Scientific Reasoning Abilities in Kindergarten:
Dynamic Assessment of the Control of Variables Strategy

Joep van der Graaf, Eliane Segers, and Ludo Verhoeven
Radboud University Nijmegen, The Netherlands

Scientific reasoning is at the heart of science and technology education, which is becoming more and more important from both international and economic perspectives, because worldwide expenditures on science and science education are increasing. Young children are curious by nature and science and technology are gradually taking their place in kindergarten education where young children are recognized as "natural scientists." Kindergartners already have some basic understanding of experimentation. However, when asked how to successively accumulate evidence or to predict and explain the outcome of an experiment, they do not perform better than predicted by chance.

✎

To help fill some of the gaps in previous research on scientific reasoning in young children, we developed and validated a measure of CVS use by kindergarten children. The aims of the present study were to develop and validate a measure of CVS use and to investigate whether kindergartners can use the CVS.

✎

A total of 46 children from an elementary school in the Netherlands participated…. All

This article is excerpted from *Instructional Science* and was published online January 24, 2014. Read the full text by logging in at the AECT website, http://aect.org/, and clicking on Publications.

CALL FOR PAPERS

Check out calls for papers, proposals, and participants. Get involved.

Page 2

JOURNALS

Members have instant online access to a wide variety of journals.

Page 5

ISSUES IN FOCUS

The column this month discusses education in fear.

Page 6

This Summer!

Learning and Knowledge Analytics in Open Education

AECT International Research Symposium

Shanghai, China
June 17-19, 2015

Association for Educational Communications and Technology

320 West 8th Street
Suite 101
Bloomington, IN 47404-3745

U.S. Toll-Free:
877-677-AECT

Local Phone:
812-335-7675

Email:
aect@aect.org

Website:
http://aect.org/

iTECH DIGEST

Calls for Papers, Proposals, and Participants

Call for Proposals. Need funding to develop a research proposal? Consider applying for a Collaborative Research Grant. The purpose of the grant is to provide monetary support to enable association members to develop research project proposals that include active collaboration among researchers, research institutions, and AECT. Information at http://aect.org/.

Call for Papers. The AECT flagship practitioner journal, *TechTrends*, is seeking manuscript submissions, including from international and newer authors. For more information, see the Instructions for Authors online by clicking on Publications on the AECT website: http://aect.org.

AECT's premier research journal, *Educational Technology Research and Development* (*ETR&D*) also welcomes submissions on topics of interest from new and experienced researchers.

Call for Speakers/Writers. Looking for a keynote speaker or someone to write for your publication, or want to be that speaker or writer? Check out the new AECT Speakers/Writers Bureau at http://aect.org/.

Call for Manuscripts. AECT, in collaboration with Springer, has announced a new series of books and monographs under the title, "Educational Communications and Technology: Issues and Innovations." The series will extend AECT's ongoing publications with Springer and offer the Springer Briefs innovative format to AECT authors and contributors. More information for potential authors at http://aect.org/.

Call for Videos. "We Are AECT" is an opportunity to share how members define AECT. What's your "elevator speech" description of AECT? Think of this project as making your "elevator video," 3-5 minutes (or shorter, 15-60 seconds), something you might share on your smartphone with a new colleague who asks, "What's AECT all about?" Complete directions can be found at http://aect.org/.

Call for Policy Briefs. AECT has created an series of policy briefs that set out association policies for reference by lawmakers and other policy makers. Consider drafting a policy brief. More at http://aect.org/.

Pre-Schoolers' Interest and Caring Behaviour Around a Humanoid Robot

Andri Ioannou, Emily Andreou,
and Maria Christofi
Cyprus University of Technology
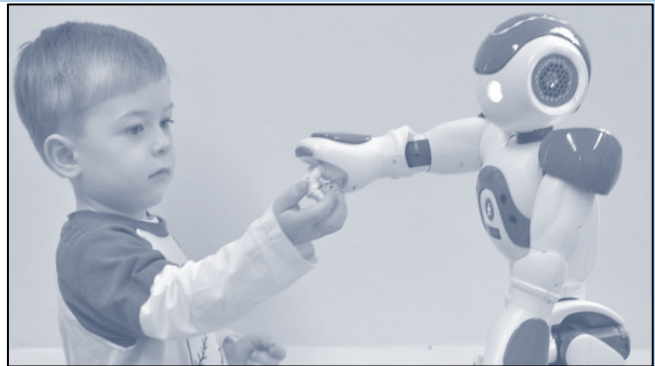
There is a growing interest in the area of robotics in education with particular focus on young children. Preschool and elementary teachers who have incorporated robots in their classes have asserted that socialization between young children and robots is possible for extended periods of time and that humanoid robots can preserve long term relationships with humans…. In the present work, we investigate preschoolers' behaviour around the humanoid robot NAO with an interest in understanding the potential of using NAO in educational settings. In particular, we explore children's interactions with NAO and how the robot may gain children's attention and interest. Beyond exploration, the study aims to provide a systematically developed coding scheme capturing the verbal and non-verbal behaviour of young children around NAO.

Four preschoolers, 3-5 years of age, participated in the study for approximately one hour. Two researchers were involved – one was an active participant in the playground to handle emergencies such as NAO falling, while the other researcher controlled NAO remotely based on a pre-written scenario. In particular, NAO was placed in an indoor playground together with other toys (dolls, cars, bears, etc.). The children entered the playroom (all at the same time) and had a few minutes to explore and play around. A few minutes later, NAO stood up from his seated position, welcomed the children and intro-duced himself. In response, the children introduced themselves with the encouragement of the researcher. Then, NAO sat down for a while and the children were left free in the room to interact with NAO and other toys as they pleased. A few minutes later, NAO told a fairytale. The same pattern was followed with NAO dancing, walking, grasping toys and talking to the children, with short breaks in between these activities….

The study showed that 3-5 year old children can easily interact with humanoid robots and addressed NAO as one of their own. Furthermore, the study showed that children paid particular attention to NAO when he was in need of help (e.g., fell down) demonstrating caring behaviour such as kisses, hugs and cuddling….

The findings of this exploratory case study, although preliminary, seem to suggest that humanoid robots might be able to assist the education of young children. The easy interaction with NAO while addressing him as a peer provides initial evidence that humanoid robots can be smoothly introduced to educational activities.

Editor's note: Excerpt from a case study. Reference citations have been omitted. Readers are encouraged to read the full text in *TechTrends* 59 (2): 23-26, the March/April 2015 issue. AECT members have online access at http://aect.org/. Click on Publications.

AECT Mission
The mission of the Association for Educational Communications and Technology is to provide international leadership by promoting scholarship and best practices in the creation, use, and management of technologies for effective teaching and learning in a wide range of settings.

Goals:
- Define the disciplines and professional activities that comprise the field of educational communications and technology.
- Serve and represent professionals in the field and support professional growth.
- Advance scholarship and practice that contribute to and enlarge the knowledge base of the field.
- Promote policies that ensure the humane and ethical use of educational communications and technology at all levels, from the personal through the international.

Scientific Reasoning Abilities...continued from page 1

of the children were in kindergarten, which is a 2-year program in the Netherlands after which formal education starts. There were 14 girls and 9 boys in the first year (K1), 9 girls and 14 boys in the second year (K2). The average age was 5 years and 3 months, with a range from 4 years and 6 months to 6 years and 3 months. The school was a so-called "talent hotbed school," which means—among other things—extra attention to science and technology during the children's education.

✎

The present results show that CVS use can be measured in kindergarten. As the number of variables to be manipulated increased, the difficulty of the experiments increased. The number of variables to be manipulated can thus be used to scale children's CVS use with different items. The total number of experiments designed correctly demonstrated an early capacity for CVS use and thus show scientific reasoning to already be present in kindergarten. Its development, moreover, can be reliably measured using the dynamic assessment method….

✎

Taken together, these results suggest that science education programs can now be evaluated with regard to their capacity to produce an understanding of the CVS and its correct usage. This aspect of scientific reasoning is particularly relevant when scientific reasoning is conceptualized as involving the intentional seeking of knowledge via application of the methods of scientific inquiry. Children can gain knowledge from their own exploration and experiments with the application of the CVS as part of these. Together with the knowledge that young children are curious by nature and the knowledge that hands-on experimentation in the classroom can foster interest in science both inside and outside the school, we can conclude that even young children can and should, thus, be encouraged by schools to explore how the physical world works.

Editor's note: Reference citations have been omitted from this excerpt. Like most excerpts, this one cannot do justice to the full study. Readers are advised to consult the full text online.

Member Access Publications

Educational Technology Research and Development (ETR&D)
Bimonthly
ISSN: 1042-1629 (print)
ISSN: 1556-6501 (electronic)
Journal no. 11423
Springer US

TechTrends
Bimonthly
ISSN: 8756-3894 (print)
ISSN: 1559-7075 (electronic)
Journal no. 11528
Springer US

Instructional Science
An International Journal of the Learning Sciences
Bimonthly
ISSN: 0020-4277 (print)
ISSN: 1573-1952 (electronic)
Journal no. 11251
Springer Netherlands

International Journal of Designs for Learning
Semiannual
ISSN: 2159-449X
(electronic)
AECT

Journal of Applied Instructional Design
Semiannual
ISSN: 2160-5289
(electronic)
AECT

Visit the AECT website http://aect.org/, log on, and click on Publications for instant access.

Racing into the Future

AECT International Convention Theme Is "Accelerate Learning"

"Accelerate Learning: Racing into the Future" is the theme of this year's AECT International Convention, which will take place November 3-7 at the Hyatt Regency Hotel in Indianapolis, Indiana.

Early-bird registration is now in progress. Check the AECT website at http://aect.org for details.

The annual event is on track to draw record-setting attendance again this year, with participants from around the globe.

In addition to the usual session formats, a new one has been added. It's called *pecha kucha.* The phrase is Japanese for "chit-chat." This format will allow a three-person panel to present information very quickly and then provide optimal discussion time. Look for pecha kucha sessions this year when you sign up to attend the convention.

✍
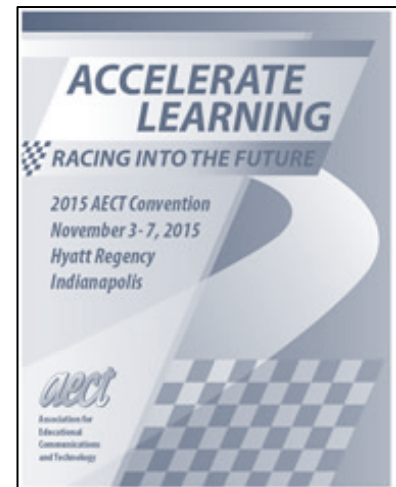
"The principal goal of education is to create men and women who are capable of doing new things, not simply repeating what other generations have done."
—Jean Piaget

Issues in Focus

Education in Fear

In February, as this edition was being prepared, news reports recounted the murders of three students at the University of North Carolina in Chapel Hill. All were killed with a .38 caliber revolver.

The United States leads the world in gun ownership and gun violence. Powerful forces within our society are determined to keep it that way. However, as open-carry laws increase across the United States, many institutions, organizations, and businesses have pushed back by setting in place policies to protect members' and clients' safety.

AECT now has in place a policy that hotel and conference facilities contracted for AECT events must have a no-weapons-on-premises policy in place.

The alarming statistics cannot be ignored: More than 30,000 gun deaths take place each year (about three every hour), and there are some 70,000-plus non-fatal gunshot wounds a year. Consider: During the 20-year Vietnam War period, between 1955 and 1975, more than 58,000 U.S. service members were killed, slightly less than the number of U.S. civilian gun deaths in any two-year period.

Schools from kindergarten to university have instituted safety measures, but many are more palliative than practical. It's difficult to retrofit a school or university as a fortress. And why should we want to? Most institutions opt for locked entrance doors with cameras. One elementary school I visited had begun locking all interior doors: offices, classrooms, library, and so on. Observers, whether school staff or visitors, were issued a key to allow them to enter classrooms without interrupting the lesson by knocking for admittance.

Students and educators increasingly work in similar prison-like conditions. Ironically the security measures often provide only an illusion of safety rather than true security.

In that school with all the locked doors, for example, every door had a large glass window. The locked library was behind a wall of glass. The camera-equipped entrance doors to the school: all glass. Any would-be armed assailant determined to enter the school or any room within it could do so with relative ease. Such security measures affect only the law-abiding, not those with criminal intent.

This is not to minimize the devastation that one deranged shooter can wreak. But exceptionality should not be used as an excuse for universality. Teachers are taught not to punish the entire class for the transgression of one or two students. Yielding to unreasonable fears and spending money that could be used for teaching and learning on unnecessary and ineffective security apparatus is wasteful and worrying.

Franklin Roosevelt in 1933 admonished Americans that "the only thing we have to fear is fear itself." In the same inaugural address Roosevelt also said, "Only a foolish optimist can deny the dark realities of the moment." The dark realities of the present moment are not would-be assailants lurking near schools, ready to invade classrooms and gun down children and teachers. Such incidents are exceptions, dreadful, tragic exceptions. But the actual dark realities are our unreasoning fears, which pierce the hearts and minds of parents, educators, and most damagingly, children.

Locked glass doors won't keep a determined killer at bay, but they do send a dangerous and damaging message to children and adults alike that they live in an uncertain world, a world in which they need to be constantly afraid. What kind of educational message is that?