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Translating Between Representations in a Social Context: A Study of Undergraduate Science Students' Representational Fluency

Kim Nichols, Muditha Ranasinghe, and Jim Hanan

University of Queensland, St. Lucia, Australia

(Editor's note: See full text for reference citations.)

Interactive digital learning environments can support illustration of complex scientific phenomena using representations in different modes. These include computer simulations that allow students to see the relationship between data and hypotheses, web-based tools that permit students to construct and represent their ideas or explain the nature of a scientific concept, and discussion-based tools that enable communication with other

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learners, to promote dialogic interaction and facilitate construction of knowledge and understanding of complex phenomena. They offer learners a variety of approaches to envisage complex scientific phenomena such as dynamic graphs, video, animations and simulations. They can facilitate learners' understanding of the complex forms of representations utilised in the science community. They can be designed to "provide visualisations of complex phenomena that are impossible to see in the real world yet whose experience will provide understanding that is difficult to achieve without such representation." They may provide a single representation or multiple representations at the same time.

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CALL FOR PAPERS

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

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JOURNALS

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

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RESEARCH

The topic this month is instructional design terminology and resources.

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**2013 AECT
International
Convention**
October 29 – November 2

It's not too early to begin planning to attend this year's convention in Anaheim, California, on the theme: "Innovate – Integrate – Communicate!"

**Association for
Educational
Communications and
Technology**

P.O. Box 2447
Bloomington, IN 47402-2447

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

Local Phone:
812-335-7675

Email:
aect@aect.org

Website:
<http://aect.org/>

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For more information please go to:

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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 is available on the homepage at:

<http://aect.org/>.

Call for Papers. The AECT flagship practitioner journal, *TechTrends*, is seeking manuscript submissions, including from international and newer authors. See the display ad below. Likewise AECT's premier research journal, *Educational Technology Research and Development* also welcomes submissions at <http://www.editorialmanager.com/etrd>.

Call to Converse. Did you know that you can participate in an online discussion forum through the AECT website? The current topic is "Barriers to a National Certification Standard." Join in and read what others are saying and then contribute your own thoughts in the Forums section from the AECT homepage <http://aect.org/>.

CALL FOR PAPERS

TechTrends

Linking Research and Practice to Improve Learning

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For more information, see Instructions for Authors online: aecttechrends.com

Authenticity in Learning for the Twenty-First Century: Bridging the Formal and the Informal

David Hung, Shu-Shing Lee,
and Kenneth Y.T. Lim

National Institute of Education
Nanyang Technological University
Singapore



How was learning characterized before the advent of formal instruction? The online worlds and social media of today remind us of older constructs of communities that were defined by locality and face-to-face interactions. However, with the development of social media, community-collectives comprising members from different localities are able to unite in the pursuit of common goals in a manner not achievable in the past. The authenticity of learning, consistent with traditional notions of communities of practice, re-emerges in new ways facilitated by social media.



The focus of this paper is to advance the argument that principles from informal learning might be leveraged to make formal learning more authentic. Two case studies were constructed using qualitative research methods, such as observations, informal open-ended interviews, field notes, and informal conversations with students, teachers, coaches, and parents, over a two-year period. Observations comprising field notes of students' learning experiences occurred regularly at least once a week. Interviews focused on individuals' learning experiences, strategies, and peers' learning approaches. The interviews were conducted twice a month. Each interview lasted approximately 30 minutes. All interviews were audio-

recorded and transcribed for analysis. Artifacts produced by students, such as written accounts of learning experiences and expressions of students' conceptual understandings, were also recorded and/or archived. The data analysis process was iterative as we discussed observations, analyzed transcripts, and identified the learning experiences of students in both formal and informal contexts.



Informal learning is generally characterized by outcomes which are emergent; seldom are specific outcomes or closures determinable at the outset. There are seldom direct trajectories which might be traced from the intended scrutiny to an outcome of learning.... However, when principles of informal learning are leveraged to create authentic learning experiences in formal settings, activities inspired by informal learning are put in place to augment the de-contextualized learning that characterizes so many formal classrooms.... Teachers might thus begin to use more dialogic modes of pedagogy and instruction that emphasize interactions between formal and informal learning spaces.

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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.

Translating...continued from page 1



This study aimed to investigate the nature of the participants' empirical explanations using as a criterion their ability to construct scientifically accurate explanations...[and the results showed] that a simulation of action potential that fosters interaction with and translation across dynamically linked representations is far more beneficial at fostering accurate use of concept-specific scientific language and representational fluency by students constructing knowledge of action potential mechanisms than is a paper-based activity with static representations. These outcomes confirm and extend our previous findings that students working with the same simulation have fewer misconceptions around action potential-related terminology and spend more time constructing explanations about this complex scientific phenomenon than students working with the usual tutorial-based worksheet.



In conclusion, representational fluency is an important characteristic in the development of disciplinary expertise. Promoting expertise in students also involves teaching them to think and communicate in a disciplinary way as experts would. In science, this would be demonstrated by discourse that reflects higher order thinking and active construction of knowledge while translating between representations as well as by the accurate use of scientific language when explaining scientific phenomena. Our previous study demonstrated that the group working with the simulation demonstrated a significantly greater level of knowledge construction discourse linked with higher order thinking than the paper-based activity. The current study showed that in addition to actively constructing knowledge the simulation group demonstrated a higher incidence of representational fluency and were able to explain action potential mechanisms with greater scientific accuracy. Taken together, these findings suggest that representational fluency is key to the endeavour of knowledge construction and to the accurate use of scientific language. Future studies need to explore more closely how representational fluency is developed through scaffolded simulation tasks.

[Editor's note: Excerpts seldom do justice to the full expanse of information and ideas in the original works, and that is especially true in the case of this study. I encourage readers to seek out the full article. The funding for this study was provided by a University of Queensland Strategic Teaching and Learning Grant. The authors also gratefully acknowledge the support of Valda Miller and Leslie Lluka.]

Coming Soon



New AECT-Springer Books and Briefs Series Planned

AECT and Springer, the publishing company responsible for most AECT journals and books, are working together to launch a new series of books and briefs. The books are planned to be 250-350 pages, edited collections or works by one or more authors, while the briefs are envisioned as shorter publications of 80-120 pages.

Goals of the new venture are to encourage the sharing of critical applied research and development findings; to provide the AECT membership with additional peer-reviewed, high-quality outlets for disseminating their scholarly work; to support graduate students and early-career professionals by pairing them with senior faculty in the production of such works; and to promote the use and wide-spread adoption of research-based innovations in educational technology and instruction.

The series editors have been named: J. Michael Spector is an AECT past president and a professor at the University of North Texas in Denton; M.J. Bishop is, like Spector, one of the editors of the newly revised fourth edition of *Handbook of Research on Educational Communications and Technology* and is an associate professor at Lehigh University in Bethlehem, Pennsylvania; and Dirk Ifenthaler is vice president of communications for the AECT Design & Development Division and an associate professor at the University of Freiburg in Germany.

Member Access Publications

Educational Technology Research and Development

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

Quarterly
ISSN: 2159-449X
(electronic)
AECT

Journal of Applied Instructional Design

Quarterly
ISSN: 2160-5289
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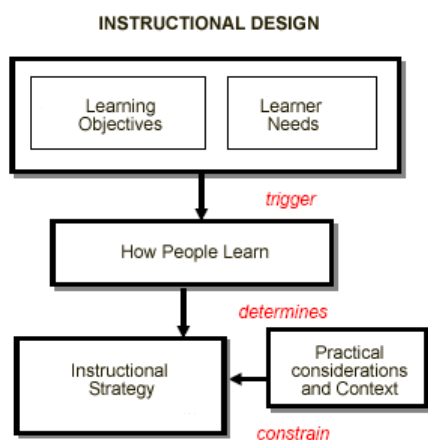
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Research Roundup

Looking into Instructional Design

A key topic of conversation during the AECT International Convention last fall was *instructional design*—what to call it, how to define it, and what it encompasses in terms of models and philosophies. For this issue of Research Roundup, instructional design—or *learning design*, as several have advocated calling it—is the focus, with particular emphasis on international perspectives.

Websites for institutions and commercial firms offer one type of resource. For example, a useful website is Instructional Design Australia (<http://instructionaldesign.com.au>). The lead-in at this website begins with a definition and a helpful graphic:



The website includes a wealth of information that may be helpful to both novice and veteran practitioners.

Another website is SICET, the Society of International Chinese in Educational Technology (<http://sicet.org>). SICET is a nonpolitical, nonprofit academic organization with a mission to establish and strengthen academic international connections, exchanges, research, and studies in educational technology for teaching and learning, as well as to promote the application of educational technology in Chinese education. The society's newsletter offers a window into the organization.

Journals are another type of resource. Many

offer at least some open access to articles or abstracts. Following are a few examples:

Journal of Information Literacy (<http://ojs.lboro.ac.uk>), from the United Kingdom, “aims to investigate information literacy in all its forms to address the interests of diverse IL communities of practice.”

International Journal of Technology Enhanced Learning (<http://www.inderscience.com/jhome.php?jcode=ijtel>) offers an array of articles by authors from around the world, many addressing instructional design in technology-mediated classrooms. This journal is one of many published by Inderscience, a U.K.-based journal publisher (<http://www.inderscience.com>) that provides online access to many articles.

AJODL, or *ASEAN Journal of Open and Distance Learning* (<http://ajodl.oum.edu.my>) includes many articles related to instructional design. ASEAN, the Association of South East Asian Nations, in the journal title refers to the publication's geographic target area, not the association. The journal is housed at Open University Malaysia in Kuala Lumpur.

Canadian Journal of Learning and Technology/La revue canadienne de l'apprentissage et de la technologie (<http://www.cjlt.ca>), addresses, in addition to instructional design, topics such as learning theory and technology, cognition and technology, online learning, computer applications, simulations and gaming, and other aspects of technology in learning.

An Internet search using *instructional design* or *learning design* will yield an over-abundance of website and journal resources to complement those already available through AECT. On the homepage at <http://aect.org/>, click on the Publications tab and sign in to access content in a variety of resources in addition to those listed on page 5 of this newsletter. In particular, take a look at the *International Journal of Designs for Learning* and the *Journal of Applied Instructional Design*.