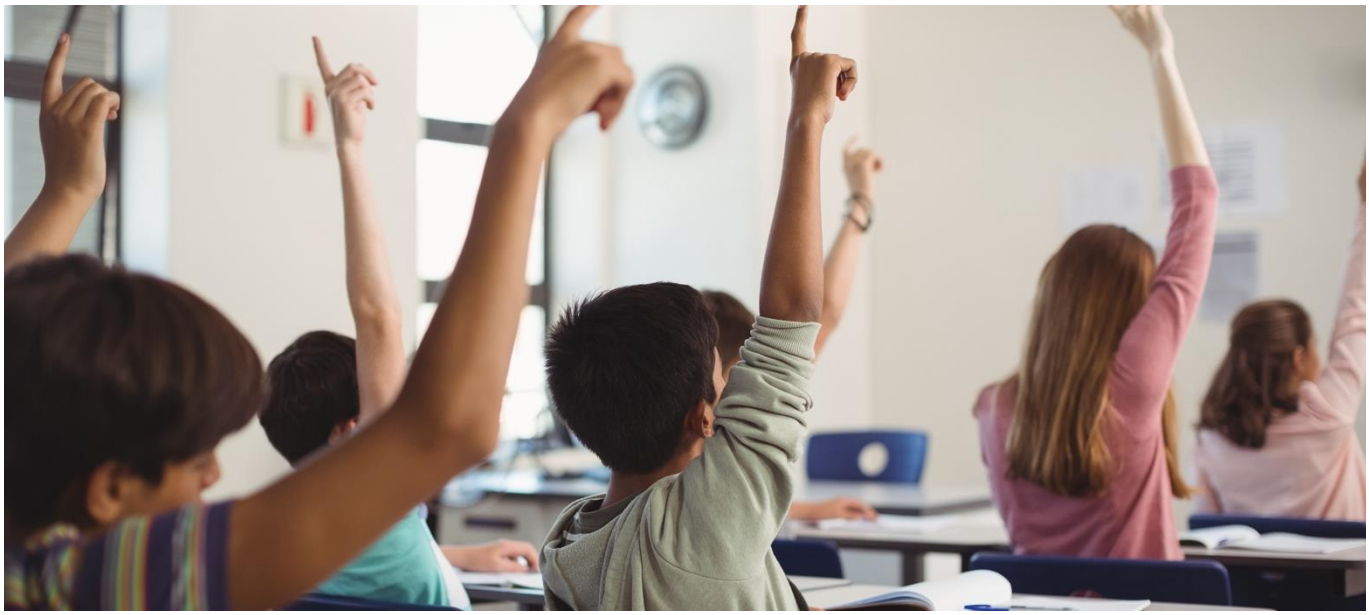
Did you know that you can actually enhance your visual skills by playing action video games? But at the same time, *lots* more video-gaming is not better – too much can affect your brain negatively. Find out more to understand how to use game time to your best advantage!

Read the article ›

Get the latest science for kids with your class by following FYM on Twitter, Facebook, and Instagram, and for more great stories from science, read the FYM blog!

# Class activities

After your class has read these FYM articles, explore play and gaming with them using these activities. Find answers to the questions at the end.



## Discussion

Challenge your class to a discussion using these questions:

- What are the two main types of short-term memory? And which one do we use to learn math? What sort of play can we use to tap into this, and what are some examples?
- What do you think of when I say 'play'? What pretend play have you done with a friend? How does pretend play help you develop? What type of pretend play is best for your development?
- What benefits could you get from playing video games? How could this be good for you in the future? Are your parents wrong to stop you from playing video games for more than one hour a day? What is a good length of time to play video games?

## Play

In small groups, challenge your class to:

- Choose a scenario for pretend play with each person using a doll or toy.
- Play together for 10 minutes, aiming to reach the end of a narrative when the time is up.

- After playing, talk to each other about the emotions or empathies they explored. What do they remember most from the scenario?

## Group work

Put the class into breakout groups, and give them a set time to read and discuss one of the following situations. Each group must identify what is happening in the scenario developmentally, and what the outcome is likely to be.

- Hannah has always built things. When she was small, she made Duplo towers and houses from cardboard boxes; now at school she builds cool Lego sets with complicated designs. She's also quite good at maths – she quickly understands what the teacher is trying to teach. Why does Hannah find math easy? What process in her brain is responsible? Is she likely or unlikely to have strong reading skills too, and why?
- Dan has a great imagination. He likes to play at being a knight and he often gets his mates to join in and joust against him or play with plastic swords! Dan's friends enjoy playing with him, and even more when they can use his awesome toy castle to have adventures with all the knights, lords, ladies and townspeople figurines in it! What skills is Dan developing, and what brain process is responsible for this? Why might this sort of play help Dan make friends and build relationships?
- Zeyneb is brilliant at video games. She wins tournaments with her friends on Super Mario, World of Warcraft, and Grand Theft Auto. But sometimes she ends up spending a couple of hours a night playing long online quest games. What benefits might Zeyneb get from her video game skills? And what negative effects might she see longer term if she continues long hours of gaming? What would you advise her to do to get it right?

## Creative writing

Ask your class to each write a response to one of these scenarios:

- Write a short blog post about play and how it can help kids your age. You need to make it simple and fun to read. This can be a summary of your learning from the pretend play article.
- What if your parents tried to stop you playing video games altogether? Write them a letter showing them the benefits, and arguing that you could agree to a sensible schedule.

# Answers

## Discussion

### Math learning through play

- The two main types of short-term memory are verbal memory (words) and visuospatial memory (shapes, colours, locations).
- To learn math we use visuospatial memory.
- Construction play can tap into this.
- Examples include Lego, building blocks, Jenga, building sandcastles, making wood models on a workbench, creating murals with chalks (e.g. drawing a house), connecting magnets, cardboard boxes as forts, houses, or sheds, etc.

### Brain development through play

- Discuss what play means - many different forms. Prompt if needed for: physical play, social play, construction play, fantasy/pretend play, games with rules.
- Pretend play helps you develop social skills such as empathy.
- Play with dolls and with friends is best for this.

### Brain effects of video games

- Benefits from playing video games include improved vision (small details resolution, contrast sensitivity and perceiving quick visual stimuli – "visual masking"). Also you may be better at paying attention, multitasking, and mentally rotating objects (like when reading a map).
- This could be good for your future as you could benefit in professional simulations that surgeons and astronauts do.
- Parents are not wrong to forbid more than an hour a day as more is too much.
- About 30-40 mins per day is good.

## Group work

### Hannah and her math ability

- Hannah finds math easy because she uses play to strengthen her short- and long-term memory in the right way to support math learning.
- The brain processes are visuospatial short-term memory and working memory, which ensure she can process and store information.

- Hannah is likely to have strong reading skills too, because these are correlated with math ability – but reading doesn't use the same part of memory.

### Dan and his pretend play

- Dan is developing social skills in pretend play, particularly empathy.
- He is using the part of the brain called the posterior superior temporal sulcus (pSTS) – associated with developing social understanding and empathy.
- This might help Dan make friends and build relationships because he is practising empathy. Empathy is very important when it comes to understanding other peoples' feelings, and it is the first step toward helping other people feel better.

### Zeyneb and her video games

- Zeyneb might benefit from improved vision (small details resolution, contrast sensitivity and perceiving quick visual stimuli – 'visual masking'). She may also be developing skills in paying attention, multitasking, and mental rotation of objects (like when reading a map).
- Negative longer term effects of too much gaming might include getting hooked on it, not achieving a healthy balance with physical exercise, brain stimulation, and social activities, through playing alone for hours instead of with friends. It could possibly affect the development of her frontal cortex – a key part of the brain for self-regulation, control, and planning.
- You could advise Zeyneb that although action video games enhance some skills, playing in excess can be bad for you. So you should manage your gaming time – about 30-40 minutes per day is ideal. Since gaming improves some real world skills, go out and make the most of them!

## Creative writing

### Blog post about play

- Play can help kids develop useful skills, in many ways.
- Pretend play particularly helps kids develop social skills and empathy.
- Researchers tracked brain activity in the pSTS area of the brain (responsible for social understanding and empathy) while kids played pretend in different ways.
- They found the pSTS was active in all kinds of pretend play, both with dolls and with a tablet if they played with someone else. But when playing alone, play with dolls was much more activating.

## Letter to parents about gaming

- Benefits from playing video games can be improved vision (small details resolution, contrast sensitivity and perceiving quick visual stimuli - 'visual masking'). It may also help with paying attention, multitasking, and mentally rotating objects (like when reading a map).
- It could be good for my career, for example in in professional simulations of surgery or space flight.
- Parents are right to moderate use of video games, but because there are benefits, a sensible length of time is about 30-40 minutes per day.

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