Transforming Classrooms into Learning Studios

What Does It Take to Make Classrooms a Living Space?

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In this article, the authors start with a description of the learner-centered paradigm of education. The key tenets of the paradigm are outlined as: Competency-based student progress, competency-based student assessment and records, personal learning plans, project-based learning, just-in-time instructional support, student as self-directed learner, and teacher as guide on the side. Toward this end, they explain the self-directed, project-based learning approach using an exemplary school: Minnesota New Country School. Due to new roles of teachers and students in this new paradigm, they discuss how learning technology can support those roles by providing various functions. The functions include four major functions (record-keeping, planning, instruction, and assessment) and several secondary functions (communication, administration, and improvement). In the final section, the authors address the need for transforming schools' physical spaces and exemplify a design of such spaces as learning studios to best support the learner-centered paradigm of education.

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Introduction

Four walls, desks in rows, a board, and some pictures on the wall... This is what typically comes to mind when thinking about classrooms, even today. The way they are designed is synthetic, artificial, and impersonal. Why were classrooms designed as they are now? Are they meeting the needs of today's students and teachers? How can they be transformed into more organic and effective learning spaces? Addressing these questions requires an analysis of how schools change as a result of major changes and shifts in society.

As an outcome of the industrial revolution, schools were transformed from *one-room schoolhouses* to their current structure: *A factory-model type of approach*—a building in which students are divided into grade levels and move from classroom to classroom at timed intervals, somewhat like stations on an assembly line. During the Industrial Age, a system was needed that sorted out the laborers from the managers and professional people. In this approach, students were clustered based on their ages, and time—not learning—was the driver of students' educational progress; hence many students had to move on before the learning standards had been met. Although the transition from the Industrial Age to the Information Age has happened in many parts of the world, and employers expect different qualities from graduates, no major changes can be observed in most schooling today. In other words, most schools are still operating based on the needs of an industrial society.

In the Information Age, knowledge work is replacing manual labor as the most common kind of work. Far more students must learn at far higher levels than before, so the sorting focus of time-based student progress no longer serves our needs. This requires that each student progresses as soon as a standard has been mastered—and not before. But how can schools be designed for their students to be learning different things and progressing at different rates? Almost everything would have to change, from the roles of the teacher, the student, and technology, to the nature of instruction, assessment, and student records, to the design of the physical space in which learning occurs. We need a paradigm change to meet our new educational needs and realities, just as paradigm change from the one-room schoolhouse to the factory model of schools was necessary when communities evolved from the Agrarian to the Industrial Age.

In this article, we describe the nature of the learner-centered paradigm of education, starting with the big ideas about this paradigm. Then we explain how learning technology can support the learner-centered paradigm by providing various functions. Finally, we discuss how schools' physical spaces (classrooms) should be transformed to meet the needs of today's students and teachers in this new paradigm.

Big Ideas: Give Them Fish or Teach Them How to Fish?

In the Information Age, people change careers much more often than during the Industrial Age. Hence lifelong learning gains more importance. However, there are two requirements for promoting lifelong learning: cultivating a love of learning and nurturing skills for learning on one's own. The teacher-directed paradigm of education fails miserably at both. To move from *"Give them the fish" (teacher-directed learning)* to *"Teach them how to fish" (student self-directed learning)*, learners must be allowed, encouraged, and coached to choose the kinds of fish (desired outcomes) and methods to fish (different instructional options). This does much to develop the joy of fishing.

From a factory-model-of-schools' perspective, consider a teacher's role: A teacher in a classroom is assumed to be the major source of information, driver of teaching activities, and ultimate owner of student learning. The constructivist wave in education is recognition of the need to give more autonomy to students in the learning process for the Information Age. Thus, there has been a great emphasis on a shift from teacher-centered to student-centered approaches—teachers providing more personalized learning experiences. Since this is a customized approach to "giving them fish," we see this shift as a transitional step towards the learner-centered paradigm of education.

Some people consider learning activities as student-centered if students receive differentiated instruction, or if they are actively doing a task on their own. Typically, students have little or no role in designing or driving their learning paths in these scenarios. Teachers are still the decision-makers for what learning tasks students will do, what learning goals they will pursue, how they will work towards these learning goals, and which technologies or resources they will use. More importantly, there is still an emphasis on mass education—all students are asked to complete the same learning tasks for the same learning goals in the same amount of time.

Furthermore, in today's practices of student-centered approaches, students are usually asked to complete smaller learning tasks, which typically results in fragmented learning. From a motivational (passion for learning) perspective, education should help the learner see the big picture (long-term learning goals) and how the details of the picture (short-term learning goals) contribute to it. And students should be encouraged to define that big picture based on their interests, and to decide how they would like to proceed in achieving this big goal (personalized learning paths), with teacher guidance as needed. To this end, there is a need to go beyond student-centered learning, which is still constrained by time-based student progress and norm-referenced student assessment, to the learner-centered paradigm of education. So what is this new paradigm like?

The following are the major building blocks of the learner-centered paradigm (Lee, 2014; McCombs & Miller, 2007; Reigeluth & Karnopp, 2013):

- **Competency-based student progress.** The foundation of the learner-centered paradigm is student progress based on learning rather than on time. But this change requires changes throughout the rest of an educational system to work effectively.
- **Competency-based student assessment and records.** For student progress to be based on learning, it is essential to determine when learning has occurred—when a standard has been met (mastered). Hence, norm-referenced assessment must be replaced by criterion-referenced assessment. And norm-based grades, which compare students with each other, must be replaced by criterion-referenced records that indicate which competencies have been mastered.
- **Personal learning plans.** If different students are learning different things at any given time, it is important to have a personal learning plan for each student, rather than a single lesson plan for the teacher. This plan should have both a long-range component (career goals and other long-term goals) and a short-range component (goals for the next project period).
- **Project-based learning.** Learning typically occurs within the context of a significant, meaningful, authentic project that is of particular interest to the student. Often students work together in teams of two to four.
- **Just-in-time instructional support.** As students work on a project, they encounter a need to acquire a new skill or develop a new understanding (mental model). At that point, well-designed instruction should be available to the student most cost-effectively (e.g., Intelligent Tutoring Systems —ITSs) or peer tutoring. When neither of these is available or effective, the teacher is responsible for providing such tutoring, typically upon request.

This instructional support provides an opportunity for reliable and valid assessment of student mastery, as in ITSs (Aleven & Koedinger, 2000; Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palincsar, 1991; Murray, 1999).

- **Student as self-directed learner.** To promote student motivation and lifelong learning, students should be given much control over deciding what to learn next and how to learn it (which particular project out of many that could be used to learn it). This marks a change in student role from passive, teacher-directed learner to active, self-directed learner.
- **Teacher as guide on the side.** With different students learning different things at any given time, the teacher's role must change, as many have said, from "sage on the stage" to "guide on the side." The teacher should support the student as designer of student work (designing or selecting projects), facilitator of student work (motivational and instructional support within projects), mentor for well-rounded student development, and learning with, about, and for the student.

Self-Directed, Project-Based Learning

While the building blocks described in the previous section are essential components of the learner-centered paradigm of education, it is important to note that there can be great variation in how they are implemented. With such variations, we see significant potential in self-directed, project-based learning as an approach to improve student learning.

The fish analogy described previously is a good representation of how self-directed, project-based learning works in action. Students learn how to fish by actually fishing, for the fish they choose, and with the methods they choose. Then students reflect on their fishing experience, for example, via a presentation explaining the process they went through, showcasing the fish they caught, and evaluating their own success. Through this process, they do not evaluate the end product only (the numbers/types of fish they caught), but the process they went through as well—the fishing experience from beginning to end—to improve their future fishing experience (self-directed learning).

This may sound good in theory, but how can we implement these ideas in the real world? How can the self-directed, project-based learning approach work in action? The next section describes a school that implements a true learner-centered approach through self-directed, project-based learning.

An Example of a Learner-Centered School

The Minnesota New Country School *(www.mncs.org)* has extensively implemented the self-directed, project-based learning approach (Aslan, 2012; Aslan, Reigeluth, & Thomas, 2014; Thomas, Enloe, & Newell, 2005). Teachers identify students' needs and characteristics through establishing a *strong relationship* with them. This strong relationship is a key to guiding students to set up long-term goals for their education. Based on these goals, students, with guidance from their teachers, come up with short-term goals, based on the state standards in this school. Students are then asked to design projects in which they can meet these short-term goals. Next, a project proposal is prepared and submitted by each student. The proposal requires teachers' feedback and approval. In some cases, parents are involved in this approval.

Upon mutual agreement to begin, students start working on the project, and teachers continue their support and guidance throughout the process. Students are asked to enter time logs (microblogs) as reflection moments to review their learning throughout the project. If a project is not completed on time, the advising teacher (i.e., advisor) and each student get together to set up a new timeline—just like how projects are handled in the workplace. Upon successful completion of a project, the student and a team of teachers (i.e., advisors) get together to do a project assessment. The student presents the project along with its artifacts, and evaluates both process and products. The teachers ask clarifying questions to check the student's level of learning. Upon finalization of this assessment, the teachers, together with the student, decide on credits earned and standards met (transparent assessment). When credits and standards are finalized, the project is successfully completed and archived.

As explained above, MNCS provides a powerful example of the learner-centered paradigm of education by implementing self-directed, project-based learning. In this learning environment, there are two major expectations for students: choice and responsibility. From designing their own projects, to deciding how they would like to complete the projects, students assume much more choice and responsibility than in traditional learning environments. For both teachers and students, this requires learning technologies to serve a variety of functions in supporting self-directed, project-based learning. In the next section, we describe these functions.

Learning Technology to Support Learner-Centered Education

To assist teachers and students in the learner-centered paradigm of education, technology needs to serve a number of functions that are different from those that technology serves in the teacher-centered paradigm. Reigeluth, S. Watson, W. Watson, Dutta, Chen, and Powell (2008) described four major functions and three secondary functions that technology should serve to facilitate student learning. These functions are further elaborated by Reigeluth *et al.* (2015).

The major functions are recordkeeping, planning, instruction, and assessment for student learning. The *recordkeeping* function includes: (1) a detailed inventory of competencies and other attainments, including national, state, and local educational standards; (2) a record of which of those attainments each individual student has mastered; and (3) an inventory of each student's personal characteristics that have an influence on student learning (e.g., learning styles, multiple intelligences, interests, major life events, etc.).

The *planning* function involves: (1) determining short-term and long-term learning goals (attainments); (2) choosing projects as vehicles for meeting those learning goals; (3) identifying team members to collaborate on those projects; (4) defining the roles of teachers, students, and other stakeholders in the projects; and (5) creating a learning contract that specifies learning goals, projects, roles, and deadlines.

The main purpose of the *instruction* function is to create an effective learning environment for students (1) by facilitating the initiation of projects; (2) providing immersive virtual project environments or augmented reality for real project environments; and (3) supplying just-in-time instructional support during the project.

Finally, the *assessment* function of technology supports (1) reflection on, and summative assessments of, students' team performance outcomes in the project; (2) immediate formative feedback on each student's learning during the just-in-time instructional support; and (3) authentic summative assessments of students' individual learning outcomes during the just-in-time instructional support (certification).

In addition to these four major functions of learning technology, Reigeluth *et al.* (2015) outlined three secondary functions. Technology should fully support (1) communication and collaboration among students, teachers, parents, and other key stakeholders throughout the learning process. Additionally, technology should support (2) the administration function, which includes the management of access, general student data, and personnel data. Other administration sub-functions could be added, such as budgeting, maintenance, and transportation, but separate computer systems are typically used for them. Finally, technology should support (3) the improvement function, which evaluates and improves all its functions (major and secondary functions) and helps add additional functions or sub-functions as users need them.

Considering the big ideas about the learner-centered paradigm with self-directed, project-based learning, MNCS is an exemplary case for this paradigm and the functions of learning technologies compatible with this new paradigm (Aslan, 2012). In the next and final section, we address the need for transforming schools' physical spaces and exemplify a design for such spaces to best support the learner-centered paradigm of education.

From Classrooms to Learning Studios

Is it important to transform schools' physical spaces? Think about collaboration and communication as 21st century skills that an information society expects from our graduates. The physical space in traditional classrooms, with desks in rows making students sit behind each other, does not foster communication and collaboration among students. In fact, the nature of the design discourages students' interactions with their peers. Think back to your own education and remember how many times you were punished for talking to your peer or asking for help. So, how should physical space be transformed in schools to support the new paradigm of education?

To address this question, let's take a look at how workplaces have transformed their physical space to improve productivity of employees by enhancing communication and collaboration among them. In workplaces, there is a trend towards open offices—CEOs, managers, and employees sitting together and sharing the same work space. More importantly, employees from different units and disciplines sit next to each other with fewer barriers to their interactions (e.g., walls, separate offices, etc.). From a *hierarchical perspective*, there is a shift to a *team-spirit perspective* in workplaces. Such changes signify that everyone has something to learn from others and should work together despite their varying experiences, ages, and areas of expertise.

Leveraging from this perspective, we envision a similar approach applied to schools' physical space to remove barriers to learning—despite students' varying ages, expertise, and abilities. Earlier, we referred to traditional classrooms as synthetic, artificial, and impersonal. As described previously, learner-centered education requires a more dynamic, natural, and collaborative environment. In this section, inspired from *Active Learning Spaces* (K–12 Blueprint, 2016), we present a vision of classrooms as *learning studios* enabling implementation of learner-centered education. More specifically, we outline key features of the learning studios related to self-directed, project-based learning.

There are several key features of learning studios as extensively discussed in K–12 Blueprint (2016). These features include: (1) flexible spaces for different types of instructional activities; (2) movable desks and chairs with backpack storage to arrange the classroom layout based on the type of instructional activity; (3) a presentation center (mobile desks that help presenters dock their laptops and connect them with display devices); (4) display devices, including a main display (large-format interactive whiteboard or interactive display), a flat panel display (mentoring/work-group station), and col-

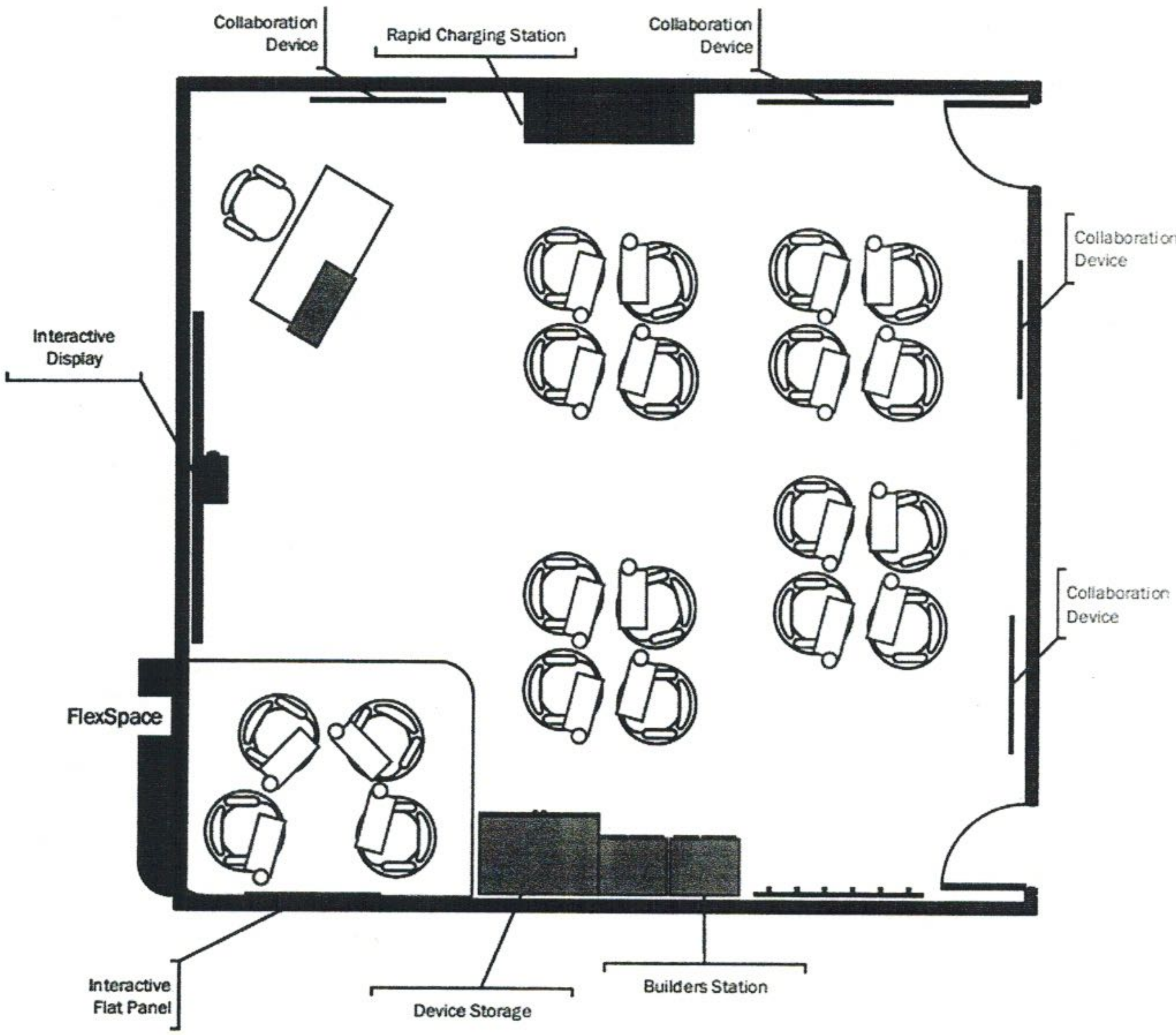

Figure 1. Exemplary physical setup of a learning studio (K–12 Blueprint, 2016).

laboration devices (digital flip chart or similar write-and-capture product); (5) audio options for individuals, work groups, and the whole room; (6) wired, wireless, and local wireless network capabilities; (7) video camera for the whole room and the collaboration station; (8) a builder station (including 3D printing, document camera, and multifunction printing); (9) wall power outlets for video display devices and cabinet power for the builder station; and (10) a rapid charging station to increase device accessibility. ***Figure 1*** shows an exemplary physical setup of a learning studio with all of these key features in place.

As illustrated in ***Figure 1***, the physical setup of the learning studio allows various learning scenarios for different educational activities, including *whole-group instruction, workgroup collaboration,* and *teacher/student mentoring*. The setup of the learning studio should be customizable, modular, and adaptive based on each of these scenarios. For instance, if there is a need for additional technologies (e.g., robotics kits) for a specific project, required equipment should be brought to the learning studio for students to use.

For *whole-group instruction*, a teacher, student, or guest speaker can deliver a lecture to all students in the learning studio, just like a brown-bag session in workplaces. During this lecture, the presenter connects to a main interactive display through a wireless docking station and connects with student devices via the learning technology (described previously). Students have access to instructional content and can follow the lecture from their own devices. For this type of instructional scenario, a U-shaped seating setup or a small-group setup is appropriate for each student to see the main projection screen. This scenario is also applicable to end-of-project presentations. After the students complete their projects, they can present their projects along with their artifacts individually or as a group to the all students and advising teachers.

For *workgroup collaboration,* a small-group setup facing or around a collaboration station would be useful. The teacher connects to a main interactive display through a wireless docking station and connects with student devices via the learning technology. The teacher can monitor the students using the learning technology to ensure they are on track with their learning goals and project progress. With the help of the instruction function of the learning technology, the teacher can ensure instructional support for students. Whenever necessary, the teacher facilitates group work by providing continuous feedback throughout the process. The teacher may also acknowledge exemplary projects and share them with all other students through an interactive display (e.g., milestones, artifacts, process, etc.). With this kind of teacher guidance, all groups and individuals can have a better understanding of the teacher's expectations and have a chance to improve their work accordingly.

As in the way projects are handled in workplaces, each team member in the workgroups may have different roles and responsibilities in project work. For instance, one of the students in a workgroup could be assigned as the project manager responsible for managing timelines and durations of project tasks. Another student in the team could be delegated as the technical lead for supporting the team with technical problems or challenges. Yet another student could be assigned as the subject-matter expert for a specific topic (e.g., the expert on human cognition). There could be many more roles based on the needs and scope of the project. One of the key considerations for role assignment is the fact that each student experiences different roles in different projects. As opposed to project roles in workplaces, students should develop a range of skills in different roles, not be an expert/specialist in one role yet.

For the *teacher/student mentoring* scenario, the teacher can use *FlexSpace*—a small, isolated space (see ***Figure 1***)—for individuals and small groups to provide feedback on their progress in projects and guide them towards achieving their learning goals and project artifacts. Students can move their desks to the *FlexSpace* for mentoring time with their teacher. When *FlexSpace* is used by a group, the teacher can connect to an interactive flat panel in *FlexSpace* through a wireless docking station. Additionally, the teacher can directly connect to the student devices when necessary. Students can participate in instruction from their own devices, and they can connect their devices to an interactive display to make some corrections on their work by collaborating with each other and the teacher.

In addition to academic mentoring, *FlexSpace* can be utilized as a space where a teacher can get to know students better (e.g., their learning styles, likes/dislikes, intelligences, etc.) through 1:1 meetings. This can help build stronger mentor-mentee relationships, and the teacher can provide psychosocial support for students' growth. *FlexSpace* can also be used for academic peer tutoring/mentoring. Students can choose to get peer feedback from one of their friends on certain procedures or project artifacts. In this sense, students can arrange 1:1, 1:many, or many:many meetings/workshops with each other. In some cases, a student might choose to spend some time in an isolated space. Towards this end, individual booths can be located in the learning studio, in addition to *FlexSpace*. Students can use such booths to take a break and rest, read a book, watch an entertaining video, or engage with some learning material.

Last, but not least, we would like to discuss Builders Station—an open space with equipment enabling students to "get their hands dirty" and play with technological gadgets to create their project artifacts. In a sense, students are positioned as Makers in this station. The Maker Movement (Dougherty, 2012; Peppler & Bender, 2013) is in line with project-based learning in the learner-centered paradigm, as the key tenet of the paradigm is for students to learn by doing. Through Builders Station, students can experience new technologies, including but not limited to 3D printing and robotics. In this station, students can work on various project artifacts integrated with science, technology, engineering, arts, and math (STEAM) (Kim & Park, 2012; Park & Ko, 2012). As a part of their project work, students can model and create 3D objects using 3D printers. Using educational robotics kits, students can develop and program robots. Therefore, students are no longer dependent on traditional project artifacts (e.g., presentations, pictures, articles, etc.), and they can be as creative as building their own mini-bridge using a similar design process as an architect.

Conclusion

The transition from the *Industrial Age* to the *Information Age* has resulted in the need for innovative approaches to teaching and learning. In the Information-Age paradigm of education, students should be at the center of the learning process, taking an active role, whereas teachers take the role of a learning mentor. This transition has also created the need for innovative methods of instruction and assessment using technology as an enabler of such methods. Implementation of such innovative methods requires a different set of infrastructure needs; therefore, in this article, we outlined features of an exemplary learning studio. This set of features can help teachers improve students' 21st century skills, including collaboration, problem-solving, creativity, self-confidence, self-direction, peer-mentoring, and leadership. □

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Peer Apprenticeship Learning in Networked Learning Communities: The Diffusion of Epistemic Learning

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This article discusses peer apprenticeship learning (PAL) as situated within networked learning communities (NLCs). The context revolves around the diffusion of technologically-mediated learning in Singapore schools, where teachers begin to implement inquiry-oriented learning, consistent with 21st century learning, among students. As these schools have in past practices excelled in performance-driven pedagogies suitable for passing examinations, redesigning curricular resources, assessment, and pedagogical practices towards inquiry-based learning was not insignificant. These teachers required convincing and also significant degrees of apprenticeship. The authors document PAL in action for teachers' epistemic change occurring within networks of teachers from across schools. The article delves into PAL processes, expanding the theory (see Hung,

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