Nurturing the youngest STEM learners

Professor Ellen Wartella explains her research into the relationship between child psychology and learning through television as well as how her investigations will prove invaluable to teaching STEM subjects.

Why should STEM education form a part of preschool informal and formal learning?

The purpose of preschool is to foster a love for learning in children that will not only lead to college acceptance and completion, but also career and life success. High quality preschool experiences set the stage for later learning by eliciting children's innate curiosity about the world around them. STEM disciplines structure and guide this curiosity by teaching children how to explore, ask questions, gather information, construct knowledge through the analysis of this information and communicate their findings to others. These disciplines embody the essence of inquiry-based learning that we believe puts children on the path to success.

What are some of the main shortcomings of STEM education in the US?

STEM disciplines guide children's natural curiosity by teaching them how to think critically about the world around them. However, in the US, there is a misconception that cognitive skills of young children are not mature enough to understand scientific concepts. While we agree that STEM content can be challenging, the processes of scientific inquiry – a common thread that runs throughout every scientific sub-discipline – are not difficult to grasp when coupled with developmentally appropriate experiences that address children's innate curiosity.

Could you explain what analogical transfer is and how it corresponds with children's informal learning of STEM subjects?

Problem solving is the basis of all learning. Oftentimes, new problems remind us of ones we have solved successfully in the past. Analogical transfer occurs when learners use these older solutions in an attempt to solve new problems. Analogies provide a bootstrap for learning about STEM concepts, many of which can be rather difficult to grasp. For instance, researchers that specialise in analogical transfer often use electricity as an example. Electricity cannot be directly perceived and, therefore, can be rather difficult for children to understand. However, when you compare the flow of electricity to the flow of water – something that children can understand, as well as directly perceive – it increases their understanding substantially by providing context.

How does your research on media and STEM learning relate to children's parasocial relationships with characters onscreen?

Screen characters dominate mass media that is aimed at young children. More often than not, children form strong attachments to particular characters. These relationships are illusory in that they proceed in one direction – from viewer to character – and can never be reciprocated. In spite of this, research has demonstrated that these relationships not only have the power to influence what children learn, but also how they adapt and extend what they have learned to new situations. The underlying premise is two-fold. First, children are social beings who not only act upon the world around them, but are also acted upon. Secondly, children are influenced by their experiences with screen characters. Second, children can take what they have learned from a screen character and use it to solve problems in their own lives.

What methods do you use in your research to test higher-order cognitive skills such as problem-solving and seriation?

We are not using Piagetian measures of higher-order cognitive skills. Instead, in our experiments we have created hands-on measures to assess whether children can transfer their learning about measurement from the television screen to a similar object in the lab. Moreover, we carry out surveys with parents in which we ask for their assessment of their children's interest in and understanding of math and science concepts as well as their school performance.

Are you hoping to be able to implement your findings in schools?

Children are living in the digital age. Interestingly, children born today will never know a world without mass media or interactive technology. For these reasons, it is crucial to be able to guide parents and teachers when it comes to the appropriate use of media technology.

Yet, barriers do remain. Media technology is often stigmatised for being detrimental to children's learning and development. As a result, many parents seek to limit their children's exposure to and experiences with media technology. Additionally, the cost of media technology can be a deterrent to its usage, especially in lower-income areas.
Can television foster problem-solving skills?

Researchers at Northwestern University, USA, have been investigating the developmental psychology behind child-learning through educational television programmes and examining how such programmes can be used to teach basic STEM concepts.

**PRIMARY SCHOOL IS** essential in developing a person’s curiosity in the world around them. Education for early learners is as much about creating a passion for learning as it is about teaching children facts relating to the world. Often, however, there is little attention paid to teaching children the basics of STEM subjects, beyond mathematics. This is due to the perception of these subjects as being too complex for young minds. However, this stance forgets that STEM subjects are not primarily about complex theories and concepts, but rather about problem solving.

Problem solving is a fundamental skill that can be applied to almost any aspect of life. It is one of the key skills a person should learn at school. While all subjects require an ability to analyse and find solutions to problems, STEM subjects are primarily based around solving problems. Despite containing some very complicated theories, these subjects are, at their core, about taking steps to ensure that questions are examined in a thorough way. In this regard, they can provide valuable skills that are applicable both to other subjects and problems in general.

**THE POWER OF TELEVISION**

For children between the ages of 3 and 5, television is by and large their main form of media exposure, with 90 per cent of individuals in this age group watching television daily. This is often perceived by parents and teachers as a problem. They worry that mass media can only have a detrimental effect on education, and that watching too much television or spending too long on a computer will result in a regression in key skills, such as social intelligence, and can lead to health issues such as obesity.

However, while in need of attention, many of these concerns have not been proven valid with scientific evidence. Additionally, there are benefits that television can offer to young children if seized upon in the correct way. For example, children tend to have a strong connection to characters they see regularly on the television and often try to emulate and follow their examples. Ellen Wartella, Professor in Developmental Psychology and Director of the Center on Media and Human Development at Northwestern University, USA, has been investigating the effectiveness of television characters in teaching young children problem-solving skills and seriation tasks. She is particularly interested in children’s psychological connection to the characters and how that impacts on their ability to transfer the lessons learned to real-world tasks.

**THE SOCIAL CONTACT**

Initial research by Wartella and her collaborators Drs Sandra Calvert and Rebecca Richert has established the importance of the emotional link developed between young children and the characters they watch on screen. Children generally learn better from a character they are familiar with than an unknown one. It was the nature of this relationship that has particularly interested Wartella: “One way to describe these meaningful relationships has been as parasocial relationships in which children act as if they are in a two-way, personal relationship with a media character when the reality is that the relationship is only one way, from viewer to character”.

By exploring the role of these relationships and the effect they can have on learning, Wartella hopes to convince parents and teachers of the merits of using mass media to teach certain aspects of STEM subjects. Her aim is to develop educational programming that can be supported by parents and teachers to eventually identify the social factors that directly influence early years learning through mass media.

Wartella should be able to pinpoint the social factors that directly influence early years learning through mass media.
USING EDUCATIONAL DVDS TO ENHANCE YOUNG CHILDREN’S STEM EDUCATION

OBJECTIVES

• To examine the development of children’s parasocial relationships with characters

• To explore the relationship between children’s parasocial relationships with characters, their beliefs about characters’ expertise, and the extent to which these relationships traverse across informal learning settings, such as mass media and interactive technologies

• To inspect the relationship between children’s beliefs about, and relationships with, media characters and children’s learning of problem-solving and seriation tasks from those characters

KEY COLLABORATORS
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EDUCATIONAL DVDS

Wartella and her collaborators intend to carry out 18 studies across three different sites and over a period of five years. The data gleaned from these experiments will be invaluable to the makers of educational programmes. They will directly result in a better understanding of the social and psychological factors at play while a child watches an educational programme. “A large part of our research is dedicated to determining not only what children are able to learn from media characters, but also how they learn it,” Wartella notes.

From her research, makers of educational programmes will then be able to tailor characters, examples and stories in a far more effective way. “We aim to use insights into these areas to provide feedback to programmers of educational DVDs about the social processes that can help children learn and transfer information from DVDs as well as guide media use by families, whose young children watch television and DVDs in their homes every day,” Wartella enthuses. This, in turn, will lead directly to a more productive educational experience for the child and foster in them a love for learning that will help them throughout their lives.

In order to provide convincing evidence, Wartella will investigate the development of these relationships and to what extent children trust the expertise and knowledge of the characters depicted.

ASSESSING ANIMATIONS

In addition to studying these relationships, Wartella will explore the ability of children to develop higher-order cognitive skills through television characters. She will use two well-established methods for analysing a child’s higher-order cognitive skills. Firstly, she will use seriation tasks to assess children’s logical-mathematical skills. These tasks generally involve ordering similar items based on a particular property. In this case, Wartella will ask the children to nest cups by size and order the sequence of a story, both based on the events shown in a television programme.

Second, she will ask the children to perform a physical problem solving task. These problems will resemble problems the characters in the show had to overcome. One example will involve asking the children to make a ball fly through the air using a triangle block and a spoon – reminiscent of situation in which a television character uses a shovel and block to make a toy fly.

Alongside these assessments, Wartella will conduct interviews with the children in order to determine their perception of the characters. This will define to what extent they trust the expertise of the character, how real they perceive them to be and how much they like them. Indeed, pilot data have suggested that when children rated a character as being more knowledgeable and realistic than another, they consequently learnt more from that character.

In carrying out these investigations, Wartella should be able to pinpoint the social factors that directly influence early years learning through mass media. This, in turn, will prove indispensable in convincing teachers of the utility of television shows in the teaching of key STEM-based principals.