MEETING THE WORLD'S NEEDS FOR 21ST CENTURY SCIENCE INSTRUCTION

A Summary of 5 Key Findings

PASCO® scientific

The following findings are supported by a review of research and expert opinion related to science instruction and the worldwide need for expanded scientific expertise—considered together with the capabilities and experiences of educators using tools and instructional resources provided by PASCO.

There is a worldwide need to develop more qualified scientists, medical professionals, engineers and technologists.

Scientific expertise represents a key asset with economic and social benefits for individual countries and the world (Dobbs et al., 2012; OECD, 2013; UNESCO, 2010; U.S. Congress Joint Economic Committee, 2012).

Scientific, mathematical, and technical expertise translates into benefits for students and future workers, with attending benefits for countries (Dobbs et al., 2012; National Science Board, 2014; U.S. Congress Joint Economic Committee, 2012).

As the demand grows for qualified workers in STEM-related jobs, there are indications that supply may not be able to keep pace with demand (Dobbs et al., 2012; National Science Board, 2014; UNESCO, 2010; U.S. Congress Joint Economic Committee, 2012).

Experts in science education call for students to be more "scientifically literate" and gain experience with the tools and practices of science.

Reports and guidance from major global institutions stress that this includes not only knowledge about the facts, theories, and concepts of science, but also an understanding about the practices of science (ISTE, 2007a, 2007b; National Research Council, 2012; OECD, 2007, 2014).

PASCO's sensor-based investigations provide extensive opportunities for students to develop scientific literacy and familiarity with the practices of science through hands-on experiences using tools similar to those used by scientists and engineers. The availability of high-quality student equipment at low cost helps stretch precious science education resources further.

Use of technology tools for data collection, analysis, and visualization as part of hands-on, inquiry-based science instruction has been shown to deepen students' understanding of science concepts.

Research confirms the positive impact of inquiry-based instruction on student understanding of science (Bredderman, 1983; Furtak et al., 2012; Minner, Levy, & Century, 2010; Schroeder, Scott, Tolson, Huang, & Lee, 2007; Shymansky, Hedges, & Woodworth, 1990; Weinstein, Boulanger, & Walberg, 1982).

Research and expert opinion confirm the value of technology to support student data collection, analysis, and visualization, including sensors and probes (Linn & Hsi, 2000; Krajcik & Mun, 2014; Kulik, 2003; Rogers & Finlayson, 2004; Webb, 2008).

Education experts specify that such technology is most effective in supporting student learning when it is used in an inquiry context (Krajcik & Mun, 2014; National Research Council, 2006; Webb, 2008).

Technology use should support students in actively constructing meaning; be situated in an authentic, real-world context; provide cognitive tools; support specified learning goals; and scaffold student capabilities (Krajcik & Mun, 2014).

PASCO provides technology tools that expand human capacity for data collection, analysis, and visualization, together with instructional resources to support use within an inquiry context, aligned with principles of positive instructional use of technology.

PASCO technology also makes inquiry investigations more focused and time-efficient, with a corresponding benefit for teachers and students.

Involving students in hands-on, inquiry-based science can increase their motivation and interest in science.

Research supports the motivational value of incorporating scientific inquiry activities and related engineering design activities into instruction (Barron et al., 1998; Crawford, 2014; Cunningham & Carlsen, 2014; Fraser, Giddings, & McRobbie, 1995; Kolodner et al., 2003; National Research Council, 2006; Scanlon, Jones, & Waycott, 2005; Webb, 2008; Wong & Fraser, 1995).

Survey data show that many students find hands-on experiences using technology both motivating and memorable (Farris-Berg, 2008).

Technology tools and instructional resources provided by PASCO help build students' interest in science through hands-on scientific inquiry and engineering design investigations.

Throughout the world, teachers are using PASCO sensor and data analysis technology to deepen student understanding of science concepts and practices while increasing student engagement and motivation in science.

A physics and chemistry teacher in the Czech Republic has found that integrating scientific inquiry using PASCO tools helps university-bound students think critically and develop their research and problem-solving skills.

A physics teacher in Australia has found that inquiry-based instruction using PASCO measurement tools helps students connect physics theory to practice and better visualize data—leading to improved student engagement and motivation. Teaching throughout his school has been revitalized as other teachers have adopted the same model of technology-supported inquiry.

A secondary science instructional supervisor for a school district in the United States implemented a hands-on, inquiry-based science approach that incorporated PASCO technology, leading to increased motivation and creativity. During this time, student achievement on the state science exams has also improved, reflecting deeper understanding of scientific concepts and principles.

To read more, download the whitepaper Meeting the World's Needs for 21st Century Instruction: A Synthesis of Research and Best Practices available at **www.pasco.com/BestPractices**

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