The Informal Informing the Formal to Form New Models of Learning

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ABSTRACT
Media Lab Europe's Everyday Learning group and initiatives associated with the Empowering Minds project are developing new strategies for broad access to technologies and appropriation of the ideas they engender. Here we include examples of sensor-equipped portable devices for registering environmental conditions, a form and forum for developing public opinion, materials enabling personal engagement with computational ideas, and a model of professional development that sustains Constructionist uses of technologies in schools.

Keywords
Sensors, mobile computing, multimodal representations, public opinion, computational materials, Constructionist learning, professional development

INTRODUCTION
Informal learning is sometimes situated as a reaction against the compartmentalized curricular and social structures of formal education systems. We believe that what's considered fun, good learning in informal settings could and should also be the norm in formal learning. Formal education could benefit from the emphases on personal involvements with ideas, open-style learning environments, and broad diversity among collaborating learners.

EVERYDAY LEARNING [1]
Twenty years ago the increasing miniaturization and affordability of silicon chips made predictable a revolution in computation and communications. Today sensor technologies are becoming smaller and more affordable, and their predictable pervasiveness could enable people to "see the unseen" or otherwise perceive the imperceptible in the world around them.

We are developing techniques for translating sensor data as representations that can be meaningful to non-scientists and with which they could constructively interact. Current projects complement interactions in an immediate time and place with constructive interactions in a subsequent temporal and spatial sphere.

Nature Trailer
In this example of such a "collect and reflect" interface, a sensor-equipped handheld device uses GPS, compass, sundial, weather sensors and map overlays to create a tool that graphically informs hikers of changing environmental conditions and plays selections of a story told by fictional characters who have experienced the locations in similar conditions. The combined information enhances the experience and informs decisions about how to proceed. The device records a trail of the hiker's varying locations. Later, the hiker can view and augment these traces, recapitulating the hike in more contemplative fashion and enjoying a lengthier, higher quality cinematic experience.

Smoke Rings
Wearers of a mobile sensing device can collect readings of fluctuating chemical levels in environmental tobacco smoke. The readings are displayed on a 12-hour clock, allowing the wearer to correlate smoke exposures to varying locations throughout the day. Wearers can upload the data to a simulator that projects long-term health consequences of sustained exposures. The resulting visualisations resemble x-ray images of cartoon characters progressing from infancy through old age. Each character appears twice, one registering projections based on studies supported by the tobacco industry and the other registering projections from studies supported by other interests, such as insurance companies. Guess which character appears healthier.

TexTales
This large-scale installation uses photographs and SMS text messages to form a basis for developing and expressing opinions at personal and public scales. We work with community members as they take and arrange photos

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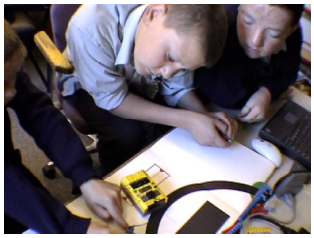
related to an issue that concerns them. We project the resulting sets of 9 images in public spaces where passersby use their mobile phones to send captions. As the display changes it both reflects aspects of the larger discussion and feeds back into it as others in the crowd respond. Meanings emerge through combinations of images, image plus texts, and texts with regard to other texts.



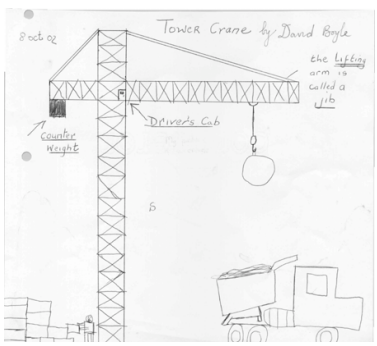

In this manner we have supported discussion of renovation of low-income housing in an inner-city neighbourhood, tensions among factions within a rural community, and legislation restricting smoking in public places. Through the other "collect and reflect" interfaces we support informed decision-making and aim to promote environmental awareness and action. With these tools people can think about probabilities, notions of acceptable risk, and changing timescales and frames of reference. We hope to demonstrate that rich representation and interaction schemes can help mobile communications devices to transcend gadgetry and transform learning as a pleasurable, constructive, everyday experience.

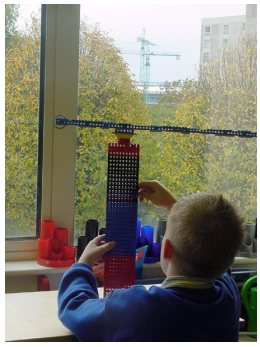
EMPOWERING MINDS [2]

Empowering Minds is a new model of professional development in which primary school teachers learn about digital technologies side-by-side with their students. Teachers and students explored the theme, "Story, Myth, and Legend" using the Programmable Brick developed at MIT to extend a LEGO construction kit. This technology enabled participants to build models that interact with the physical world through sensors and motors.

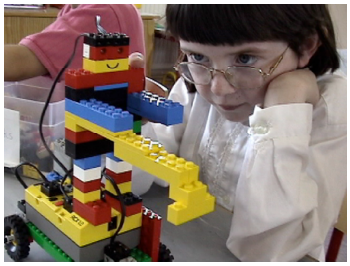
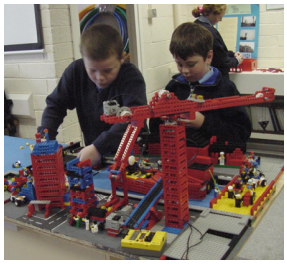



Inspired by the Logo programming environment, these "low ceiling / high threshold" materials are easy to begin working with and have the capacity to continue supporting the learner as understandings grow. Learners can construct something personally meaningful from the start, and the materials provide the stimulus and building components to construct increasingly in-depth and probing projects.

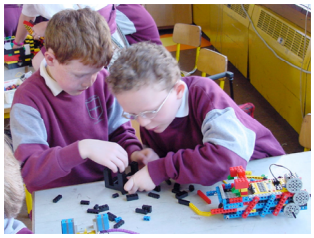




The materials are attractive, motivating, and robust to daily handling by multiple users in a classroom setting. Such materials are worth paying for, even in the restrictive budgetary context of primary education. They are "conversational", accommodating feedback and negotiation; "connective," enabling learners to develop personal relationships with powerful ideas; and challenging, leading to more than one "right" answer and allowing more than one way of seeking answers.

These computational materials, combined with the open-environment, "atelier" style of working, provide the spark and intense sustaining experience necessary for challenging teachers to question their assumptions and begin to think about thinking.




The web-based Empowering Minds Learning Network now serves 13 Irish primary schools, 24 classrooms, 29 teachers, and more than 500 students. The project is extending to initiatives within several Dublin-based community centres, and related efforts are beginning more broadly in Europe.

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