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INSTRUCTIONAL-DESIGN THEORIES AND MODELS, VOLUME IV

The Learner-Centered Paradigm
of Education

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THE LEARNER-CENTERED PARADIGM OF EDUCATION

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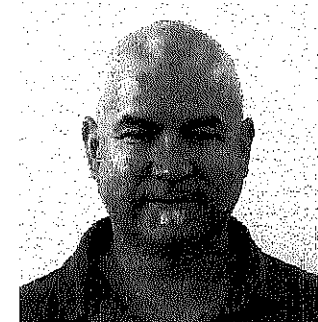
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EDITORS' FOREWORD

Preconditions (when to use the theory)

Content

- *All kinds of content.*

Learners

- *All kinds of learners.*

Learning environments

- *Learner-centered rather than teacher-centered.*
- *Attainment-based learner progress rather than time-based progress.*
- *Customized rather than standardized instruction and assessment.*

Instructional development constraints

- *Requires well-designed resources in the form of tasks and instructional support.*

Values (opinions about what is important)

About ends (learning goals)

- *Development of intrinsic motivation and love of learning are highly valued.*
- *Development of learner self-regulation skills (how to learn) is highly valued.*
- *Mastery of knowledge and skills is highly valued, including transfer to varied and real-world contexts.*
- *Development of collaboration skills is highly valued.*
- *Emotional, social, and character development are highly valued, including empathy and desire to contribute to one's community.*

About priorities (criteria for successful instruction)

- *Effectiveness and intrinsic motivation of the instruction are more important than efficiency.*

About means (instructional methods)

- *The instruction should be customized regarding pace, content, methods, and assessment.*
- *Intrinsically motivated learning and love of learning are highly valued.*
- *Learning by doing (active learning) is highly valued.*
- *Just in time instructional content while learning by doing is highly valued.*

- *Learning from peers through collaboration is highly valued.*
- *Self-regulated learning is highly valued.*
- *Self-reflection and self-evaluation are highly valued.*
- *Both formative and summative assessment should occur throughout instruction.*

About power (to make decisions about the previous three)

- *Empowering learners to make decisions about ends, priorities, and means is highly valued.*

Universal Principles

1. Attainment-based instruction

- *Attainment-based learner progress: Each learner's progress should be based on reaching the learning goals, rather than based on time.*
- *Attainment-based learner assessment: Each learner should be assessed through comparison with the criteria for mastery (criterion-referenced assessment) rather than through comparison with other learners (norm-referenced assessment).*
- *Attainment-based learner records: Each learner's records should be a list or map of individual attainments, rather than a traditional report card with names of courses and letter or number grades.*

2. Task-centered instruction

- *Task environment: Most instruction should be organized around the performance of a task that is of great interest to the learner, aligned with the learner's goals, of significant duration, within an immersive environment, and authentic or realistic.*
- *Scaffolding: Three types of scaffolding should be used whenever the task is too difficult for the learner: adjusting, coaching, and instructing.*

3. Personalized instruction

- *Personalized goals: Long-term life goals and short-term learning goals should be personalized.*
- *Personalized task environment: The task selection should be personalized. Decisions about collaboration (teammates) should be personalized. And the nature and amount of self-regulation should be personalized.*
- *Personalized scaffolding: The nature and amount of coaching and instructing should be personalized.*
- *Personalized assessment: The choice of assessor and format for the assessment should be personalized.*
- *Personalized reflection: The way the learner reflects on the process and product (or performance) of the task should be personalized.*

4. Changed roles

- *The teacher's roles should be: a) to assist learners in setting goals, b) to assist learners in designing or selecting tasks, c) to facilitate task performance, d) to facilitate learning, e) to help evaluate performance and learning, and f) to mentor the learner.*
- *The learner's roles should be: a) to be an active learner, b) to be a self-regulated learner, and c) to be a teacher of one's peers.*
- *Technology's roles should be: a) to support recordkeeping for learning, b) to assist planning for learning, c) to provide or support instruction for learning (both the interactive task environment and the just-in-time scaffolding), and d) to provide or support assessment for and of learning fully integrated with the instruction.*

5. Changed curriculum

- *Expanded curriculum: Many important kinds of learning that are currently absent from the curriculum should be added (and some removed).*
- *Fundamentally restructured curriculum: The curriculum should be organized around the four pillars of effective thinking, acting, relationships, and accomplishment rather than math, science, literacy, and social studies.*

Situational Principles

1. Task environment

- *An inauthentic task environment might be preferable: a) when it is more motivational for the learner than an authentic environment, b) when it can prevent cognitive overload associated with an authentic environment, or c) when it can be sufficiently safer or less expensive than an authentic environment.*
- *A learner-designed task might be preferable: a) when the available tasks from which to choose are inadequate given the learner's learning needs and interests, b) when there is sufficient time for the learner and teacher to design it, and/or c) designing a task is itself an important learning goal.*
- *The task may be project-based, problem-based, inquiry-based, or maker-based, depending mostly on the nature of what is to be learned.*

2. Scaffolding

- *Scaffolding can be universal (initiated at a predetermined point in the performance of a task), or triggered (when a certain learner action indicates it is needed), or requested (when the learner asks for help).*
- *Scaffolding can be offered by the teacher, another learner, an expert in the task, or technology.*
- *Scaffolding can be in the form of a leading question, or information, or a hint, or an explanation (developing an understanding).*

3. Learner roles

- *The kinds and amounts of self-direction given to the learner should vary with the kinds and levels of self-regulated learning skills the learner has developed.*

– C.M.R., B.J.B., & R.D.M.

THE LEARNER-CENTERED PARADIGM OF EDUCATION

I. Introduction

Definition of Learner-Centered Education

The learner-centered paradigm of education stands in contrast to the teacher-centered paradigm. Based on the work of the American Psychological Association's Presidential Task Force on Psychology in Education, McCombs and Whisler (1997) define learner-centered as:

The perspective that couples a *focus on individual learners* (their heredity, experiences, perspectives, backgrounds, talents, interests, capacities, and needs) with a *focus on learning* (the best available knowledge about learning and how it occurs and about teaching practices that are most effective in promoting the highest levels of motivation, learning, and achievement for all learners). (p. 9) [emphases added]

Furthermore, that task force (American Psychological Association Presidential Task Force on Psychology in Education, 1993) produced a report that identified 12 learner-centered psychological principles (see Table 1.1). Research upon which those principles are founded is reviewed by McCombs (1994) and Lambert and McCombs (1998). Additional supporting research is reviewed by Bransford, Brown and Cocking (2000).

Importance of Learner-Centered Education

So, why is the learner-centered paradigm of education important? There are two major reasons, one on the personal level and one on the societal level (Reigeluth & Karnopp, 2013). On the personal level, since learners learn at different rates, time-based learner progress forces slower learners to proceed to new material before they have mastered the current material, so they accumulate gaps in their learning that make it more difficult for them to learn related material in the future, virtually condemning them to fail. It also holds faster learners back, squandering their talents. Learner-centered education is the only way to maximize every learner's learning—to help all learners reach their potential.

TABLE 1.1 Learner-Centered Psychological Principles

Metacognitive and Cognitive Factors	<ol style="list-style-type: none"> 1. The nature of the learning process: Learning is a natural process of pursuing personally meaningful goals, and it is active, volitional, and internally mediated; it is a process of discovering and constructing meaning from information and experience, filtered through the learner's unique perceptions, thoughts, and feelings. 2. Goals of the learning process: The learner seeks to create meaningful, coherent representations of knowledge regardless of the quantity and quality of data available. 3. The construction of knowledge: The learner links new information with existing and future-oriented knowledge in uniquely meaningful ways. 4. Higher-order thinking: Higher-order strategies for "thinking about thinking" – for overseeing and monitoring mental operations – facilitate creative and critical thinking and the development of expertise.
Affective Factors	<ol style="list-style-type: none"> 5. Motivational influences on learning: The depth and breadth of information processed, and what and how much is learned and remembered, are influenced by (a) self-awareness and beliefs about personal control, competence, and ability; (b) clarity and saliency of personal values, interests, and goals; (c) personal expectations for success or failure; (d) affect, emotion, and general states of mind; and (e) the resulting motivation to learn. 6. Intrinsic motivation to learn: Individuals are naturally curious and enjoy learning, but intense negative cognitions and emotions (e.g., feeling insecure, worrying about failure, being self-conscious or shy, and fearing corporal punishment, ridicule, or stigmatizing labels) thwart this enthusiasm. 7. Characteristics of motivation-enhancing learning tasks: Curiosity, creativity, and higher-order thinking are stimulated by relevant, authentic learning tasks of optimal difficulty and novelty for each learner.
Developmental Factors	<ol style="list-style-type: none"> 8. Developmental constraints and opportunities: Individuals progress through stages of physical, intellectual, emotional, and social development that are a function of unique genetic and environmental factors.
Personal and Social Factors	<ol style="list-style-type: none"> 9. Social and cultural diversity: Learning is facilitated by social interactions and communication with others in flexible, diverse (in age, culture, family background, etc.), and adaptive instructional settings. 10. Social acceptance, self-esteem, and learning: Learning and self-esteem are heightened when individuals are in respectful and caring relationships with others who see their potential, genuinely appreciate their unique talents, and accept them as individuals.

(continued)

TABLE 1.1 (continued)

Individual Differences	<p>11. Individual differences in learning: Although basic principles of learning, motivation, and effective instruction apply to all learners (regardless of ethnicity, race, gender, physical ability, religion, or socioeconomic status), learners have different capabilities and preferences for learning mode and strategies. These differences are a function of environment (what is learned and communicated in different cultures or other social groups) and heredity (what occurs naturally as a function of genes).</p> <p>12. Cognitive filters: Personal beliefs, thoughts, and understandings resulting from prior learning and interpretations become the individual's basis for constructing reality and interpreting life experiences.</p>
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On the societal level, as we have evolved from the Industrial Age to the Information Age (Toffler, 1970, 1980, 1990). Manual labor is giving way to knowledge work as the predominant form of work, requiring that many more people be educated to higher levels than ever before. Only learner-centered education can meet this need, which will benefit our economic competitiveness in a "flat" world (Friedman, 2005), as well as our political system (through better informed voters and leaders) and individual citizens' ability to thrive in an increasingly complex digital world.

However, it is also important to keep in mind that there are situations where the sorting focus is appropriate, such as when we want to select learners for special awards or programs that have limited space like the Navy Seals. The learner-centered paradigm needs to become the predominant, rather than the exclusive, paradigm. For more about this paradigm change, see Wagner and Dintersmith (2015).

Theoretical Foundations of Learner-Centered Education

At the core of learner-centered education is the belief that humans make sense or make meaning out of information and experience in their own way. Because each person is unique in his or her nature (a combination of DNA) and nurture (experiences), we each perceive, feel, and think about things differently. The theoretical foundations of this belief stem from cognitivism, constructivism, and humanism.

Cognitivism

Cognitivist theories such as information processing theory, schema theory, and mental models provide a foundation that each learner has her or his own way to process information based on prior experience and knowledge. Information

processing theory tells us that how information is received and structured within learners' minds is subject to learners' mental processes. Learners selectively pay attention to incoming information, encode it within their short-term memory in their own ways, store it in long-term memory in their own ways, and retrieve the information based on the way it was encoded (Miller, 1956; Miller, Galanter, & Pribram, 1986). Thus, selecting, encoding, and retrieving information vary by individual learners.

Schema theory states that knowledge is organized into units and structured based on their relationships with other units. When new information comes in, learners use their own schema to process the information. This schema is continuously and actively developed as learning occurs. Therefore, every learner with different schemata has a unique way to process, store, and retrieve information (J.R. Anderson, 1983; Ausubel, 1968; Schank, 1982; Schank & Abelson, 1977).

A mental model is a representation of the relationships between various parts in the surrounding world. People selectively choose concepts that are important to them, symbolize the concepts in their own ways, and create relationships among them according to how they perceive them. Therefore, internalization of incoming information largely depends on individual learners and is affected by learners' prior experience and knowledge (Johnson-Laird, 1983).

Constructivism

Based on the epistemological belief that knowledge is subjectively and individually constructed rather than that it exists external to the learner, constructivism lays down the fundamental theoretical foundation of learner-centered education (Jonassen, 1999; Lambert & McCombs, 1998). Constructivists such as Piaget and Vygotsky state that knowledge is constructed while learners are engaged in social interaction on the learning topic by experiencing disequilibrium, negotiating and finding an equilibrium through assimilation and accommodation (Littleton & Häkkinen, 1999; Palincsar, 1998). Therefore, learning should be designed to facilitate individual knowledge construction by helping learners engage in an authentic task and meaningful conversation around the task.

Humanism

Carl Rogers (1951), one of the foremost psychologists of the 20th century, argued that the role of therapists should be to free the client to solve his or her own problems, thereby realizing one's full organismic potential, rather than prescribing solutions that develop a false, ideal self based on the expectations of others. He advocated applying this person-centered approach to education. Rogers argued that humans have an innate desire to learn, but that a person cannot be taught directly; rather, one can only facilitate the learning of another (Rogers, 1969). Therefore, learning must be self-initiated and self-regulated,

motivated by the person's natural desire to learn those things that are necessary to maintain and develop the self (Rogers, 1959). Consequently, the act of learning requires the full participation of the learner, which means that the learner "chooses his own directions, helps to discover his own learning resources, formulates his own problems, decides his own course of action, [and] lives with the consequences of each of these choices" (Rogers, 1969, p. 162).

Early Pioneers

In this section, we introduce three early educational movements that led the way to learner-centered education. We briefly present only key figures and ideas from these movements.

Dewey's Progressive Education

John Dewey was a principal figure in boosting American public schools and leading educational reform from the 1880s. Dewey presented his educational theories in several books (e.g., Dewey, 1899, 1938; Dewey & Small, 1897). Throughout his books, he maintained that learners learn when they are allowed to experience, observe, and reflect on their own past and current experience, and all human experience involves social interaction. Thus, education should be based on experience through a social process, and the teacher should play the role of facilitator of the process rather than a dictator. He placed a heavy emphasis on learners' active participation and ownership in the learning process.

Montessori Education

In the 1900s, Maria Montessori, an Italian physician and educator, pioneered the Montessori education system. Her educational philosophy places a heavy emphasis on development of a child's independence, children taking initiative, and development of natural ability through practical play. This educational philosophy is based on the four distinct phases of child development that she observed from infants. She developed appropriate educational methods and environments that can maximally realize natural child development in each phase (Montessori, 1917, 2013). Some empirical studies on Montessori education have revealed equivalent or higher educational outcomes compared to traditional education (Borman, Hewes, Overman, & Brown, 2003; Dohrmann, Nishida, Gartner, Lipsky, & Grimm, 2007; Lopata, Wallace, & Finn, 2005). A recent study that compared two Montessori programs with different levels of implementation fidelity to a traditional program found that high-fidelity Montessori programs were associated with positive effects in several academic outcomes (Lillard, 2012).

Carroll's and Bloom's Mastery Learning

In the 1960s, Carroll and Bloom criticized time-based learner progress of the traditional schooling system (Bloom, 1968; Carroll, 1963). They argued that having all learners spend the same amount of time on the same tasks would result in failing learners with low aptitude for the subjects. Therefore, individual differences in aptitude should be taken into account by allowing individual learners to spend as much time as they need to reach mastery.

Bloom's famous synthesis of empirical research on mastery-based learning supported the effectiveness of this approach. In his synthesis, when learners were given sufficient time to master the current topic by checking their understanding through ongoing formative assessments and being given an opportunity to address their learning deficiencies before moving on to the next topic, the achievement level of the average learner in the mastery group was two sigmas higher than the average learner in the conventional group, known as the 2-sigma effect. Other studies to date have reported consistent positive outcomes for competency-based learner progress (S.A. Anderson et al., 1992; Kulik, Kulik, & Bangert-Drowns, 1990; Light, Reitze, & Cerrone, 2009; Research & Policy Support Group, 2010).

II. Values of LCI

The learner-centered paradigm of education is founded on the following values:

About ends (learning goals)

- Development of intrinsic motivation and love of learning is highly valued.
- Development of learner self-regulation skills (how to learn) is highly valued.
- Mastery of knowledge and skills is highly valued, including transfer to varied and real-world contexts.
- Development of collaboration skills is highly valued.
- Emotional, social, and character development are highly valued, including empathy and desire to contribute to one's community.

About priorities (criteria for successful instruction)

- Effectiveness and intrinsic motivation of the instruction are more important than efficiency.

About means (instructional methods)

- The pace of instruction should be customized to each learner (attainment-based learner progress).

- The content of instruction should be customized to each learner (individual needs, interests, talents, and goals).
- The methods of instruction should be customized to each learner (individual learning preferences).
- The methods of assessment should be customized to each learner (individual needs, interests, talents, and goals).
- Intrinsic motivation and love of learning should be cultivated.
- Learners should typically learn by doing (task-centered instruction).
- Learners should receive just-in-time support while learning by doing (instructional scaffolding).
- Learners should learn much from peers through collaboration.
- Learners should be taught to set their own goals and manage their own instruction as much as possible (self-determination, self-regulated learning).
- Learners should be involved in assessing their own learning (self-reflection, self-evaluation).
- Both formative and summative assessment should occur throughout instruction (continuous, integrated assessment).
- Learners should make decisions about ends, priorities, and means.

About power (to make decisions about the previous three)

- Empowering learners to make decisions about ends, priorities, and means is highly valued.

III. Universal Principles

There are some principles of education that we propose should always be manifest in truly learner-centered education, while there are others that we believe should be present in some situations but not others. We describe the universal principles here, followed by the situational principles in the following section.

One of the key characteristics that distinguishes the Information Age from the preceding Industrial Age is holism (integration of tasks) replacing compartmentalization (division of tasks). Consequently, it is inappropriate to try to address instructional theory in isolation from other kinds of educational theories, such as those for curriculum, learner assessment, recordkeeping, planning, and the proper use of technology in education. Hence, we address universal principles in all these areas when appropriate.

We propose five foundational educational principles or guidelines for learner-centered education:

1. **Attainment-based instruction:** Learner progress should be based on learning rather than time.
2. **Task-centered instruction:** Instruction should be organized around the performance of authentic tasks.

3. **Personalized instruction:** Instruction during task performance should be personalized.
4. **Changed roles:** The roles of the teacher, learner, and technology should be transformed.
5. **Changed curriculum:** The curriculum should be extended and reorganized.

The universal principles for learner-centered education are grouped into these five main categories.

1. Attainment-Based Instruction

To be truly learner-centered, instruction must be structured so that learner progress is based on learning rather than on time (Bloom, 1968, 1981; Carroll, 1963; Reigeluth & Karnopp, 2013). While commonly called competency-based instruction, there are important kinds of learning besides competencies, such as dispositions (e.g., attitudes, values, morals, and ethics) and emotional development. Hence, we prefer the more comprehensive term, *attainment-based instruction*. For learner progress to be based on attainments, learner assessment must be criterion-referenced rather than norm-referenced, and learner records must also be lists (or maps) of attainments rather than lists of courses with grades. Chapter 2 focuses on this principle.

Attainment-based instruction ensures that learners fully master the current topic before moving on to the next topic. It helps learners to move at their own pace by allowing them to spend as much or little time as they need on the current topic, which improves efficiency in the learning process by not making fast learners wait for the rest of the class before they can move on, and by not forcing slow learners to move on before they have mastered the material, so they don't accumulate deficits in their learning that make it more difficult for them to learn related material in the future. Attainment-based instruction entails three components: attainment-based learner progress, assessment, and learner records.

1.1 Attainment-based learner progress

Each learner's progress should be based on reaching the learning goals (standards and criteria for mastery), rather than based on time.* This ensures that learners are not forced to move on to the next topic without mastering the current one. It helps learners to effectively construct their new knowledge based on pre-existing or pre-required knowledge and facilitates deep understanding of the

* Editors' note: This is addressed by Principle 3 in Chapter 2, *Principles for Competency-Based Education*; by Principle 5 in Chapter 10, *Designing Instructional Coaching*; and by several principles in Chapter 9, *Designing Instruction for Self-regulated Learning*. While none of the approaches in Unit 3 explicitly advocates this principle, all seem compatible with attainment-based approaches.

subject matter (American Psychological Association Presidential Task Force on Psychology in Education, 1993; Bransford et al., 2000).

1.2 Attainment-based learner assessment

Each learner should be assessed through comparison with the criteria for mastery (criterion-referenced assessment) rather than through comparison with other learners (norm-referenced assessment). The purposes of assessment in attainment-based instruction are to check learners' understanding, identify learning deficiencies, and make sure learners reach a high enough level of mastery on the topic before moving on. Criterion-referenced assessment is more appropriate than norm-referenced to serve these purposes, as the domain to be tested is more narrowly and precisely defined, and there should be enough items to thoroughly cover the content (Thorndike & Thorndike-Christ, 2010).*

1.3 Attainment-based learner records

Each learner's records should be a list or map of individual attainments, rather than a traditional report card with names of courses and letter or number grades. The traditional report card does not provide information about learners' competencies on specific topics and does not inform about the learners' learning needs. Having a domain map of individual attainments helps teachers track learner progress towards their learning goals, identify learning needs, and select appropriate instructional materials (Miliband, 2006; Sturgis & Patrick, 2010).**

None of these three principles falls under what is typically thought of as instructional design theory. In Volume I of *Instructional-Design Theories and Models*, Reigeluth identified five major categories of educational theory: instruction, curriculum, counseling, administration, and evaluation (see Fig 1.1 in Reigeluth, 1983). Within instructional theory, he identified design, development, implementation, management, and evaluation as additional categories for theory. The term "instructional theory" is generally thought to address only the instructional design category. However, the three principles described here, which belong in the instructional management category, may have a greater impact on learning than most instructional design strategies.

2. Task-Centered Instruction

To foster intrinsic motivation, instruction should be centered on authentic, collaborative tasks that are interesting to the learner and appropriate to her or his

* Editors' note: This is elaborated by Principles 4-6 in Chapter 2, Principle 4.8 in Chapter 8, *Designing Games for Learning*, Principle 3 in Chapter 9, and Principles 1.1 and 4.2 in Chapter 11, *Designing Technology for the Learner-Centered Paradigm of Education*.

** Editors' note: This is addressed by Principle 7 in Chapter 2 and Principle 1.2 in Chapter 11.

levels of development. These include projects, problems, inquiries, and other forms of learning by doing. However, scaffolding should be provided within the task environment when possible, to accelerate learning and make it more motivating. Chapter 3 focuses on this principle. Chapters 6-10, 12, 14, and 15* provide multiple examples of specific instructional strategies that elaborate this principle.**

Task-centered instruction situates learners in an authentic environment in which they are likely to use the new knowledge, and helps learners to better see connections with other knowledge and skills (American Psychological Association Presidential Task Force on Psychology in Education, 1993; Bransford et al., 2000; Merrill, 2013). Much research has revealed several educational benefits of task-centered instruction, such as development of critical thinking, problem solving, creative thinking, collaboration, communication, and meta-cognitive skills, as well as learners becoming more motivated and self-directed (Barrows, 1986; Bell, 2010; Blumenfeld et al., 1991; Duch, Groh, & Allen, 2001; Gijbels, Dochy, Van den Bossche, & Segers, 2005; Hmelo-Silver, 2004; Jonassen, 2000, 2004; Savery, 2006; Savery & Duffy, 1996; Şendağ & Ferhan Odabaşı, 2009; Torp & Sage, 2002).

2.1 Task environment

Most instruction should be organized around the performance of a task. The task should be:

- of great interest to the learner—relevant to the learner's life—preferably either designed or selected by the learner, with teacher and parent input;***
- aligned with the learner's learning goals (which are typically selected by the learner based on standards, with teacher and parent input);†
- of significant duration—lasting for weeks or even months;
- within an immersive environment—real or virtual;††
- authentic or realistic, which typically makes them interdisciplinary.†††

* Editors' note: The just-in-time instruction described in Chapter 15 specifies engagement in tasks that may be simpler and shorter in duration than tasks as described in this chapter and Chapter 3.

** Editors' note: Content gamification of instruction as described in Chapter 13 emphasizes engaging learners in activities that offer meaningful choices and foster a sense of autonomy. These activities could be structured as a series of increasingly challenging tasks with scaffolding and feedback.

*** Editors' note: This is elaborated by Principle 1 in Chapter 6, *Designing Maker-Based Instruction*, Principle 1 in Chapter 7, *Designing Collaborative Production of Digital Media*, and Principle 1 in Chapter 9.

† Editors' note: This is elaborated by Principle 3 in Chapter 6 and Principle 1 in Chapter 10.

†† Editors' note: This is elaborated by Situational Principle 1 in Chapter 6, Principle 1.2 and Principle Category 2 in Chapter 8, and Principle 3 in Chapter 14.

††† Editors' note: This is addressed by Principle 1 in Chapter 3, Principle 5 in Chapter 6, and Principle 1.2 in Chapter 8.

2.2 Scaffolding

Three types of scaffolding should be used whenever the task is too difficult for the learner: adjusting, coaching, and instructing.*

- **Adjusting.** The complexity of the task should be adjusted to be neither too challenging nor too easy for the learner. This is done by identifying conditions that make some real-world versions of the task simpler than others. The learner's record of attainments can then be used to select the most appropriate level of complexity for the task.**
- **Coaching.** When the learner lacks some relatively easy-to-learn information to perform the task well, the information should be provided just-in-time. However, that information should be tested later for retention and possibly transfer, depending on the learning goals.***
- **Instructing.** When the learner lacks an attainment that is difficult to learn through a single coaching experience, then time on the task should be paused, and instruction (tutoring) should be provided just-in-time until the attainment is mastered, at which point the learner resumes work on the task, using the newly acquired attainment. Since this instruction is piggy-backed onto the task environment, it is often called "instructional overlay."† Merrill (2013) is an outstanding resource for designing such just-in-time tutorial instruction.

3. Personalized Instruction

To maximize learning, instruction should be personalized, with respect to the goals, the nature of the tasks used to achieve the goals, the nature of the scaffolding provided during the task performance, the nature of assessment of the learner's learning and task performance, and the nature of reflection on the learner's learning and task performance. The principles for each of these five aspects of personalized instruction are described here. Furthermore, instruction should be personalized based on learners' competency level, learning or career goals, interests, and other characteristics. Chapter 4 focuses on these principles. Instructional theories described in Chapters 6, 7, 10, and 14 implement many of these principles.††

* Editors' note: This is elaborated by Principle 4 in Chapter 6 and Principle Category 3 in Chapter 8.

** Editors' note: This is elaborated by Principle 3.1 and Situational Principle 5.1 in Chapter 8.

*** Editors' note: This is elaborated by Principle 3.2 and Situational Principle 5.2 in Chapter 8.

† Editors' note: This is elaborated by Principles 2–5 in Chapter 3 and Principle 3.3 in Chapter 8.

†† Editors' note: While Chapter 12, *Designing Instruction for Flipped Classrooms*, does not directly address personalizing instruction, it embraces the idea that a community of learners will adapt designed instruction to meet its needs. Similarly, in the just-in-time approach discussed in Chapter 15, learners exert great influence on in-class instruction because it is adapted based on the learners' pre-class activities and expressed understandings.

3.1 Personalized goals

Two kinds of goals should be personalized:*

- **Long-term goals.** Career and life goals should be discussed and established by each individual learner, even though they are likely to change often. They provide extra motivation and direction for learning.**
- **Short-term goals.** The learning goals to be pursued for the next project period should be discussed and established by each individual learner. They provide the basis for task selection (see 3.2 below).***

3.2 Personalized task environment

Several aspects of the task environment should be personalized:†

- **Task selection.** The task itself should be personalized to the learner's learning goals, interests, and prior learning. This includes adjusting the task complexity to the level appropriate for the learner's development.††
- **Collaboration.** The decision about whether to have teammates and who to have as teammates should be personalized to the learner's needs and preferences.†††
- **Self-regulation.** The nature and amount of self-regulation should be personalized to the learner's self-regulation skills and developmental needs.‡

3.3 Personalized scaffolding

Two aspects of the coaching and instructing should also be personalized:‡‡

- **Quantity.** The amount of coaching and instructing should be personalized to the learner's needs.‡‡‡

* Editors' note: These are both elaborated by Principle 1 in Chapter 4, *Principles for Personalized Instruction*, Principle 2 in Chapter 9, and Principle 1 in Chapter 10.

** Editors' note: This is elaborated by Principle 2.1 in Chapter 11.

*** Editors' note: This is elaborated by Principle 2.3 in Chapter 11.

† Editors' note: These are elaborated by Principle 2 in Chapter 4, Principle 1 in Chapter 7, and Principle 3.1 in Chapter 11.

†† Editors' note: This is elaborated by Principles 1 and 3 in Chapter 6, Principle 1.6 in Chapter 8, Principle 2 in Chapter 10, and Principle 2.4 in Chapter 11. Aspects of gamification discussed in Chapter 13 could apply personalization by structuring the content so that many paths through a variety of increasingly difficult tasks are available to learners.

††† Editors' note: This is elaborated by Principle 1.6 in Chapter 8 and Principle 2.5 in Chapter 11.

‡ Editors' note: This is elaborated by the third situational principle in Chapter 9.

‡‡ Editors' note: These are elaborated by Principle 3 in Chapter 4, Principle 6 and Situational Principle 3 in Chapter 6, most of the principles in Chapter 10, and Principle 3.2 in Chapter 11.

‡‡‡ Editors' note: This is elaborated by Principle 1.4 in Chapter 8.

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- **Quality.** The nature of the coaching and instructing should be personalized to the learner's needs and learning styles.

3.4 Personalized assessment

Two aspects of assessment should be personalized:*

- **Assessor.** The choice of assessor of the performance (teacher, peer, computer system, or external expert) should be personalized.
- **Representation.** The choice of representation or format for the demonstration of competence should be personalized.

3.5 Personalized reflection

Two aspects of reflection should be personalized:**

- **Learning process.** The way the learner reflects on the process by which he or she learned during the task should be personalized.
- **Learning outcome.** The way the learner reflects on the product or performance that results from completion of the task should be personalized.***

4. Changed Roles

To implement the above principles of learner-centered instruction, the teacher's role must change dramatically, from the "sage on the stage" to the "guide on the side" (Reigeluth & Karnopp, 2013). The teacher must be a co-designer (or co-selector) of learner work, a facilitator of learner work (provider of scaffolding), and a caring mentor. The learner's role must change from passive and teacher-directed to active and self-directed (which is not an easy change for older learners). And technology's role must change from primarily a tool for the teacher to primarily a tool for the learner.† This includes four major functions: planning for learning (selecting tasks and creating a personal learning plan for each learner), instruction for learning (often providing an immersive task environment and a virtual pedagogical agent for just-in-time scaffolding), assessment for/of learning (criterion-referenced and integrated with the instruction,

* Editors' note: These are elaborated by Principle 4 in Chapter 4, Principle 3 in Chapter 6, Principle 3 in Chapter 7, Principle 5 in Chapter 10 and Principle 4.1 in Chapter 11.

** Editors' note: These are elaborated by Principle 5 in Chapter 4, Principle 2 in Chapter 7 and Principle 6 in Chapter 10.

*** Editors' note: This is elaborated by Principle 7 in Chapter 6.

† Editors' note: The approach to mobile learning discussed in Chapter 14 emphasizes these changed roles, with teachers being much more facilitative, learners being much more self-regulating, and the affordances of mobile technology being a critical factor in the learning experience.

and in the Khan Academy), and recordkeeping for learning (a list or map of individual attainments). These transformed roles are addressed throughout most of the chapters in this volume.

It is unusual for roles to be specified by instructional design theory, yet roles are critical for successful implementation of any instructional strategy. Therefore, it is important to offer design guidelines for the roles of the teacher, learner, and technology.

4.1 Teacher roles

The teacher's role should be dramatically different in the learner-centered paradigm, as follows:

- **Assist learners in setting goals.** The teacher should help the learner to select long-term career goals ("What do you want to be when you grow up?") and short-term learning goals, both those that meet state standards and those that are of greatest personal interest to the learner.*
- **Assist learners in designing or selecting tasks.** The teacher should help the learner design or select appropriate tasks to pursue his or her learning goals or, when appropriate, should do the designing or selecting for the learner.** The teacher should also assist in decisions about whether to work in a team and who the teammates should be. This work results in creating a personal learning plan or learning contract.
- **Facilitate task performance.** The teacher should coach the learners as they work on their tasks. This may occur on the level of individual skills needed to perform the task, or the level of higher-order thinking skills such as self-direction and reflection, or the level of project management, team-building, interpersonal relationships, and emotional development.***
- **Facilitate learning.** The teacher should ensure that instruction is provided just-in-time when needed. This goes beyond coaching by providing tutorials, including practice with immediate feedback, as well as demonstrations and explanations. Often, such instruction is provided by technology or peers, with monitoring by the teacher.†
- **Help evaluate performance and learning.** The teacher should ensure that both formative and summative evaluation are provided within both

* Editors' note: This is elaborated by Principle 1 in Chapter 4, throughout much of Chapter 5, Principle 3 in Chapter 6, and Principle 1 in Chapter 7.

** Editors' note: These are elaborated by Principle 2 in Chapter 4, Principle 4 in Chapter 6, Principle 2 in Chapter 9, and Principles 2 and 3 in Chapter 14.

*** Editors' note: These are elaborated by Principle 1 in Chapter 3, Principle 3 in Chapter 4, Principle 5 in Chapter 6, Principle 1 in Chapter 9 and Principle 2 in Chapter 10.

† Editors' note: These are elaborated by Principles 1–5 in Chapter 3, Principle 3 in Chapter 4, Principle 6 in Chapter 6, and Principles 3, 4, and 5 in Chapter 10.

the task environment and the instructional overlay (in the scaffolding).^{*} Again, such evaluation is often provided by technology or peers, with monitoring by the teacher, and the results of the summative evaluations are recorded.

- **Mentor the learner.** Every learner should have a caring mentor who motivates and guides the learner in all aspects of her or his development. This is particularly beneficial for learners who do not receive much emotional support at home.^{**}

4.2 Learner roles

The learner's role should include the following:

- **Active learner.** The learner should be an active rather than passive learner. This means learning by doing rather than learning by listening, watching, or reading.^{***}
- **Self-regulated learner.** The learner should be self-directed rather than teacher-directed, as much as possible, given the learner's self-regulation skills. The teacher should devote considerable effort to developing those skills, including goal setting and designing or selecting tasks.[†]
- **Learner as teacher.** The learner should engage in teaching things that she or he has just learned, for this is as great a benefit to the one teaching as to the one being taught.^{††}

4.3 Technology roles^{†††}

To support learner-centered instruction, technology should be used whenever appropriate to serve the following functions:

- **Recordkeeping for learning.** Provide a list or map of all standards that are possible to learn (not just a "common core"), broken down to the level of individual skills, understandings, and other kinds of attainments. Provide the capability to mark all of those attainments that have been mastered by each individual learner (as is done by the Khan Academy).[‡] And provide an

* Editors' note: These are elaborated by Principles 5 and 6 in Chapter 2, Principle 4 in Chapter 3, Principle 4 in Chapter 4, and Principle 2 in Chapter 7.

** Editors' note: This principle is not addressed by many theories in this volume, due to their focus on academic learning to the exclusion of educating the whole learner. However, Principle 4 in Chapter 7 does address academic mentorship.

*** Editors' note: This is elaborated by virtually all the chapters in this volume.

† Editors' note: This is elaborated in greatest depth by all of Chapter 9.

†† Editors' note: This is elaborated by Principles 3 and 4 in Chapter 4 and Principles 2–4 in Chapter 7.

††† Editors' note: This is elaborated in detail in Chapter 11.

‡ Editors' note: This is addressed by Principle 3 in Chapter 13, *Gamification Designs for Instruction*.

inventory of each learner's characteristics that should influence the nature of the instruction for that learner, including interests, learning styles, learning strategies, multiple intelligences, and much more.

- **Planning for learning.** Provide a tool to help each learner, in collaboration with his or her teacher and parents, to select career goals, select short-term learning goals (e.g., for the next project period), select tasks as vehicles for meeting those learning goals, select teammates (if any) for each task, and create a personal learning plan or contract.
- **Instruction for learning.** Provide either an immersive, authentic, virtual, task environment or suggestions for engaging in a real, local, task environment. Also, either provide virtual, just-in-time coaching and instruction ("instructional overlay" or scaffolding), preferably through a virtual pedagogical agent, or provide guidance for just-in-time peer and/or teacher coaching and instruction.
- **Assessment for and of learning.** Provide for formative evaluation for learning through immediate feedback on learner performances in the instructional overlay. Also, provide for summative evaluation of learning through immediate determination of whether the learner has met the criterion for mastery in the instructional overlay (e.g., the last 10 practice items correct without assistance). Finally, provide for formative and summative assessment of team performance in the task environment.

5. Changed Curriculum

What to teach is considered curriculum theory, in contrast to instructional theory, which is concerned with how to teach it. Yet, this is an aspect of paradigm change that is arguably as important as instructional theory, assessment theory, and other dimensions of educational theory (educational superstructure) such as attainment-based learner progress and new roles for teachers, learners, and technology. Therefore, it is important to offer principles about what should be taught.

To be truly learner-centered, instruction must address all important aspects of each individual learner's development, including emotional, social, and character development, as well as cognitive and physical development. It must also be reorganized in a way that is more closely related to people's lives and more interdisciplinary, such as thinking effectively, acting effectively, relating effectively, and accomplishing effectively. Chapter 5 focuses on this principle. Chapters 6, 7, and 14, focused on production-oriented instruction, describe the implementation of instruction that is not constrained by current academic curriculum alignment.

5.1 Expanded curriculum

The Partnership for 21st Century Skills (n.d.) has identified particular attainments that fall into these categories: 1) core subjects (the 3 Rs) and 21st-century

themes; 2) learning and innovation skills (creativity and innovation, critical thinking and problem solving, and communication and collaboration; 3) information, media and technology skills (information literacy, media literacy, and technology literacy*); and 4) life and career skills. Furthermore, Daniel Goleman (1995, 1998) popularized the understanding that emotional development is more important than cognitive development to a person's success in life. Emotional and social development, largely overlooked in the teacher-centered paradigm of education (and training), should therefore be addressed. Mental and physical health is equally important to the individual and society. And attitudes, values, morals, and ethics are also important to the success of individuals, families, communities, and entire countries. However, adding so much to the curriculum would be problematic, even with the considerably greater efficiency of learner-centered instruction, so paradigm change is needed within the curriculum and some elements of the current curriculum should no longer be required of all learners.

5.2 Fundamentally restructured curriculum

Prensky (2014) has proposed a fundamental redesign of the P-16 curriculum, from being organized around the four pillars of math, science, literacy, and social studies, to being organized around the four pillars of effective thinking, effective acting, effective relationships, and effective accomplishment. Many elements of the current curriculum would still be taught, but they would be reorganized. For example, effective thinking would include mathematical thinking and scientific thinking, as well as critical thinking, problem solving, design thinking, systems thinking, and self-knowledge of one's passions, strengths, and weaknesses, among others.**

IV. Situational Principles

In Chapter 1 of Volume III of *Instructional-Design Theories and Models*, Reigeluth and Carr-Chellman (2009) described that methods (and therefore the principles that encompass them) exist on a continuum ranging from high generality (universal, used in all situations) to low generality (local, or only used in rare situations). The authors also described that methods (and therefore principles) exist on a continuum ranging from highly imprecise to highly precise in the guidance they provide. The more precise a principle or method, the more useful yet local (narrow) it is likely to be. The principles described above are highly imprecise but serve to provide a useful "big picture" of learner-centered education.

* Editors' note: These skills are a particular focus on Chapter 14, *Design Considerations for Mobile Learning*.

** Editors' note: This is elaborated extensively by all of Chapter 5.

The remaining chapters in this volume provide greater precision and thereby greater usefulness to designers, educators, and trainers. However, we also offer here some situational variables (situationalities) that call for variations in the methods described in the above principles. Of course, there are many more situationalities not described here, with correspondingly more detailed descriptions of the methods and guidance for each. Here we just identify ones we believe are most important.

Principle 2.1: Task Environment. One aspect of this principle is that the task should be authentic or realistic. However, some fantasy task settings can be powerful vehicles for learning. The universal aspect of this principle is that the nature of the performance should be authentic, so the cognitive processing will be authentic and thereby transfer to real settings. However, the task environment within which the learning occurs does not always have to be authentic. Some situations in which an inauthentic environment would be preferable include: a) when it is more motivational for the learner than an authentic environment, b) when it can prevent cognitive overload associated with a truly authentic environment, or c) when it can be sufficiently safer or less expensive than an authentic environment.*

Principle 2.1: Task Environment. Another aspect of this principle is that the task should be of great interest to the learner. This can be accomplished in different ways: by helping the learner to select a task or by helping the learner to design his or her own task. Designing might be preferable: a) when the available tasks from which to choose are inadequate given the learner's learning needs and interests, b) when there is sufficient time for the learner and teacher to design it, and/or c) designing a task is itself an important learning goal.

Principle 2.1: Task Environment. The task may be project-based, problem-based, inquiry-based, or maker-based. The selection of each of these variations depends mostly on the nature of the task needed, which in turn depends on the nature of what is to be learned. For example, in medical school, problems are much more common than projects, whereas in instructional design programs, projects are much more common than problems. Inquiry-based tasks tend to be more appropriate for basic science (descriptive theory), whereas maker-based tasks tend to be more appropriate for applied science (design theory).

Principle 2.2: Scaffolding. Just-in-time coaching and instructing can be universal (initiated at a predetermined point in the performance of a task for all learners), or triggered (when a certain learner action indicates it is needed), or requested (when the learner asks for help). Triggered is likely preferable when efficiency of learning is more important than developing self-regulated learning skills. Universal is likely only preferable when cost or logistical factors are paramount.**

* Editors' note: Chapter 8 provides an illustration of this situational principle, since many game-based instructional environments create immersive yet inauthentic environments that are instructionally effective.

** Editors' note: This is elaborated by Principle 6 in Chapter 6.

Principle 2.2: Scaffolding. Just-in-time coaching and instructing can also be offered by the teacher, another learner (peer), an expert in the task, or technology. In a classroom situation, it may be preferable for it to be offered by another learner (because this tends to help the other learner as well, to build relationships among learners, and to be least expensive). If that doesn't work, then it will likely be best for it to be offered by the teacher. But if an outside expert in the task is available and the difficulty the learner is having is of sufficient magnitude, the outside expert is usually the best option. In a computer system (simulation or virtual learning environment), it is preferable to use a virtual coach if the number of learners justifies the expense of creating the virtual coach and sufficient budget is available.

Principle 2.2: Scaffolding. Just-in-time coaching can be in the form of a leading question or information or a hint or an explanation (developing an understanding). This depends largely on the kind of learning and kind of learning problem the learner has. Questions and hints tend to cause deeper cognitive processing and better understanding and retention. Providing information and explanations tends to be quicker (more time efficient). Information tends to be useful for lower levels of learning, while explanations are more useful for higher levels.

Principle 4.2: Learner roles. The kinds and amounts of self-direction given to the learner should vary with the kinds and levels of self-regulated learning skills the learner has developed.

These are but a few of the many situational principles that can be identified as we provide more detailed guidance for each of the universal principles. The remaining chapters in this volume provide additional guidance within this big-picture view of the learner-centered paradigm of education.

V. Closing Remarks

The learner-centered paradigm of education is fundamentally different from the teacher-centered paradigm. The universal principle of attainment-based instruction means that grade levels, grades, and even classrooms as we know them are inappropriate and detrimental to learner success. Consequently, best practices for the teacher-centered paradigm typically bear little resemblance to best practices for the learner-centered paradigm. Furthermore, to be useful, research on design theory for the learner-centered paradigm needs to be conducted within that paradigm, or the results will be suspect.

This means that there is a strong need for researchers and theorists to work in school systems that conform to the basics of the learner-centered paradigm. Fortunately, there are many such systems already. In 2012 a research team at Indiana University¹ identified over 140 such systems (see Appendix A in Reigeluth & Karnopp, 2013).

1 The research team, led by Dabae Lee, included Yeol Huh, Chun-Yi Lin, and Charles M. Reigeluth.

There is also a strong need for educators to recognize that the features of a learner-centered school system cannot be adopted one at a time. This would akin to trying to transform a railroad into an airline one feature at a time. Fundamental changes in just a few features makes those features incompatible with the rest of the system, which consequently tries to change them back. A "critical mass" of features must be changed all at once, so that they will exert more pressure on other features to change than the other features will exert on the transformed features to change back. For more about the transformation process, see Chapter 4 in Reigeluth and Karnopp (2013).

It is our sincere hope that readers of this book will join the effort to advance knowledge about the learner-centered paradigm and contribute to the transformation process for the benefit of our children, their communities, and their country.

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PRINCIPLES FOR COMPETENCY-BASED EDUCATION

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