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Chapter 17

The Learner-Centered Paradigm of Instruction

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Instruction (in both education and training contexts) must change from the Industrial Age paradigm, which was designed to sort students by basing student progress on time rather than on learning, to the Information Age paradigm, which is designed to maximize learning for all by basing student progress on learning rather than on time (Reigeluth & Karnopp, 2013). Instruction must change . . .

- from teacher-centered to *learner-centered* (task-based learning with just-in-time instructional support),
- from standardized to *personalized*,
- from time-based to *attainment-based*[1] *student progress*,
- from passive (learning by listening or reading) to *active* (TBL with just-in-time instructional support),
- from teacher-directed to *self-directed learning*, and
- from a content-centered to a *task-centered organization*.

This is a true paradigm change that requires massive changes in . . .

- the roles of *teachers* from sage on the stage to guide on the side (including teacher as designer or selector of student work, facilitator of student work, and mentor for the student),
- the roles of *students* from passive to active, self-directed learners,
- the roles of *parents* (in education) or managers (in training) from marginalized to active partners in learning, and
- the roles of *technology* from primarily teacher tools to primarily learner tools (including the functions of recordkeeping for student learning, planning for student learning, instruction for student learning, and assessment for and of student learning).

So what are the implications of this for instructional design? Certainly, instructional theory must offer some different *methods* for learner-centered instruction than for teacher-centered instruction. But the more important, and often overlooked, implication is that instructional theory must address what might be called the *instructional superstructure*—the more comprehensive features that truly learner-centered instruction requires. I start with the latter.

Instructional Superstructure

Attainment-Based System

The most important feature of the instructional superstructure for the learner-centered paradigm is *attainment-based student progress* (Reigeluth & Karnopp, 2013). Rather than

students moving on when a certain amount of time has passed, each should move on only when s/he has mastered the current attainments, and as soon as s/he has mastered them (Bloom, 1968). However, for it to work, attainment-based student progress requires *attainment-based student assessment*, often called competency-based or criterion-referenced assessment. Without this, it is impossible to tell when each student is ready to move on. This kind of assessment, in turn, requires *attainment-based student records*. Rather than a report card that lists courses and grades, which only compare students with each other, this requires a report card that lists individual attainments and indicates whether or not each has been mastered yet by the student and which ones are within the student's reach, similar to Vygotsky's (1978) "zone of proximal development." These three aspects of an attainment-based system (Reigeluth & Karnopp, 2013) are seldom thought of as instructional strategies, yet they likely have a larger impact on student learning than any other instructional strategy and need to be an integral part of any instructional design to truly maximize student learning.

Personal Learning Plan

Given that students learn at different rates, in order to allow each student to move on as soon as s/he has mastered the current attainments, the instruction must be personalized (Martinez, 2001; Wolf, 2010; Lee, 2014), or learner-centered (McCombs & Whisler, 1997; McCombs, 2013). This means that each student must have a personal learning plan, which is a tool for identifying and monitoring the attainments on which each student is currently working. It uses information in the attainment-based student records to help the learner and his/her mentor to decide which attainments to pursue next. This, too, is seldom thought of as an instructional strategy yet is essential to maximize each student's learning.

Instructional Methods

If different students are progressing at different rates through different learning plans, the instructional methods must change from teacher-centered to learner-centered or personalized. This requires more reliance on intrinsic motivation and self-directed learning (i.e., cultivating both the desire to learn and skills to learn).

Task-Based Learning

Perhaps the most important way to do this is with task-based learning (or learning by doing), which includes project-based learning, problem-based learning, case-based learning, inquiry learning, and so forth. For brevity, I follow the lead of several others (Merrill, 2007; van Merriënboer & Kirschner, 2007; Francom & Gardner, 2014) by referring to them all as *task-based learning* (TBL). In many cases, TBL should be collaborative (team-based) so that students can help each other learn, based on a social-constructivist approach. To promote intrinsic motivation and self-direction, tasks for a personal learning plan should typically be designed or selected by the student, based on the student's goals, targeted attainments, and prior learning (from the attainment-based student records). Computer-based simulations or virtual worlds can provide powerful immersive task environments.

JIT Instructional Support

However, TBL alone can be inefficient and ineffective, as Kirschner, Sweller and Clark (2006) point out. Therefore, it should usually be accompanied by just-in-time (JIT)

instruction (e.g., tutorials, mini-simulations, and/or drill-and-practice, depending on the kind of learning) for the attainments that need to be developed, especially when transfer or automatization is desired (Reigeluth, 2012). This JIT instruction is now typically provided by teammates, other students, and/or the teacher. However, a technology program like the Khan Academy could be designed to provide a virtual pedagogical agent that tutors the student and provides ample opportunities for practice in divergent situations before the student uses the new attainments on the task. Overlaying this instructional support onto TBL provides a powerful integration of constructivist, cognitive, and behavioral pedagogies.

Integrated Student Assessment

Such a technology program would make it easy to certify and record mastery by having the student practice until a mastery criterion is reached of, say, the last ten practice correct unaided (summative assessment), and it could automatically enter the mastery information into the attainment-based student record (Reigeluth & Karnopp, 2013). When the student needs help, feedback could be provided (formative evaluation). Such integration of assessment with instruction saves much teacher time, which can be more productively spent being the student's mentor and guide on the side. So, while attainment-based student assessment is an important part of the instructional superstructure, it should also be integrated into the instruction, and this should be addressed by instructional theory to maximize student learning.

Technology Functions

Technology is seldom addressed by instructional theory. Some believe that instruction can be carried out (equally well?) with any medium (Clark, 1983, 1994). However, there is no doubt that truly personalized, attainment-based instruction for large numbers of learners can benefit greatly from technology to make it more effective while reducing its costs.

As mentioned earlier in this article, there are four important functions that technology can serve to support student learning in this new paradigm of instruction (Reigeluth et al., 2008):

1. Recordkeeping for student learning: to keep track of each student's learning and their personal characteristics that influence instruction.
2. Planning for student learning: to help students choose what attainments to work on next and to help them design or select tasks that require them to learn those attainments.
3. Instruction for student learning: to provide immersive task environments and JIT instructional support.
4. Assessment for and of student learning: to provide formative feedback and summative determination of when a student has mastered a competency.

These four functions should be seamlessly integrated in a single system so that information can be passed automatically from one function to another, but it should also have an open, modular architecture, somewhat like the iPhone so that small developers can develop apps for the system, but apps that are designed to share information with other apps within the system.

We talk a lot about "no child left behind" in public education. Corporations also want their employees to be competent at what they do. It is time we transform our education

and training systems from a sorting focus with time-based student progress to a focus on maximizing learning for all with an attainment-based design. To do so, we need instructional-design theories that address not only the learner-centered paradigm of instruction but also the instructional superstructure and the functions of technology to support the new paradigm.

Note

1. I use the term "attainment-based" rather than "competency-based" because there are important kinds of learning besides competencies, including such dispositions as honesty and industry, as well as emotional development and psychological health, among others.

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RESPONSE BY STEPHEN W. HARMON

It is an old aphorism that generals always prepare to fight the previous war. The same might be said of Professor Reigeluth's call for educational reform. One the one hand he is absolutely correct. Our current system, with its basis in the industrial era, was well suited to preparing students for factory or manufacturing jobs. When this system was put into place, there was a pressing need for workers who had routine expertise and could successfully churn out the same product over and over again. The more identical the workers were, the more easily they could be swapped out and moved around as circumstances dictated. As Professor Reigeluth notes (1994), those days have passed. As we have moved from the Industrial Age to the Information Age, education has been among the least affected of society's institutions. But his call does not go far enough.

The pace of change is accelerating at an exponential rate (Kurzweil, 2001). We are already moving from the Information Age into a new, as yet unnamed, era. For purposes of this response, let us call it the Knowledge Age. Instead of the mass production of the industrial era, we are rapidly moving to a time of mass customization. Instead of preparing students for jobs where they spend a lifetime doing the same task over and over, it now seems likely that jobs in the future will be relatively short-lived. Today's students might have many different careers over the course of their lifetimes. Instead of changing our educational system merely to better prepare students to be routine experts, we need also to change the goal to prepare students to have adaptive expertise.

Whereas routine expertise allows performers to be efficient and accurate, adaptive expertise goes beyond this to include innovation and a high degree of transfer (Hatano & Inagaki, 1986). Adaptive experts have a deep conceptual understanding that allows them to develop new solutions to problems, or even to reconceptualize the problems themselves. In the rapidly approaching future where the only constant is change itself, learners must be prepared to continuously reinvent not only themselves but also the environments in which they operate. Professor Reigeluth moves toward this with his calls for self-directed, task-based learning, with an increased emphasis on personalization and intrinsic motivation, but he should include more emphasis on lifelong learning, life-wide learning (Bransford, Slowinski, Vye & Mosborg, 2008), innovation, and the conative domain (Reeves, 2006). In an age of continuous scientific and technological advance, what it means to be educated will always be changing, hence the need for lifelong learning. Given that the amount of content necessary to master even very narrowly focused fields is so vast, and that the amount of time students spend in formal educational settings is so small, there is also a need for students to expand their learning in informal settings throughout their waking hours. (To be fair, Professor Reigeluth does begin to address this with his call for just-in-time instruction.) In the industrial model of education, innovation is not encouraged and is often discouraged. Factories wanted workers to do everything the same way every time. But in an age of mass customization and change, innovation will be essential. The recent rise of the maker movement is a step in the right direction for enhancing innovation as a learned skill. Beyond these recommendations though, there is an overarching need to enhance students' ability in the conative domain. The conative domain deals with willpower and drive. It is different than intrinsic motivation in that it focuses on follow-through more than just desire.

All of the above recommendations are consistent with what Professor Reigeluth has recommended. It is in dealing with technology, however, that his essay falls somewhat short. We are consistently becoming more integrated with, and more reliant, on our technologies. In the developed world we are seldom more than a few button clicks away from the sum

total of human knowledge. We are continuously off-loading portions of our cognitive routines and thought processes onto our devices. At the same time, our devices are becoming more and more a part of us. The smartphones of today will become the smart-glasses of tomorrow, and the neural implants of the day after that. While this is happening, our technology is itself becoming smarter. Some argue that machine intelligence is the next step of evolution (Müller & Bostrom, 2014). This is the future for which we must reform our educational system. It is already too late to prepare for the Information Age.

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REJOINDER BY CHARLES M. REIGELUTH

Steve Harmon addresses an important issue—that what we teach needs to change dramatically—but that was not the topic of this piece. My main point is that instructional theorists need to develop "instructional-design theories that address not only the learner-centered paradigm of instruction, but also the instructional superstructure and the functions of technology to support the new paradigm" of education and training. I agree completely with Harmon that we need "to change the goal to prepare students to have adaptive expertise," and I go considerably beyond this in much of my writing (see e.g., Reigeluth & Karnopp, 2013). The fact that my "call does not go far enough" was because limited space in this piece forced me to focus on instructional theory and omit addressing the need for paradigm change in curriculum theory. Such a curriculum change is a major part of Volume IV of "The Green Book" (Reigeluth, Myers & Beatty, in press), represented primarily by Marc Prensky's work to define a new paradigm of curriculum—one that is based on the four pillars of thinking effectively, acting effectively, relating effectively, and accomplishing effectively—rather than the four pillars of math, English, science, and social studies (MESS) (Prensky, 2014, in press). So I suggest that Harmon's call for adaptive expertise does not go far enough.

My major concern about Harmon's comments have to do with his statement that we are leaving the Information Age and entering the Knowledge Age. I believe a careful read of Toffler's work (1980, 1990) reveals that the key markers of the Information Age still predominate: customization rather than standardization, diversity rather than uniformity, team-based organization rather than bureaucratic organization, shared decision making rather than autocratic decision making, initiative rather than compliance, holism rather than compartmentalism, autonomy with accountability rather than centralized control, and cooperative relationships rather than adversarial ones, among others. Certainly, additional "ages" are likely to come. So, in Toffler's frame of thinking, what might the next one be? Since the Industrial Age was an extension of our physical capabilities and the Information Age an extension of our mental capabilities, it seems likely to me that the next major stage of societal evolution will be the Spiritual Age, an extension of our spiritual awareness and capabilities. But that is pure speculation on my part. The point is that our society is squarely within the Information Age as described by Toffler.

Finally, I am somewhat baffled by Harmon's concern that my suggestions regarding technology "fall somewhat short." I agree that technology is likely to continue to evolve in ways he suggests. My intent was to propose that technology needs to play very different roles in the learner-centered paradigm than in the teacher-centered paradigm and that consequently theorists and designers need to design the features of the technology systems that they will use in instruction, not just the instructional strategies. Certainly, as new affordances arise and costs decline, design principles must evolve. But the four main functions to support student learning—recordkeeping, planning, instruction, and assessment—will still be important. I fail to see how this falls short.

As Harmon points out, all his recommendations except those for technology "are consistent with what Professor Reigeluth has recommended." But they are largely separate issues from the main point in my piece—the need for instructional theorists (and designers) to devote more attention to the instructional superstructure and the functions of technology that support the learner-centered paradigm, in addition to instructional principles for the learner-centered paradigm.

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