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Translating Learning Sciences Research into Classroom Practices

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Introduction

A perennial challenge in educational research is the bridging of the gap between research and practice (Chafouleas & Riley-Tillman, 2005). On one hand, researchers generally tend to scoff at practitioners' lack of theoretical and empirical bases in their practices. On the other hand, many practitioners are cynical about the applicability of findings from so-called esoteric research. Action Research was advanced as an approach to engage practitioners in evidence-based research to improve classroom practices (Kemmis, 1982; Mills, 2003). There are calls to researchers to direct their effort towards applicable knowledge. The Spencer Foundation in the United States has launched an initiative to promote research that produces usable knowledge in education (Lagemann, 2002). Also, in the Call for Papers for the American Educational Research Association (AERA) 2006 Annual Meeting, the theme *Education Research in the Public Interest* was chosen to emphasize the importance of research serving the real world.

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Learning Sciences, as an emerging field of educational research, is facing the same challenge of bridging research and practice. Sabelli and Dede (2001) have lamented the lack of impact of decades of funded study on large-scale improvement in classroom practice. Looi, Hung, and Tan (in this issue) share the same sentiment. Likewise, when we started our research studies on Knowledge Building in Singapore classrooms in 2001 (Ibrahim & Tan, 2004; Tan, Hung, & So, 2005), we were challenged by the immense difficulty in achieving pervasive and sustainable applications in classrooms. In many cases, when the researchers left the classroom, the innovation stopped altogether. Research on innovative practices in schools would come and go, but classroom practices would remain essentially unaffected.

When the Learning Sciences Lab (LSL) was set up in Singapore in early 2005, we took up the challenge of impacting classroom practices through Learning Sciences research (Looi, Hung, Bopry, & Koh, 2005). In this article, we analyze some factors contributing to the disjunction between educational research and practice in the Singapore context. We also propose a "communities of practice" (CoP) approach to narrow the gaps between policy-makers, researchers, and practitioners that could potentially provide a systemic framework for translating research into practices. In Singapore, we are able to leverage via the unique close relationship between the policy-makers (Educational Technology Division in the Ministry of Education), the researchers (Learning Sciences Lab within the National Institute of Education), and the practitioners (the schools in Singapore), to potentially effect the transfer from research to practice. All three parties need to co-evolve the research agenda and goals, based on a distributed expertise approach to engage in research-to-practice translations. Through such an approach, we posit that research can have better chances at scaling innovations in practice and then sustaining them.

Disjunction Between Research and Practice

To get a better picture of how the gap between research and practice may arise, we start by analyzing the typical life cycle of an educational innovation from a research community to the practitioners in the Singapore context (Figure 1).

Researchers would usually define research problems or innovation for investigation, which would be strongly influenced by the availability of research funding provided by the policy-maker. After funding is awarded, the researchers would be required to provide a final report of the research findings to the policy-maker, when the research is completed. Generally, the policy-maker would look through the research findings and decide on the areas for policy changes, very often independently of the researchers. In this hierarchical

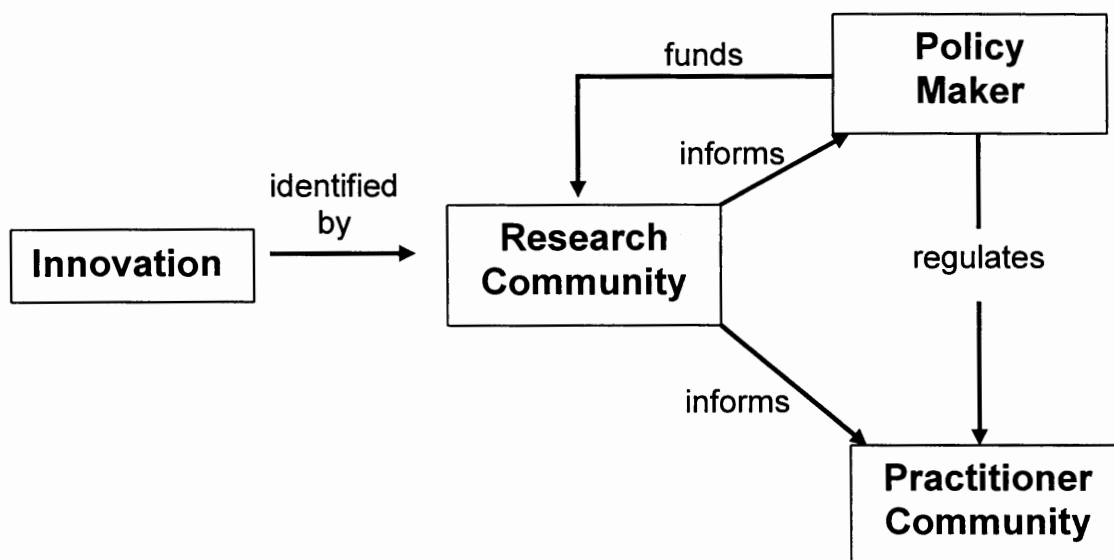


Figure 1. Typical life cycle of educational innovation.

model, knowledge is being generated in the research community, transferred via the policy-maker, and eventually implemented in the practitioner community. Based on the above hierarchical model, the various parties involved may not share the same goals, concern, and values. Table 1 lists the possible differences among various communities.

Table 1. Disjunction among research community, policy-maker, and practitioner community.

	Research Community	Policy-maker	Practitioner Community
Goal	Generate knowledge; introduce innovation in education	Identify strategic directions, setting systemic policies	Holistic development of students
Concern	Design and implementation of research	Education for nation-building and benefits to society at large	Improvement in classroom practices
Value	Rigor of research process; acceptance by research community	Education excellence against global benchmark	Educational achievement and holistic development of school students

Several consequences could arise from this misalignment in goals, concerns, and values, including usability of knowledge, transfer of knowledge and skills, and sustainable implementation.

Usability of Knowledge

Researchers, through participation in research communities, would often be exposed to innovative ideas and technologies, which would then be translated into research projects. When introduced to school settings, these ideas would often be met with cynicism, or at best compliance by the practitioners, who were not involved in the research. One main reason could be the lack of ownership of the intervention by the practitioners not involved in the research. Classroom teachers are primarily concerned about their classroom processes and students' learning outcomes. Injected alien innovations would often be deemed to be 'nice-to-have' for those with the luxury of time and resources. In order to achieve better alignment of goals among researchers, policy-makers, and practitioners, the research should generate usable knowledge through intervention studies with integrity that has high potential of generalizability to school settings (Rosenfield, 2000).

Transfer of Knowledge and Skills

Transfer of knowledge and skills is a prerequisite for success of a research study, starting from the time the innovation is first introduced to a classroom. Any innovation in classrooms should be implemented with an understanding of the underlying theoretical

underpinning and epistemologies. While it might be easy to transfer technical and procedural skills, it is a challenge to develop practitioners who can implement an educational innovation with appropriate pedagogies and epistemologies. We could testify from our experience with introducing Knowledge Building to our schools (Tan, Hung, & So, 2005). The effort was first met with disappointing outcomes, when students used *Knowledge Forum* (Scardamalia & Bereiter, 1994), an online discussion forum with graphical interface and customizable scaffolds, as a chat tool or information repository. It is a far cry from our intended outcome: one in which the students are engaged in progressive discourse leading to knowledge building (Scardamalia & Bereiter, 2003). Subsequently, successful implementations emerged when some teachers, who attended our Master's class, implemented the innovation in their classrooms. It then dawned on us that we had neglected an important mediating factor: the teachers must appreciate the pedagogies and must possess the appropriate epistemology to effectively implement the innovation.

Sustainable Implementation

Once an innovation finds its way into the classroom, a more significant and challenging task is to sustain the use of the innovation. In order to sustain innovative practices, our experience showed that not only must the practitioners (the teachers) have the capabilities of implementing the innovation as outlined above, they must also take personal ownership of the innovation. If the teachers do not have ownership of implementation and regard the innovation as an imposition, the innovation is likely to be abandoned once the research ends. In many instances, innovation mandated by the authority is often carried out at a superficial level by the teachers, if there is no buy-in from them. In some cases, the innovation is implemented without integrity, rendering it ineffective. Or worse, there could be superficial activity conducted simply to show compliance. In all cases, the end-result is ineffective implantation of innovation, which is counter-productive, because it takes away precious curriculum time. In order to sustain innovative practices, the innovation has also got to be recognized and valued by the school leadership. Support from leadership is essential. The innovation can be institutionalized only with the full support of the school leadership.

Limitations of Current Practitioner-Centric Research Models

Action research, which is practitioner-centric research, has been a promising model that holds the potential to bridge the gap between research and practice (Mills, 2003). It works on a partnership model, where researchers and practitioners collaborate on the design and implementation of the innovation. It

empowers the practitioners by engaging them in the research process; encourages ownership of the innovation; and enhances the probability of the innovation being ecologically valid and culturally receptive (Stringer, 1993).

However, action research may have limited success, unless there is voluntary partnership between researchers and practitioners. Building trust and working relationship is by no means an easy task; it involves both commitment and effort in aligning goals and negotiation of working procedures. Another common criticism of action research is the lack of rigor and generalizability of the research findings (Hughes, 2003). Often, practitioners are involved in data collection and analysis, and anecdotal evidence is often used to support claims. This problem arises because of the attempt to pass the responsibility of research onto the practitioners, who are already burdened with heavy teaching responsibility. In so doing, we are not harnessing the distributed intelligence of the research community.

Another approach commonly advocated by learning sciences is Design-Based Research. Design-Based Research (DBR) and similar methodologies, such as participatory research, design-ethnography, and other approaches all share the commonality of the researchers' involvements as change-agents (Barab & Squire, 2004; Design-Based Research Collective, 2003). In this approach, Learning Sciences researchers become an integral part of the practitioner context and attempt to empower the participants with the skills and competencies to engage in innovative practices. As such, there may be a higher chance that innovations are sustained. But much more can be done. We recommend a community of practice (CoP) approach of participatory co-construction stance among researchers, policy-makers, and practitioners.

From the ongoing discussion, the key root cause contributing to the gap between research and practice in educational research and possibly in the Learning Sciences is the mis-alignment in goals, concerns, and values among the research community, the policy-maker, and the practitioner community. This mis-alignment means that investments in terms of finance, effort, time, and expertise are diffused, leading to wastage. There are several consequences. First, the knowledge generated by the research community may not be valued by the practitioner community. Second, the transfer of knowledge and skills are limited to superficial procedural and technical skills, without the deep transformation-like epistemological changes which are necessary for effective implementation of the innovation. Third, the innovation will not be sustainable. Action research is a promising solution, but it is premised on a voluntary and committed partnership. The internal validity and generalizability of research studies may also be sacrificed with action research.

In the next section, we describe a recent case of a needs-driven research project that evolved into a partnership among the initiating school, the Ministry of Education, and researchers. This experience pointed us to a possible strategy to effectively bridge research and practice in classrooms.

Partnership Model: A Case Example

"T" Junior College (pseudo name), which traditionally enrolled 11th and 12th grade students, started to offer the Integrated Program (IP) in 2005. The Integrated Program is a recent innovation in educational programming by the Ministry of Education that exempts students with proven academic performance from the national examination at the 10th grade level. The time saved from preparing for the examination can be used for exploring learning in more breadth and depth and to develop creative and critical thinking. T Junior College now admits 9th grade students, who will sit for a national standard examination at 12th grade level.

When T Junior College started to plan for the Integrated Program, the science teachers proposed a technology-enabled, problem-based learning approach for the learning of science. They conceptualized a learning framework called THINK cycle, meaning Trigger, Harness, Investigate, Network, and Know, which represent the various stages of problem investigation. They were interested in using technology to support the problem-based learning approach, including the use of wireless and tablet PC technologies. There were two main areas where they solicited assistance from the Ministry of Education—budget to enhance the school's technology infrastructure, and guidance in the development of pedagogies. What ensued was the involvement of the Educational Technology Division (ETD) in the Ministry of Education and the Learning Sciences Lab (LSL) from the National Institute of Education.

When ETD was first approached by T Junior College, it played the role of a policy-maker by providing the seed funding for the college to enhance its technology infrastructure. As the R&D unit in ETD had just been set up, it acted as a 'resource broker' by linking the school with the Learning Sciences Lab (LSL) researchers in the National Institute of Education. The LSL researchers, together with the officers from the R&D unit, have since been working with the school teachers on research to improve the pedagogies. Currently, they are working on using computer supported collaborative learning (CSCL) technology to support the collaborative problem-solving process, and to improve the teachers' scaffolding strategies. The complementary roles of the three parties (T Junior College, ETD, and LSL) as well as the evolving stages of research are summarized in Table 2.

This research project possesses several characteristics:

1. The research is needs driven and initiated by practitioners rather than researchers. The school teachers requested assistance in research so as to improve their innovation.
2. It involves a tripartite collaboration of three education communities—the school teachers represent the practitioner community, ETD is the policy-maker, and LSL researchers come from the research community.
3. There was a common goal among the three communities—to improve innovative practices in classrooms.
4. It drew upon distributed expertise from the various communities, unlike some action research approaches that require the teachers to assume the roles of researchers.
5. It involves cross-departmental communities within an organization. For example, the R&D unit and the Professional Development and Consultancy unit in ETD work together to introduce the approach to other schools.
6. In contrast to the hierarchical model (Figure 1), there is a co-evolution of the innovative process and the communities' interactions. Innovation is not a 'product' passing from one community to another; it is co-designed and developed by the various communities.

This experience has prompted us to incorporate the idea of communities of practice as an organic approach that co-evolves with the transformation of research into practice.

Cross-Organizational and Within-Organizational Communities of Practice

Wenger, McDermott, and Snyder (2002) define communities of practice (CoP) as "groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis." CoP is a potential solution to bridge the gap between research and practice for the following reasons. First, it is a congregation of members with similar goals, which could lead to concerted effort by the members to solve identified problems. Second, members participating in the community are enculturated with the norms and practices unique to that community, which means transfer of knowledge and skills could go beyond the superficial level. Third, it is in line with the partnership model, yet it draws upon the distributed expertise from various communities. So, it could potentially avoid the pitfall of sacrificing the rigor of research by asking a party to assume too much responsibility, as in the case of action research.

Table 2. Summary of tripartite approach in bringing innovation to classrooms.

"T" Junior College/ Schools (Practitioner Community)	Educational Technology Division, ETD (Policy- maker)	Learning Sciences Lab, LSL (Research community)	Stage in Process
Teachers developed an innovative practice and initiated request to do research on the practice. Teachers are acting as reflective practitioners in the research.	The R&D unit acted as a broker between the school and LSL, participated in the research, focusing on improving the classroom practice.	LSL researchers elaborated on the theoretical underpinning of the approach and applied rigorous research methodologies to derive useful information that can inform both theory and practice.	Knowledge generation
Teachers were enculturated with the epistemologies and pedagogies by being partners in the research.	R&D officers worked with teachers in reflective practice.	LSL researchers tracked the development of epistemologies of the teachers and students participating in the research.	Knowledge transfer during knowledge generation
<i>In the pipeline</i>			
Teachers from other departments or schools will learn about the innovation through seminars, workshops and conferences.	The R&D unit will work with the Professional Development and Consultation unit in ETD to conduct workshops for other teachers.	LSL researchers will disseminate research findings through seminars and conferences.	Knowledge transfer after knowledge generation

We propose a model where cross-organizational and within-organizational communities of practice are formed with members from various parties—policy-maker, research community, and practitioner community. This approach leverages the unique relationship between the policy-maker, the research community, and the practitioner community in Singapore’s education context. The central goal of this approach is to improve classroom practices through the three major phases of knowledge generation, knowledge transfer, and sustained practices (Figure 2).

Unlike the critical action research that focuses on empowering teachers (Stinger, 1993), or practical action research that emphasises teachers as researchers (Mills, 2003), this approach is more akin to the co-generative model of action research (Greenwood & Levin, 2000) that integrates theory and praxis through collaboration between professional researchers and practitioners. There are several noteworthy characteristics about the development of CoPs in each phase:

1. **Evolving CoPs.** Structure and system are put in place to nurture the formation of CoPs, but there is no top-down mandate to do so. We concur on the stand that CoP should be designed to evolve (Hung, Tan,

Hedberg, & Koh, 2005; Wenger, McDermott, & Synder, 2002). For example, the officers in the R&D unit have regular meetings with LSL researchers. Through these meetings, research ideas are shared and cross-organizational teams are formed to jointly design and implement a research project. The most recent example is the team formed to study the use of interactive whiteboards in schools. The R&D unit, acted as broker to identify suitable test-bed schools. The LSL researchers contributed to theoretical underpinnings and affordances of using interactive whiteboards, as well as liaising with experts in the United Kingdom.

2. **Co-evolution of innovation and CoP interactions.**

There is no clear demarcation between the phases. For example, transfer of knowledge can occur during the knowledge-generation phase. When the researchers engage the teachers in co-designing classroom activities, knowledge and epistemologies are “transferred” through a rub-on effect. We feel that this model of knowledge transfer may be time consuming, but it is effective, as it encourages ownership of learning from the teachers, as well as facilitates learning by doing and reflecting. When there is sufficient evidence to support generalization of innovation, a different approach of

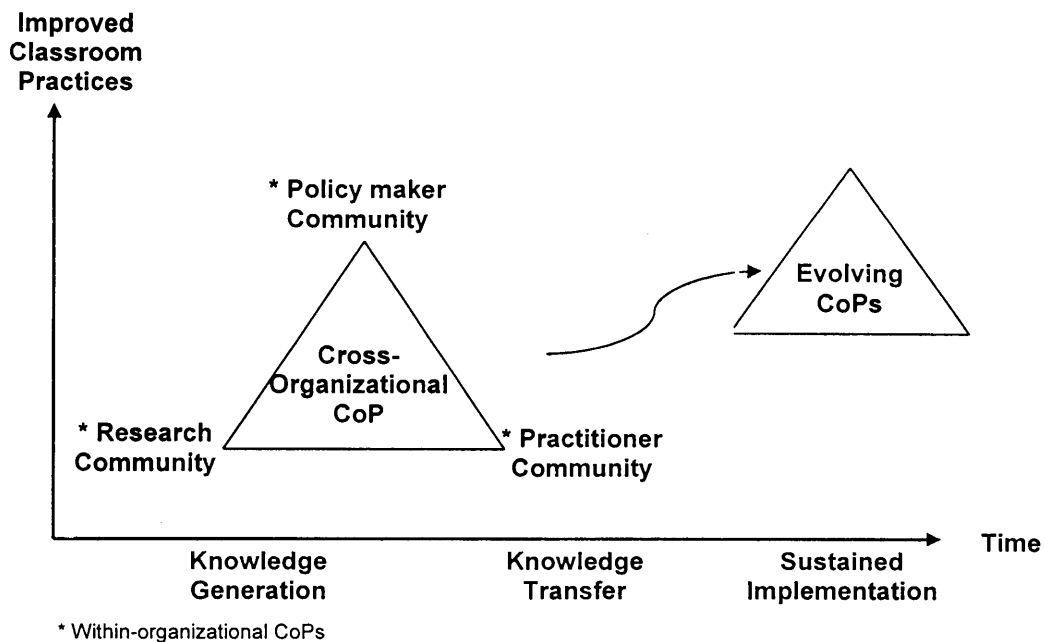


Figure 2. Cross-organizational and within-organizational CoPs.

knowledge transfer will be activated, where talks, workshops, or seminars are used to disseminate the information to more schools.

3. **Development of identity in CoPs.** In this model, the goal of the CoP remains the same: improving classroom practices through continual improvement of innovation. This shared goal may have helped to develop the identity of the cross-organizational CoP. All LSL researchers know who the members of 'The T Junior College project' are. In a way, the 'T Junior College project' members have formed a micro-community within LSL. This formation of identity is a crucial factor for the success of the partnership, as it reflects the joint ownership of the project throughout the various phases of its development. It is like a soccer match, where joint effort of all team members are needed to score goals throughout the game, rather than a relay run in which each runner's part is done once the baton is passed to another runner.

4. **Cross-organizational and within-organizational CoPs.** In the above discussion, we have shown how a cross-organizational CoP was formed from members among the R&D unit, LSL, and schools. Within ETD, we have two main branches—one takes charge of professional development of teachers and consultancy support for schools, while the other focuses on R&D and resource development. Regardless, officers in the two branches often participate in the other branch's project. For instance, a member from the professional development branch joined in the R&D core research team on educational games. Likewise, in LSL, there are

four main focus areas of research: (1) cognition, learning, and culture; (2) epistemology, community, and leadership; (3) innovative technological learning environments, pedagogies, and assessments; and (4) learning design capacity building for ICT integration. Researchers involved in these four focus areas meet regularly to cross-fertilize ideas.

In summary, the tenets that promote a CoP among stakeholders with the goal of translating research into practice are as follows:

- Co-evolve an agreed consensual research agenda that has clear goals for policy-makers and practitioners.
- Distribute the expertise of engaging in research, decision-making, pedagogical learning design, instructional skills, and development of learning activities.
- Distribute co-evolved interdependency with one another, assuming that mutual trust has been formed among the members.
- Walk the path from "beginning to end" together. In a CoP, there are always new members joining in, and so, in this sense, there need not be "an end." The innovation should be sustained.

The current CoP model differs from Design-Based Research, which we acknowledge is a significant attempt at researchers being very much involved with the practitioners on the ground. We would suggest that the CoP extends the Design-Based approach by framing the relationships among three originally disparate parties. The dimension of policy-maker becomes an

integral part “of the equation,” which DBR has likely not focused on.

It remains necessary for the field of the Learning Sciences to better understand and suggest strategies of how various parties of the research-to-practice translation can be tightened. This is imperative if we desire innovations in research and practice to be scaled-up and sustained.

Conclusion

The disjunction between educational research and practice has been a perennial issue, which retards the rate at which innovation is pervasively and effectively adopted in schools. Among many factors, we believe that a hierarchical model where there is clear division of roles in knowledge creation and implementation may lead to misalignment in goals, concerns, and values among research community, policy-maker, and practitioner communities. Some important consequences include the low usability of knowledge created, ineffective knowledge transfer, and non-sustainable innovation implementation. The recent establishment of Learning Sciences research in Singapore has prompted us to examine these issues. Harnessing the close relationship among the Educational Technology Division (policy-maker), the Learning Sciences Lab (research community), and the schools (practitioner community), we propose the idea of cross-organizational and within-organizational CoPs to bridge the gap between research and practice in the Learning Sciences.

This approach is at its infancy stage. Our future challenges are to study the scalability and sustainability issues. For scalability, we want to develop design principles that foster organic development of CoPs in terms of creation of identity, division of labor, and formation of rules in a new context to serve the goal of linking between theory and praxis in educational research. Another area of investigation is to study conditions that facilitate sustainability of innovation, where the focus could be between the practitioner community and the policy-maker.

In a culture where the hierarchical model of operation has been prevalent, finding a balance between a pre-planned structured approach and an organic evolving approach is crucial. The CoP approach is by no means a panacea to all problems. We will, however, track the development of this CoP approach so as to uncover effective and efficient ways of bringing the fruits of Learning Sciences research to our classrooms. □

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