Teaching Human Development *for* Educators

Edited by

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Russell N. Carney

A VOLUME IN **THEORY TO PRACTICE: EDUCATIONAL PSYCHOLOGY FOR TEACHERS AND TEACHING**

Teaching Human Development for Educators

A volume in
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Mike Yough, Jane S. Vogler, and Eric M. Anderman, *Series Editors*

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CHAPTER 1

EDITORS' INTRODUCTION

Teaching Human Development for Educators

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The central idea of this volume is that teaching about how children, youth, and adults develop and change over time is critical to the preparation of well-prepared classroom teachers. Simply put, teachers need to understand human development in the same way that they need to understand their subject matter, classroom management strategies, or methods of assessing student learning. Unlike Athena, who was said to have emerged completely grown from the forehead of Zeus, students do not come into the classroom fully formed. Rather, students—even preschool age children—have

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a rich and varied developmental history of growth and change. And, they continue to grow and change over the course of any given academic year. As they mature physically, so do their cognitive abilities, providing them with improved thinking and problem-solving skills and greater awareness of self and others. Their social and emotional skills, too, continue to grow through their relationships and interactions with peers, teachers, family members, and others—both within and outside of school. These developmental changes have many and varied influences on how students learn.

This book, *Teaching Human Development for Educators*, is a volume in the series Theory to Practice: Educational Psychology for Teachers and Teaching. It is intended for instructors who teach human development content in teacher preparation programs, either within the context of educational psychology courses or as distinct child, adolescent, or even adult development courses. Teachers are guides and coaches and confidantes who nurture and support their students' developing skills and interests. They hear their students' wishes, fantasies, and expressions of their personal and academic goals. They soothe students' anxieties and fears and help them navigate friendships, and to imagine and plan their future. All these interactions take place within the messy variability of individuals' growth and change and, certainly, no two students are alike. Teacher candidates who lack strong knowledge of human development are, thus, ill-prepared to perform these roles as they begin their teaching careers.

Educators who are well-versed in the study of human development are better able to create age-appropriate, equitable, and safe classroom spaces with developmentally appropriate learning tasks. Such teachers can set realistic expectations for their students' behaviors because they understand what children and youth can do at different ages and stages of development. Knowledge of human development gives teachers insights into setting appropriate learning and behavioral goals for students and a leg up in developing and interpreting assessments of their students' learning and behavior.

Knowledge about human development holds many advantages for teachers. They have greater appreciation for their students' diversity, for example, recognizing that individual as well as group differences among students lends vitality and interest to teaching. Such understandings may lead teachers to adopt more culturally responsive pedagogical practices when teaching students from diverse social, economic class, racial, and cultural backgrounds. Teachers benefit from awareness that they, too, will continue to grow and change in many ways over the course of their teaching careers. It is not simply awareness of aging, though that is important knowledge. Understanding that one's own growth may be impeded by, for example, unresolved psychosocial tasks in childhood and youth yields insights into one's adult behaviors and life choices. Knowing how stress affects health and well-being, and how to

cope with the everyday stressors that are a part of teaching is a helpful by-product of understanding human growth and development.

In an age where the quality of teacher education programs has never been more important, the authors of these chapters argue that educators need a fundamental understanding of human growth, development, and change at different ages and stages across the lifespan. The present volume's authors draw upon the latest research, including their own, as well as their classroom experiences and teaching innovations to help college instructors select and convey essential content on human development to prepare education professionals to work with infants, children, adolescents, and adults across diverse educational settings.

Educational psychologists, who typically have preparation in the psychology of human development, are well-suited to provide instruction to teacher candidates about the theories, principles, methods, and research findings in the field of human development (Anderson et al., 1995). Alongside courses in learning theories, human motivation, assessment methods, and classroom management strategies, educational psychology faculty typically teach human development courses in schools and colleges of education.

Unfortunately, over recent decades, teacher preparation programs have removed or otherwise weakened educational psychology coursework as an emphasis in teacher training—largely in response to shifting program accreditation standards (Patrick et al., 2011). Often, teacher candidates are required to take only a single educational psychology course prior to student teaching and graduation. Such a course might, of necessity, address a variety of topics (e.g., learning theories, behavior management, assessment, and motivation) as well as content regarding human development, leaving little time to examine these topics in necessary depth. University administrators and faculty are not entirely at fault. National teacher preparation accreditation standards tend to be broad and generic. While these standards do not specify the number or types of courses that teacher candidates must take (e.g., Council for the Accreditation of Educator Preparation, 2022), teacher preparation programs typically include coursework in specific content areas (e.g., math, science, social studies), and may require little more than a single course in human development. State boards of education that oversee teacher education programs also often fail to recognize the value of deep preparation in human development for teachers-in-training, instead devoting attention to specifics regarding clinical practice and supervision

Despite these lacks and omissions, the editors are firm in their belief that educational psychology faculty members can prepare teacher candidates with a strong grounding in human development—even when programmatic opportunities to do so are constrained. The chapters that follow in this book provide a variety of perspectives and ideas for instruction in human development that will be of great benefit to instructors and students alike.

AN ORGANIZATIONAL OVERVIEW OF THE VOLUME

Broadly speaking, the chapters in this volume include: (a) brief summaries of the empirical research that supports the teaching of human development as it applies to PreK–12, and postsecondary education; (b) descriptions of instructional practices used in college courses that are deemed effective in teaching about human development; and (c) discussions of issues that influence the teaching of human development theories, research, and classroom applications having clear connections between the empirical literature and the instructional practices.

In their chapter, "Teaching Human Development Using Human Development: The Science of Learning as a Guide for Future Educators," Elias Blinkoff, Hailey Gibbs, Roberta Golinkoff, and Kathy Hirsh-Pasek argue that teacher training programs across the country should put more emphasis on the science of learning—not only in terms of the content knowledge presented, but also in terms of the ways in which preservice teachers are taught. A science of learning model draws upon current research from a variety of fields, including education, psychology, cognitive science, and so forth (as well-documented via their lengthy list of references), and has deep intersection with the study of human development.

In particular, citing Golinkoff, Hirsh-Pasek and others, the chapter authors make the case that students learn best from lessons that contain six evidence-based features. That is, lessons should be: *active, engaging, meaningful, socially interactive, iterative,* and *joyful.* Blinkoff et al. go on to describe each of those six important features, and their benefits, in some detail, arguing that lessons characterized by these six features help students to develop important 21st century skills. Termed the "six-Cs," these skills are: *collaboration, communication, content, critical thinking, creative innovation,* and *confidence.*

Blinkoff et al. suggest that applying their pedagogical approach to teacher preparation demonstrates effective instructional practices that teacher candidates may adopt and eventually utilize in their own classrooms. The approach is culturally responsive in that students' lived experiences are valued and built upon. Finally, as the authors conclude, teacher candidates "deserve to learn in ways that reflect the best science so that they can teach in the ways that humans best learn."

Gabriel Velez, Keshia Harris, and Carly Offidani-Bertrand contributed a chapter, "The Student as a Development Person in Context: Socio-ecological Theory, Intersectionality, and Social Justice." Their chapter adopts a social justice approach for teaching human development with a focus on a socio-ecological framework. Learners from marginalized backgrounds, including women, LGBTQ youth, and minoritized students face significant structural barriers to education which ultimately shape their identities and life outcomes. The authors explain Spencer's (1999) phenomenological

variant of ecological systems theory (PVEST) as a useful framework for educators, underscoring how dynamic and multifaceted ecosystems form the contexts in which students develop. Understanding and use of PVEST theory can help educators to support youth from marginalized backgrounds, according to the authors. One of the systems the authors emphasize is the interlocking systems of oppression that marginalized young people face, especially considering students' intersectional (i.e., race, gender, social class) identities.

The authors also discuss equitable teaching strategies that reimagine what academic success means according to student interpretations within their cultural context and that critically examine students' educational ecosystems and behaviors. They suggest that educators need to know about the different "capacities and supports" that students from different cultural backgrounds bring with them to school and the classroom. Finally, Velez et al. offer several suggestions for educators to apply PVEST. The applications can help teachers to think more critically about the complex mechanisms that underlie students' behavior, to consider how socio-ecological contexts are interpreted and responded to by students, and how they, as teachers of youth, can build supportive learning environments that promote positive identity-based outcomes for their students.

Sarah Kiefer, Raven Robinson, Rebecca Burns, and Kerrijo Ellis contributed a chapter titled "Intentionally Integrating Developmental Theory and Research Into Teacher Education: Examples From the Field." As the title suggests, the authors make the case that educational psychology (e.g., human development, teacher education research) should be incorporated into teacher education programs. They describe concrete ways to go about doing this, as well as detailing the benefits to teacher candidates that should ensue. Indeed, "through building sustainable collaborations and by integrating human development and teacher education across the curriculum, educational psychology instructors and teacher educators can prepare teacher candidates and practicing educators to be responsive to the diverse developmental and learning needs of PK–12 learners" (Kiefer et al. (this volume, p. 73). Incorporating such content should result in several benefits, according to the authors. Next, the authors provide examples of how they facilitate the integration of educational psychology content into teacher preparation through the use of "signature assignments" (a reflective blog, a case study paper, and a lesson plan) and "collaborative teacher inquiry." Kiefer et al. conclude by advocating for the integration of developmental theory and research into teacher education.

Building upon the practice of assigning teacher candidates to conduct case studies of young learners, Dana Haraway and Ann Allred describe how they incorporate educational psychology content into a teacher preparation course by assigning case studies for teacher learning. Their chapter,

"The Why and How of What We Do: Using Case Studies to Understand Adolescent Development for Teacher Educators," focuses specifically on using educational psychology's most prominent developmental, learning, and motivation theories to prepare teachers to teach young adolescents in middle schools. In a novel approach, teacher candidates' learning is also situated within the context of their understanding of various school "structures"—in particular, how middle schools are typically organized to deliver curriculum and instruction and promote student learning and development.

Writing from their complementary perspectives as course instructor (Haraway) and a student in the course (Allred), they describe an educational psychology course in which Master of Arts in Teaching (MAT) students enroll for their final semester, post-student teaching. Students are required to complete a comprehensive case study assignment in which they demonstrate understanding of (a) young adolescents' development, (b) knowledge of middle level philosophy and organization, and (c) middle school teachers' professional roles and responsibilities. Here, students create fictitious characters—teachers and middle grades adolescents—rather than observing or interviewing actual "live" adolescent subjects. Candidates also learn about the characteristics of effective middle schools and participate in a "mock" site visit to a middle school and evaluate the degree to which the school's environment and practices align with the AMLE criteria for an "exemplary" school. The authors' report was that candidates expressed greater confidence in their ability to make the transition from teacher candidate to professional educator as a result of the mock case study project.

The chapter by Alison Koenka, Korinthia Nicolai, and Richard Garries, "Strategies for Centering Inclusion and Equity in Human Development Courses for Preservice Educators," centers the matters of inclusion and equity squarely in the context of teaching human development courses. Inclusion and equity are, in the view of these authors, topics that educational psychologists have not paid adequate attention to in the context of teacher preparation. An important idea from their chapter is how the literature on educational psychology and human development has mostly neglected the racialized and culturalized perspectives of students of color. Addressing this lack, Koenka et al. describe nine instructional strategies that educational psychology faculty can employ to promote equity and inclusion in the human development courses that they teach. These strategies address curriculum, assessment methods, and classroom discussions.

The authors situate the recommended strategies within the literature on critical race theory, stereotype threat, and motivation. They encourage human development instructors to center the development of youth from diverse populations throughout the curriculum. Turning to student work, the authors suggest that examinations and course assignments should

emphasize content mastery, must enable student choice, and address the relevance of the course materials to students' lives. Koenka et al. further encourage educational psychology instructors to get to know their students to facilitate a sense of belonging in the classroom. Finally, the authors recommend that guest scholars who vary across racial and/or gender identity, and career paths be invited to participate in class discussions.

Lisa Looney, Andréa Minkoff, and Gabriela Wilson title their chapter "Creating Clarity Through Understanding Complexity: Building a Case for Development as a Critical Component of Educator Preparation." Briefly, they make the case that developmental (and educational) psychology content should be a fundamental part of teacher education programs, and not take a back seat to the traditional focus on content related to curriculum and instruction—especially for those planning to work with middle and high school students.

They describe *complexity* via ecological systems theory (e.g., Bronfenbrenner, 1976). Systems theories suggest that developing children exist in "multiple, interrelated, complex environments," and these environments influence their "developmental trajectories." In addition, Looney et al. propose that the notion of *intersectionality* helps us to further understand the complexity of children (and teachers) in terms of their various social identifications, for example, race, class, gender, sexuality, and so forth. In their words, having training in developmental and educational psychology is important because it helps teachers understand "the complexity of the intersectionality present in the educational environment" and helps to "decenter dominate norms and to create spaces that are inclusive of the lived experiences of marginalized youth."

The focus of the Looney et al. chapter is on bringing developmental and educational psychology to secondary level educators. Key points throughout the chapter are (a) the uniqueness of developmental paths and (b) that there is no single "best practice" in teaching students from different backgrounds. Looney et al. believe that teachers need to understand the complexity of the education milieu (e.g., students' and teachers' lived experiences), and devise methods that allow for students' various identities and assets and "maintain a social justice approach to their teaching." Along these lines, Looney et al. recommend that preservice teachers become "developmental systems experts" instead of "content matter and instructional experts." The authors call for teacher preparation programs to emphasize developmental and educational psychology. The result of this emphasis will be that adolescent students will have teachers who understand their developmental needs.

In their chapter titled "Considerations and Importance of Generational Changes for Teaching," Elizabeth Pope, Katrina Dotzler, Heidi Burross, and Paul Schutz do a masterful job of explaining how familiar developmental

theories help us to better understand the importance of generational changes for teachers and students. They begin by calling upon Bronfenbrenner's (1976) ecological system's (ES) approach, describing the increasingly complex and ever-changing social historical contexts in which students and teachers find themselves. As the reader likely knows, Bronfenbrenner's theory is characterized by a series of concentric circles, with the individual located within the center, and then encircled, consecutively, by a microsystem, mesosystem, exosystem, macrosystem, and chronosystem. Each system is increasingly distant from the self, though each exerts influence on the developing individual. Pope et al. place today's social media influences within the individual's microsystem and, hence, they emphasize social media's prominent role in this innermost circle.

Next, the authors introduce self-determination theory (SDT; e.g., Deci & Ryan, 2000). SDT describes three basic and important student needs: autonomy, competence, and relatedness. Autonomy has to do with students having some control in their learning—as opposed to the classroom being totally teacher-directed. Competence should result when students "are provided with developmentally appropriate, challenging tasks that align with their own internal values and beliefs" (Pope et al., this volume, p. 175.). Such tasks are ones with which they can be successful. In this regard, they refer to Vygotsky's (1934/1987) zone of proximal development (ZPD) where the student can accomplish tasks with the assistance of a more accomplished peer or a teacher. Finally, relatedness has to do with the students' connections with others (e.g., the student feeling they belong to a social group). Teachers play an important role in meeting these needs in the school setting.

A central point made by Pope et al. is that teachers must keep on top of trends to adjust their pedagogical approach to better support current students' basic needs, rather than view them as changes that have resulted in individual or groups of students who are "lacking" in values, skills, abilities, and so forth—things that may not be a part of their cultural contexts. Rather than interpreting differences as deficits, they argue for asset-based pedagogies (ABP) approaches that build on the diverse personal and cultural knowledge students bring to the classroom. The authors close by listing seven suggestions for bridging generations.

Adults' developmental tasks and growth processes are often overlooked in teacher preparation. This oversight is ironic because teachers-in-training are largely young adults who are experiencing dramatic changes in their lives—everything from development in the prefrontal cortex (which is involved in judgment and decision-making) to separating themselves from parents and family and developing a stronger sense of personal identity. Further, as young teachers enter the profession, they will be teaching not only young students, but also working with adult colleagues and interacting with the parents of their students. As Abbie Bordewyck, Allison Fowler, and Kate Snyder point

out in their chapter, "It Doesn't End at 18: Insight into Adult Human Development," teacher candidates need to acquire an understanding of not only child and youth development, but also adult development. They need to better understand their own developmental changes as well as the growth and change that their older colleagues and parents of their children confront. Such knowledge can assist young teachers to develop empathy for parents, appreciate and learn from senior colleagues' perspectives, and prepare their own students for lives of growth and change.

Bordewyck et al. cite Arnett's (2000) controversial theory of emerging adulthood—a developmental period between the late teens to late 20s—to suggest that important developmental changes occur during these years that significantly impact individuals who are preparing to become teachers. Certainly, for teacher candidates in their late teens and early 20s, the ability to make decisions independent of parents, to accept personal responsibility for one's decisions and actions, and to achieve financial independence may not be fully realized. Given these conditions, it may be important for teacher educators to provide support and scaffolding for teacher candidates to ease their strain and help them gain confidence in their abilities to teach and manage a classroom. Further, Bordewyck et al. suggest that teacher educators should help teacher candidates to develop mature epistemic beliefs (i.e., that knowledge is context dependent rather than certain) through exposure to and critical analysis of multiple viewpoints. Finally, teacher educators, too, must examine their own beliefs and biases regarding adult development and seek to avoid conveying negative "age-ist" views about adult learners.

FINAL THOUGHTS

Collectively, the chapters in this volume offer powerful ideas and evidence-based strategies for effective instruction of human development theories, concepts, principles, and research findings for teacher candidates. While educational psychology has frequently been marginalized as a disciplinary contributor to the preparation of PreK–12 educators, it is a foundational field that provides essential knowledge about how students learn and also, critically, how children and youth develop and change over time. The chapters contained here explain *why* teachers need to understand human development and *how* they can incorporate such knowledge into their teaching. Teachers' understanding of the complex systems that act and interact to influence students' growth, change, and behaviors guides the actions they take to enhance students' learning and achievement. We are particularly pleased that several chapters address issues of equity and inclusivity and the necessity of engaging in culturally responsive, social justice-oriented practices in classrooms given the great diversity among learners in schools

today. Finally, we are confident that many teacher educators can benefit (as can their teacher candidates) from adopting the various instructional strategies and assignments that the contributing authors have described in these chapters.

REFERENCES

Anderson, L. M., Blumenfeld, P., Pintrich, P. R., Clark, C. M., Marx, R. W., & Peterson, P. (1995). Educational psychology for teachers: Reforming our courses, rethinking our roles. *Educational Psychologist, 30*(3), 143–157. https://doi.org/10.1207/s15326985ep3003_5

Arnett, J. J. (2000). Emerging adulthood: A theory of development from the late teens through the twenties. *American Psychologist, 55*, 469–480. https://doi.org/10.1037/0003-066X.55.5.469

Bronfenbrenner, U. (1976). *The ecology of human development*. Harvard University Press.

Council for the Accreditation of Educator Preparation. (2022). *Standard 1: Content and pedagogical knowledge*. https://caepnet.org/standards/2022-itp/standard-1

Deci, R. M., & Ryan, E. L. (2000). Self-determination theory and facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*, 68–78. https://doi.org/10.1037/0003-066X.55.1.68

Patrick, P., Anderman, L. H., Bruening, P. S., & Duffin, L. C. (2011). The role of educational psychology in teacher education: Three challenges for educational psychologists. *Educational Psychologist, 46*(2), 71–83. https://doi.org/10.1080/00461520.2011.538648

Vygotsky, L. S. (1987). Thinking and speech. In R. W. Rieber & A. S. Carton (Eds.), *The collected works of L. S. Vygotsky, Volume 1: Problems of general psychology* (pp. 39–285). Plenum Press. (Original work published 1934)

CHAPTER 2

TEACHING HUMAN DEVELOPMENT USING HUMAN DEVELOPMENT

The Science of Learning as a Guide for Future Educators

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Imagine you are a Kindergarten teacher giving your students a vocabulary test. Each student is presented with an image of a lion and expected to identify it by filling in a label underneath the picture. When one student hands in her test, you see that she wrote "cat," instead. You mark an "X" on the student's paper.

Now you are in a third grade math class in an underserved urban elementary school. Your students frequently face opportunity gaps and struggle to master fundamental math content. Each week, you administer a timed multiplication quiz. Today's covers the seven times tables. A student hands in their quiz with just two questions answered, even though they accurately and effortlessly stated all their times tables from 0 to 12 when you began yesterday's class with an activity that required the students to practice their times tables with each other in small groups.

One last example: You are an English for speakers of other languages (ESOL) teacher working with a class of ninth grade students. You supplement their core English course with in-class time to work on their reading assignments. Several students continue to struggle with grade-level reading. Only after the second failed assignment do you realize that your students are still overcoming a significant language barrier that impedes their ability to decode the high school-level text.

These vignettes describe what happens when teachers are not trained to recognize the principles of learning and human cognition that undergird how children, and even adults, think. The kindergarten teacher who marked her student's "cat" response as incorrect reacted to that answer just as she would have if the student said, "bathtub." Even though both answers are technically wrong, the student clearly recognized that cats and lions share four legs, claws, a tail, and sharp teeth, reflecting a level of conceptual understanding that should have been recognized and celebrated as meaningful and relevant prior knowledge. That is—the answer "cat," while technically wrong, is a better answer than "bathtub."

In the third grade math class, the student who struggled to complete the written multiplication quiz mastered the math content based on their verbal responses. What might be going on here? A teacher equipped with the lens of human development might recognize that some students lack confidence during timed tests, or perhaps that they are slow writers and cannot show their knowledge as readily in written form as they can orally.

Now to the ESOL classroom: Teachers may fail to recognize that students cannot analyze complicated texts if they do not have the language skills in their home language to do so. A student's language ability predicts their later reading ability (Pace et al., 2019). And more pointedly, even if a student has superb letter-to-sound decoding skills, if they are unable to map those

sounds to meaningful words in an unknown language, they cannot delve as deeply into the content, and potentially recognize how their prior knowledge from their native language supports second-language comprehension.

Once teachers are equipped with knowledge of human development, they bring new insights into the classroom, understanding how students' answers reflect the ways in which they learn best. Teacher preparation is about a mindset and a pedagogical approach that will heighten classroom practice and allow for deep learning that is generalizable and "sticky." Achieving this goal requires that all teachers build an understanding of human development, rooted in the science of learning, beginning in their preservice training programs.

This chapter presents a model of teacher training that prioritizes this emphasis on human development. Principles of human learning and development are not meant to be merely memorized by teachers during their preservice courses as isolated facts. Rather, instructors of human development in teacher education programs must provide future teachers with the knowledge and expertise to understand how human development can be facilitated in the classroom by using these principles in their own instruction. Only then will future teachers respond to their students based on their knowledge of *how* children learn, and better understand *what* children need to learn to achieve their goals and to meet educational standards of success.

CURRENT TEACHER EDUCATION PEDAGOGY: *HOW* DO STUDENTS LEARN? HOW CAN THIS CREATE A NEW PEDAGOGICAL FRAMEWORK?

Teacher education programs face structural and instructional challenges that may be resolved through a common curricular focus on human development and the study of how students learn. Darling-Hammond and colleagues (2005) indicate that most educational programs have historically taught "teaching" through highly theoretical, disconnected courses with limited alignment between theory and practice. This disconnect has consequences: It leads to the kinds of practices and misunderstandings that are noted in our examples above. As a start, teaching human development and using pedagogical frameworks that are rooted in the science of learning, and even providing firsthand experience learning through these frameworks in teacher training programs, would prepare future teachers to implement the methods that they learned and experienced in their own classrooms.

Darling-Hammond and colleagues (2005) highlight how many effective teacher education programs are based on a foundation of how students learn. These programs

> begin their course of study in teaching with work on learning and development—hoping to start new teachers with a focus upon students and student learning from the beginning. Such courses require students very early on in their programs to observe children and to collect detailed information about their development and learning. (p. 400)

This requires teacher candidates to practice seeing the world through the eyes of the students they will teach. However, this intensive focus on student learning and development is not typical in teacher education programs, even today.

More than a decade later, Darling-Hammond and Oakes (2019) warned that teacher preparation, as a whole, has not changed much. Through an extensive evaluation process, their research identified just seven teacher education programs in the United States that organize around principles from the science of learning as a core pedagogical focus. Given that there are approximately 26,000 state-approved teacher education programs across the country, this is concerning (Kuenzi, 2018). A study of nearly 600 U.S. educators found that they continued to endorse myths about learning, despite their training. For example, 71% of educators believed the myth that children have a dominant learning style related to their senses (Macdonald et al., 2017). This underscores just how critical it is for teachers to have a comprehensive knowledge of how their students learn. This context leads Darling-Hammond and Oakes (2019) to declare

> if teachers are able to teach in ways that reflect the outcomes we desire for students, which are informed by historical and current understandings of the workings of learning and are consistent with practices that can support deeper learning, then teacher preparation has a high bar to meet. (p. 11)

In other words, teaching the way that students learn is essential in our schools now. If this objective is to be achieved, teacher education programs are vital partners in this effort.

This movement to prioritize the science of how students learn and develop in teacher education includes two main components, an introduction to underlying evidence from the science of learning, and opportunities for teacher candidates to connect theory and practice. A third element, which we suggest is not used frequently enough in most teacher education, is active participation along the lines of the science of learning principles presented here. Only when teacher candidates use these for their *own* learning can they come to understand how best to help their *students* learn. The science of learning is a relatively new, interdisciplinary field that combines research from psychology, neuroscience, education, machine learning, cognitive science, and sociocultural studies to understand how humans learn (Meltzoff et al., 2009; Sawyer, 2014). Several research teams

that intersect developmental psychology and education inform how the science of learning stands to benefit teacher trainees. These novel frameworks use the science of learning and can guide educators in the development and implementation of equitable education systems, so that all students, from the K–12 level through those in teacher education programs, as we argue here, can gain key 21st-century skills (Darling-Hammond et al., 2020; Golinkoff & Hirsh-Pasek, 2016; Hirsh-Pasek et al., 2022; Hirsh-Pasek et al., 2020; Learning Policy Institute & Turnaround for Children, 2021; Nasir et al., 2021). Our question concerns how best to prepare teachers so that they can utilize the latest learning techniques.

EQUIPPING TOMORROW'S TEACHERS WITH EVIDENCE: HOW AND WHAT STUDENTS NEED TO LEARN

The science of *how* students learn offers a pedagogical roadmap—a kind of mindset and a suite of instructional features that teachers can infuse into their lessons to promote deep, generalizable, and "sticky" learning. *What* students need to know to thrive in a fast-paced, global world offers the flip side of this educational coin. We can ask what a graduate of our classroom or school would need to know to thrive and maximize their future success. Teachers need to be thinking broadly about what an educated person is and how they can foster that individual's development.. Using the science of learning as a foundation, Golinkoff and Hirsh-Pasek (2016) and Hirsh-Pasek et al. (Hirsh-Pasek et al., 2022; Hirsh-Pasek et al., 2020) offer a consensus view on 21st-century skills that are evidence-based, malleable (they can be changed with the right experience), and measurable in the classroom.

The science of learning model that Golinkoff and Hirsh-Pasek (2016) and Hirsh-Pasek et al. (Hirsh-Pasek et al., 2022; Hirsh-Pasek et al., 2020) propose suggests that students learn best when lessons are: *active* with emphasis on inquiry and reflection; *engaging* rather than distracting; *meaningful* with connections between new and prior knowledge; *socially interactive* through teacher-facilitated student collaboration; an *iterative* process with opportunities for hypothesis generation and testing; and *joyful* instead of dull (Hirsh-Pasek et al., 2022; Hirsh-Pasek et al., 2020; Hirsh-Pasek et al., 2015; Zosh et al., 2022; Zosh et al., 2018). These principles of how students learn (Figure 2.1) naturally appear in guided play (Zosh et al., 2022; Zosh et al., 2018)—a pedagogical approach that combines a clear learning goal identified by the teacher with student agency to engage in their own learning process (Weisberg et al., 2016). Further, they promote a set of 21st-century skills identified by Golinkoff and Hirsh-Pasek (2016) as the 6 Cs: