Science of Learning:
What Educators Need to Know About Adolescent Development

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ALLIANCE FOR EXCELLENT EDUCATION

Brain • Identity • Relationships • Agency

Acknowledgments

*The **Alliance for Excellent Education** (All4Ed) is a Washington, DC–based national policy, practice, and advocacy organization dedicated to ensuring that all students, particularly those underperforming and those historically underserved, graduate from high school ready for success in college, work, and citizenship. **all4ed.org***

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About the Alliance for Excellent Education's Science of Adolescent Learning Report Series

After reviewing research about adolescent learning and development, the Alliance for Excellent Education (All4Ed) crafted a set of principles (consensus statements) endorsed by a team of researchers. (See the Appendix for the complete list of researchers.) These statements, listed on this and the next page, now represent the twenty principles of adolescent learning and development at the center of All4Ed's SAL initiative. During 2018 and 2019, All4Ed released a series of reports, listed below, that translates supporting research on adolescent learning and development that informs the principles:

1. *Science of Adolescent Learning: How Body and Brain Development Affect Student Learning*

2. *Science of Adolescent Learning: Risk Taking, Rewards, and Relationships*

3. *Science of Adolescent Learning: Valuing Culture, Experiences, and Environments*

4. *Science of Adolescent Learning: How Identity and Empowerment Influence Student Learning*

Together, these research reports provide the foundation for All4Ed's SAL work. The sections that follow include highlights from the original report series as well as key considerations for education practitioners and policymakers on how best to support adolescent learning, particularly for students from historically underserved populations. For additional information about All4Ed's SAL initiative as well as resources to support the application of SAL knowledge and strategies, visit all4ed.org/SAL.

All4Ed's Principles of Adolescent Learning and Development

1. In addition to body changes, the onset of puberty may trigger a second period of brain plasticity, increasing both the opportunity and vulnerability inherent in adolescence. Certain life conditions may cause the process of puberty to occur earlier or later, meaning that physical, cognitive, social-emotional, and other changes associated with puberty can begin at various ages.

2. Adolescents are in a stage of development during which the brain becomes more specialized and efficient. Learning experiences and environmental influences play key roles in this process. Learning and development are inextricably intertwined; these dual processes shape patterns of neural connections during adolescence.

3. As the brain becomes more interconnected during adolescence, young people are increasingly able to engage in adult levels of complex cognition, such as abstract reasoning, future thinking, and social cognition.

4. The ability to form memories and reflect on the accuracy of those memories continues to improve during adolescence. Adolescents become better able to assess their own learning, allowing for more time for additional information gathering and review.

5. Adolescents face an increased risk, compared to adults and younger children, for certain issues related to mental health, behavioral health, alcohol and substance use, accidents, trauma, sexual health, and nutrition due to physical, cognitive, and emotional changes they experience.

6. During adolescence, biological and environmental changes affect motivation and mindset. Because adolescents have an increased sensitivity to social evaluation, praising their learning process and successful strategies, not effort alone, can support development of a positive mindset and motivate them to learn.

7. Adolescents are more sensitive to some types of rewards, such as social recognition, than adults and younger children. Adolescents are more likely to engage in both positive and negative forms of risk taking, especially if peers support that behavior.

8. The transition from childhood into adolescence is associated with an increased sensitivity to social evaluation, including feelings of belonging, acceptance, admiration, and respect.

9. Peer relationships strongly influence adolescents, even more so than younger children, in ways that contribute to opportunities as well as vulnerabilities.

10. Compared to younger children, adolescents are able to spend more time with peers without adult supervision. However, support, communication of consistent expectations, and monitoring of activities and emotional functioning by adults are essential as adolescents become more independent.

11. Culture constructs the nature of learning environments and ways adolescents experience them including their values, motivations, and beliefs related to learning.

12. Adolescents seek learning environments that are consistent with and meaningful within the social and cultural contexts of their lives.

13. Digital technologies, such as computers, the internet, social media, and smart phones, dramatically have changed the way individuals learn, play, and interact with each other. Their impacts may be greatest for adolescents who are young enough to embrace novelty and old enough to master the technologies.

14. Adolescence is marked by significant biological shifts, resulting in heightened stress-induced hormonal responses. Stress is a major modulator of human learning and memory processes. As pressures around school, work, and relationships increase, adolescents experience greater stress.

15. In addition to physical, social, and emotional impacts that economic disadvantage has on adolescents, poverty and socioeconomic status are associated with a diverse set of neuroscientific structural and functional outcomes. Based on current evidence, the most sensitive systems are those related to executive functions, language, learning, and stress regulation.

16. Inequality, bias, and the persistence of structural discrimination constitute serious hazards to the positive development of all adolescents.

17. While adolescents still are developing self-regulatory systems, under some circumstances they make more rational choices with the similar mental capacity of adults. However, the expression of self-regulatory skills depends on context and learning opportunities.

18. For adolescents, social and emotional development involves exploring meaning and finding purpose; sometimes this development is at odds with institutional structures and expectations.

19. Adolescents are developing their own adult identity, trying to understand their roles and contributions in social contexts and communities. This identity development continues into adulthood, as the individual has more diverse experiences.

20. Adolescents seek opportunities for agency where they can decide how they spend their time and influence policies and practices of institutions that shape their lives.

Why the Science of Adolescent Learning Matters for Education

Adolescence is a time of transition characterized by rapid physical, neurological, cognitive, and socioemotional development.[1] As students move toward adulthood, their bodies and minds change.[2] Those changes affect how they learn and, likewise, should influence how educators interact with youth.

A broad range of factors influence adolescent learning and development. These include *physiological* and *cognitive* factors, such as the maturation of neural pathways in the brain and the capacity to solve complex problems; *psychological* factors, such as the development of individual identity independent from parental figures; and even differing, sometimes conflicting, *cultural* and *societal* expectations.[3] Consequently, rather than being a time of deficit, adolescence is a period of immense learning and opportunity.

Research about adolescent learning and development draws from a variety of disciplines including, but not limited to, neuroscience, cognitive science, psychology, sociology, cultural studies, and medicine. By drawing from these multiple disciplines, the science of adolescent learning (SAL) synthesizes what researchers know about adolescent learning and development and challenges traditional thinking about what it means to teach and learn during this developmental period. Furthermore, it offers a body of evidence that goes beyond simply observing students in the classroom and making assumptions about their learning and the strategies that support student needs. It provides a scientific understanding about how adolescents learn that can, and should, influence the approach to education reform. When translated and communicated effectively, SAL research has the potential to positively change education policies and programs to benefit students for the long term.

Early childhood education benefited dramatically from efforts to increase educator and public knowledge about the importance of the early years of life for brain development and learning.[4] Educators, policymakers, and the public now generally understand that quality education during early childhood can have lasting positive effects long into adulthood.[5] Today, there are many national and state-led early learning initiatives, such as Head Start and New York's Pre-K for All program, that resulted from educators' increased knowledge about the science of learning and development in early childhood. Now, recent evidence shows that adolescence represents a second critical window for human learning and development.[6] Consequently, education leaders have a responsibility to ensure that education systems align with research about adolescent learning and development and focus intentionally on policies and practices that apply this knowledge.

> 66 **[R]ather than being a time of deficit, adolescence is a period of immense learning and opportunity."**

The following sections—"Body and Brain Development"; "Risk Taking, Rewards, and Relationships"; "Culture, Experiences, and Environments"; and "Identity and Empowerment"—provide an overview of the essential knowledge that educators and other adults need to know to educate and guide adolescents toward adulthood. Although this report organizes key findings about adolescent development into separate thematic sections, the research remains interconnected. Consequently, school and district leaders should incorporate findings from all four areas to create cohesive learning environments that comprehensively address adolescents' developmental needs.

Body and Brain Development

During adolescence, the body and brain experience a variety of biological changes that make this stage of human development both a time of learning opportunity and a time of risk for students. As the human brain prepares for adulthood, its development depends strongly on the learning environment provided during adolescence. Events and activities experienced during this developmental time prepare the brain for situations and circumstances the adolescent will experience as an

adult. Consequently, students in middle and high school need opportunities to use their developing prefrontal cortex to engage in deeper learning to build problem solving, critical thinking, and other higher-order thinking skills and support the application of those skills during adolescence and later in life. Therefore, education leaders must ensure that learning opportunities support the development of adolescents' increasing cognitive capabilities and provide additional resources and services necessary to support the learning and development of students during this stage. The following essential findings about adolescent learning and development should guide educators' work:

1. Research shows that adolescence is an important period of increased brain plasticity, or adaptability, second only to early childhood, making adolescence a critical stage for students and educators.

2. The learning environment plays a significant role in brain development. As adolescents perform complex mental tasks, the neural networks that support those abilities strengthen, increasing their cognitive, emotion-regulation, and memory skills. Without opportunities to use these skills, those networks remain underdeveloped, making it challenging for individuals to engage in higher-order thinking as adults.

3. During adolescence, individuals face an increased risk for certain issues related to mental health, behavioral health, alcohol and substance use, accidents, trauma, sexual health, and nutrition due to the physical, cognitive, and emotional changes they experience. These health issues can affect adolescents' behavior and ability to learn.

By understanding the science behind student learning and development, education leaders can support adolescent learning more effectively, closing achievement and opportunity gaps. Additionally, policymakers and educators can ensure that continuous improvement efforts at the secondary school level are comprehensive; developmentally appropriate; and supportive of adolescents' academic, social, emotional, physical, health, and mental needs.

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SAL–School Connection: Brain Development

Adolescence is the perfect time to engage students in college and career planning because key brain regions involved in abstract thought, planning, and thinking about the future are developing. Provide students with internships, work-based learning, career academies, career and technical education course work, and mentors from the business community. These types of authentic work/learning opportunities build on adolescents' inherent desire for novel adult-like experiences, help students envision their future selves, and activate the brain networks used for higher-order thinking.

Risk Taking, Rewards, and Relationships

As schools and districts prepare students for success in college, careers, and life, educators must ensure that school cultures and environments promote positive mindsets in adolescent students, motivate them to take risks associated with positive outcomes, and encourage them to develop supportive relationships with peers and adults. As adolescents' awareness of their social environments increases, their mindsets about learning evolve. During this developmental stage, adolescents increasingly seek novel and thrilling experiences as their capacity for self-regulation matures. Meanwhile, the roles of peers and adults shift and take on new significance for adolescents, affecting their learning and identity development. Furthermore, recent evidence from neuroscience provides an increased understanding about how changes in the brain relate to these observed changes in adolescent behavior and inclinations. SAL offers the following essential findings about the nature of adolescent motivation, risk taking, and relationships:

1. As students reach adolescence, the most effective methods for motivating them change due to changes in the brain's reward-processing systems and students' experiences in new social contexts. Motivations for adolescents tend to be extrinsic and tied to social status, shared peer values, personal memories, emotional systems, and a desire for novel adult experiences.[7] Educators can influence how adolescents engage in academic and social activities through the types of motivation they provide and by

encouraging a growth mindset—a belief that students can develop their abilities, knowledge, and skills. A school culture that supports students' positive identity development and allows them to pursue their own learning interests can inspire academic achievement and a lifelong passion for learning.

2. Adolescents' increased inclination to engage in risk-taking behaviors is not a deficit. During the adolescent stage of brain development, individuals are more sensitive to the effects of certain rewards, which can increase the likelihood that they will take certain risks to obtain those rewards. Educators can provide adolescents with school-based opportunities to take risks associated with positive academic and social outcomes, such as college acceptance, career preparation, and developing friendships, to allow students to benefit from their tendency to pursue new, varied, and intense experiences.

3. The role of peer and adult relationships shifts during adolescence. Peers become increasingly important as they influence the reward systems within the adolescent brain. Meanwhile, adult roles must shift from seeking to meet the needs of adolescents to supporting adolescents in meeting their own needs. Educators can shape school environments to provide adolescents with opportunities to engage with their peers during learning experiences and support students as they take responsibility for their own learning.

Education leaders can design learning environments that support adolescent learning and development by using developmentally appropriate motivation strategies; supporting positive relationships between adolescents, their peers, and educators; and providing opportunities for adolescent students to take risks that will enhance their own educational experiences.

SAL–School Connection: Motivation

Building programs that support adolescents' growing sense of autonomy and need for agency can motivate middle and high school students to engage more in academic or extracurricular activities. Let students design their own extracurricular programs, form new clubs, research and organize potential class field trips, and partner with community members to bring new and interest-based learning experiences into the school. Empowering students to shape their learning environment—and then recognizing their efforts—can boost students' engagement and sense of ownership for their learning.

> " [A]dolescents increasingly seek novel and thrilling experiences as their capacity for self-regulation matures."

Culture, Experiences, and Environments

Increasingly, educators are becoming aware of the impact that school culture, learning environments, and learning experiences have on educational outcomes. Findings from recent neuroscience, cognitive science, and psychological research provide a more in-depth understanding of why school culture matters for each student and why it especially is important for adolescent students to learn in environments that are safe, supportive, and culturally responsive. Multiple environmental factors—from community values and social expectations to poverty, prejudice, and inequity—influence classrooms, schools, and student learning. Learning environments also have expanded to include digital technology as today's adolescents increasingly use online spaces to learn and build relationships.

> " [S]upportive school cultures should promote ambitious learning goals, positive relationships, and critical thinking."

By understanding the full range of cultural and environmental factors that affect adolescent learning, educators and leaders can support adolescents as they learn to navigate increasingly complex social and political systems, leading to their academic and postsecondary success. Educators should consider the following essential findings about adolescent learning and development:

1. Now, more than ever, educators know that supportive school cultures should promote ambitious learning goals, positive relationships, and critical thinking. As adolescents develop their own identities along multiple dimensions and seek to understand the complex social systems and societies around them, educators and leaders must ensure that adolescent learning environments connect meaningfully to adolescents' cultural values and community experiences.

2. Neuroscientific evidence is advancing a greater understanding of the relationship between stress and learning. When the brain reacts to stress, it redirects the

individual's attention and efforts to attempt to respond to the cause of stress. This reduces the individual's capacity to remember concepts and adapt effectively to social situations, such as confrontations. Stress affects the learning of adolescents particularly because the brain structures involved in stress regulation still are developing.

3. Historically underserved and marginalized students often experience additional learning obstacles resulting from stressful experiences related to poverty and inequity. Increasing evidence shows how poverty can affect learning and the brain, absent appropriate support. This includes the impact of prolonged exposure to stress, inadequate access to nutrition and health care, and polluted environments. In addition, discrimination, bias, microaggressions, and stereotype threat can affect the learning and academic outcomes of students who identify with historically marginalized groups, regardless of their socioeconomic status or academic ability.

SAL–School Connection: Culture

During adolescence, young people become more aware of social and cultural differences, group values, and inequities in how people live and are treated. Consequently, middle and high school students need authentic opportunities to express and explore their cultural traditions, personal heritage, and community values while in school. Create professional learning activities that allow adults in the school community—such as teachers, school administrators, counselors, social workers, psychologists, and other school staff members—to meet with and learn from community members in community-based settings. Then collaborate on ways to interweave and elevate community values within the school culture. With a deeper school-community relationship, students' cultures can become an integral part of the daily school experience.

Identity and Empowerment

For more than half a century, psychologists and sociologists have recognized adolescence as a critical stage of identity development and increased agency. Researchers continue to explore how individuals construct the multifaceted aspects of their identities through their membership in different communities and social groups. Self-regulation relates closely to the development of identity and agency and especially is crucial as young people confront everyday challenges while simultaneously experiencing intense changes in identity and increased opportunities to influence the world around them.

Additionally, findings from neuroscience and cognitive science have deepened researchers' understanding of the identity development process, the role brain development plays in identity formation, and how these developmental processes affect the learning of middle and high school students. As adolescents negotiate different aspects of their identities, they shape their behaviors and perceptions to accommodate a cohesive vision of who they are and who they want to become. At the same time, they begin to understand how their identities shape the behaviors and perceptions of others and orient them in their classrooms and the world.

The process of identity development also brings an increased desire for adolescents to exert greater agency over their lives and the environments surrounding them. Adolescents seek opportunities to change the world around them and flex newly equipped cognitive and social tools to be agents who positively impact the communities in which they live and institutions that govern their lives. Furthermore, the process of discovering who they are, who they want to be, and how they can impact their communities motivates adolescents to pursue learning opportunities that align with their goals.

Building self-regulatory skills, developing identity, and increasing agency all support adolescents' academic achievement, postsecondary success, and overall healthy development. With this in mind, educators should consider the following essential findings as they support the learning and development of middle and high school students:

1. Identity development is a key undertaking of adolescence influenced by the changing brain and increasingly complex social structures of adolescents' lives. Identity development is a complicated, constant process of negotiating different aspects of oneself, informed by the communities and people to whom adolescents relate in their lives. Exploring meaning and searching for purpose during adolescence are core aspects of identity development that occur within a cultural context that assigns value to the identities, meanings, and

purposes adolescents adopt. Healthy identity development is an important and challenging process for all students, including historically underserved students who may not share identities with the majority of individuals in a society.

2. During adolescence, young people develop into agents capable of making conscious, voluntary actions that exercise greater control over themselves and their surrounding environment. Agency develops based on neurological and cognitive changes. Adolescents seek to expand their agency and use that agency to impact the institutions and systems that govern their lives.

SAL–School Connection: Agency

Adolescents seek increased independence from adults and more influence over the world around them, including their schools. Identify school staff members to serve as grade-level liaisons who meet with teams of students; listen to their concerns; and collaborate with students on ways to share their perspectives, ideas, and solutions with school administrators. Involving students in creating formal and informal processes for communicating with school leadership empowers adolescents to advocate for themselves and make decisions in ways that families and educators can support.

3. Underlying adolescents' agency is their improved ability to self-regulate. Self-regulatory skills develop further during adolescence, and adolescents' perceptions of their identities inform that development. This heightened aptitude for self-regulation offers new opportunities and responsibilities for middle and high school students. Adults must provide the support, experiences, and opportunities adolescents need to develop self-regulation properly.

Implications and Opportunities for Education Practices and Policies

Adolescence is a time when students experience multiple biological changes that create the cognitive and physiological framework necessary for advanced learning. More importantly, research shows that the environment surrounding an individual strongly influences how these biological processes take place and, consequently, shape a person's learning and development.

At the same time, students' mindsets about learning evolve and their motivations for academic persistence and success change during adolescence. Developmentally appropriate rewards and positive relationships with both peers and adults are essential components of a secondary school culture that inspires and supports students to learn and achieve.

Culture and learning environments inside and outside of schools and online likewise affect the learning opportunities adolescent students experience and their development and capacity to learn overall. Educators must consider how the intersection of school and societal cultures can support or hinder student learning and create culturally responsive environments for the diverse students they serve. Historically underserved students particularly are more likely to face the effects of poverty, negative bias, and discrimination, including chronic stress, lack of academic motivation, and stereotype threat, all of which influence adolescent learning and development.

> 66 **Exploring meaning and searching for purpose during adolescence are core aspects of identity development."**

Finally, adolescents need opportunities to explore different aspects of their identities and exercise the social and cognitive tools that allow them to develop agency over their lives. Educators must consider how they shape learning environments and practices to support healthy identity development and provide students with opportunities to direct their own actions and learning.

How can educators use these findings?

Support healthy brain and body development during adolescence.

*   Design instructional programs and resources that increase and elevate opportunities for students to apply advanced cognitive strategies, such as metacognition and future thinking; develop students' abilities to regulate and reflect upon their own thinking; increase their confidence; develop deeper learning skills; and improve their educational outcomes. These opportunities can occur through academic instruction as well as other school experiences. For example, educators and counselors can support students in developing future thinking skills through college

and career planning and disciplinary practices. District and school leaders should ensure equitable opportunities for all adolescents to access rigorous extended extracurricular learning opportunities, such as debate or robotics clubs, that develop higher-order thinking skills.

- Capitalize on adolescents' increased ability to remember personally relevant information by connecting academic learning to students' personal interests, prior knowledge, and current events. Teachers can learn about students' interests through activities such as questionnaires, exit slips, student advisory groups, journals, and online discussion boards. The strategies used should provide students with platforms to discuss their interests in structured formats that engage both peers and other adults and align with school policies and procedures. Examples include newsletters, speaking engagements, debate clubs, and intergrade or interdisciplinary communication activities. Academic approaches such as project-based learning and performance-based activities should offer students opportunities to choose from multiple ways of completing tasks to arrive at successful outcomes. Meanwhile, teachers can develop students' working memory skills by designing assignments and assessments that require students to solve complex problems and connect information to their own experiences, rather than simply regurgitate memorized information.

- Provide teachers, counselors, psychologists, social workers, and other personnel with the support and professional learning necessary to guide students through opportunities to develop social and emotional skills and emotion-regulation strategies, such as cognitive reappraisal, as they navigate increasingly complex social environments. This might mean designating time during the school day, such as an advisory period, for adults in the school to discuss timely social issues with students.

- Ensure that health and physical education classes provide information about the body changes students experience during adolescence and how to care for themselves during this time of rapid development and as adults. In addition to offering formal opportunities for this type of learning, schools and districts should develop informal learning structures to engage parents, students, and communities to empower students to make healthy choices for themselves. These could include offering workshops or providing video clips on the importance of sleep and preparing healthy meals during parent-teacher-student association meetings or partnering with community public health organizations to provide access to community clinics and other resources.

- Offer students and families information about healthy strategies for coping with stress and access to other mental health resources that focus on the adolescent stage of development.

Motivate adolescents in developmentally appropriate ways and encourage positive risk taking and peer relationships.

- Provide opportunities for students to engage in high-quality service learning and work-based learning. For example, educators can engage students in rigorous projects that integrate academics with social justice; service-learning projects to support causes important to students; and internships with business and community organizations. These types of learning opportunities can motivate students and provide them with opportunities to build relationships with their peers and adults in their community.

- Value the importance of peers in adolescents' lives and support the development of positive peer relationships by creating opportunities for students to work with and learn from each other under the supportive guidance of teachers, parents, community members, business professionals, and other adults. Effective strategies for this include long-term group projects and other in-school assignments that engage students within and between grade levels and schools.

- Use nonacademic time such as lunch, student advisory and homeroom periods, or other less structured time to build supportive relationships with students separate from discussions about academic progress. This might include a time for students to talk openly about current events or community activities of interest to them. Students might even talk with their peers about social issues or seek help on assignments. Educators can use two-way communication approaches such as dialogue journals to allow students to communicate with their teachers without involving their peers.

- Provide opportunities for students to establish personal academic, career, and social goals. Students are more likely to thrive and make positive choices when they understand

(1) the relevance of education to their future success and (2) that high school is not an end in itself but rather a path to greater autonomy and choice. Schools and districts can partner with community colleges and businesses to offer on-campus experiences, college-level course work, career training, and internships. Meanwhile, teachers and counselors can work with students, their families, and mentors to develop personalized learning plans that align with students' interests and goals.

Value students' cultures, experiences, and environments.

- Assess whether districts and schools respond equitably to the diverse needs of students by monitoring and gathering information about existing practices through multiple forms of qualitative and quantitative assessment. Issues to note include access to opportunities and resources, assessment bias, and the diversity of high-quality teachers in classrooms serving predominantly groups of students with the greatest needs.

- Include various voices and input on decisions from adolescents themselves, other adults in their lives, diverse groups, and community representatives throughout the decisionmaking process. Student motivation and community collaboration are more likely to increase when there is inclusive dialogue among leaders, educators, families, and students.

- Engage with all students, their families, and communities to learn about their cultural backgrounds and values. With that knowledge, educators can implement inclusive educational and organizational strategies, such as incorporating key perspectives into instruction and extracurricular activities, using inclusive language, and connecting academic topics and goals to the cultural values of students to ensure that district and school structures are equitable and respond to the needs of students outside the dominant culture.

- Integrate technology strategically into academic instruction using blended learning approaches to create a personalized learning experience for students. At the same time, school and district leaders should address potential equity concerns that may arise from expected technology use, such as differences in students' home access to the internet, professional development opportunities for educators, and data privacy considerations.

- Make opportunities and resources available to improve educator diversity and build school capacity around cultural responsiveness, such as strategies for recruiting and retaining diverse teachers and providing culturally responsive instruction. Diversifying the educator workforce can foster adolescents' positive identity development especially among historically underserved students. However, all educators can lift up students from diverse backgrounds by teaching and mentoring in culturally responsive ways.

Promote self-regulation, identity development, and agency among adolescents.

- Understand that self-regulation improves from childhood but still develops during adolescence. To foster self-regulation skills, educators must ensure that students' basic needs are met, including access to nutritious food, adequate sleep, exercise, acceptance, and feelings of safety and belonging, as these all contribute to adolescents' ability to manage their behavior. Educators should check in with students and their families regularly and work with the school and community partners to intervene in cases where students have unmet needs.

- Guide the development of adolescent self-regulation skills seamlessly so it is not an "add-on" to the curriculum. Educators should create time and space during the school day to model, teach, practice, and support self-regulation with their students rather than resorting to punitive responses. Activities such as simulating, role-playing, and discussing stressful moments in students' academic and personal lives can help adolescents develop self-regulatory skills. Technology can supplement these types of activities by providing video clips and vignettes that demonstrate positive and negative examples of self-regulation with specific strategies that result in positive outcomes. School personnel also can provide opportunities for students to design scenarios or share personal experiences that cause them to role-play and self-reflect on how best to regulate themselves in times of stress, anger, pain, or discomfort. During adolescence, students need opportunities to explore self-regulation as part of their natural learning, to make mistakes, and to learn from their own experiences.

- Understand that meaning making is a central aspect of creating identity, so it is important for an academic environment to recognize the key issues students face in

becoming their own selves. Schools should nurture the identity development of students by allowing them to explore various activities and authentic learning opportunities through which they can understand the world around them. Educators can develop systemic approaches that allow for meaning making through virtual and in-person field trips, guest speakers with a wide variety of expertise and diverse backgrounds, projects and assignments that allow students to go beyond the classroom and connect with the real world, and opportunities to share students' interests and questions about the world.

- Research and data support the integration of identity groups as a positive aspect of adolescent development. Students who see successful peers and adults around them who represent aspects of their own backgrounds and aspirations are more likely to connect those individuals and their own identities. This exposure allows adolescents to envision themselves reaching certain goals, being a part of a certain trajectory, and feeling confident in their own capabilities.

- Identify students' personal interests, skills, and aspirations and provide academic and social experiences aligned with those interests. School and district leaders should model similar practices with school staff members, making this approach part of the schoolwide culture to ensure that school experiences respond to students' needs.

- Practices that isolate students for long periods of time for academic catch-up or punitive behavior management can be at odds with adolescents' social and emotional development. Adolescents seek to make sense of institutional structures around them and how well those structures accept them. Adults can provide conducive environments for learning and social engagement by focusing on peer relationships and elevating student voice and agency. One way to do this is to seek adolescent input when designing or developing systems for behavior management and supplemental academic support. Using evidence-based approaches, such as restorative justice practices and positive behavior intervention support, enables educators to create systemic ways to engage students in developmentally appropriate ways to improve both their academic performance and behavior. Meanwhile, for misbehavior related to behavioral health issues, educators should employ evidence-based trauma-informed interventions, such as trauma-focused cognitive behavioral therapy or Aggression Replacement Training®, as a first step to building student agency.

- Engage students in meaningful activities that connect them to the world beyond school. Educators can accomplish this through mentoring from business and community leaders; authentic learning and community service opportunities with community, faith, and business organizations; systems for recognizing and incentivizing the contributions of students in school and the community; an enhanced role of student government to address school and community issues; student personalized learning plans; and student-led conferences that allow students to direct their own academic development.

What can policymakers and advocates do?

- Adolescence is an important time for student learning and development, yet evidence suggests that Title I funding, the federal government's primary source of financial support for underserved students, is allocated disproportionately to elementary schools.[8] School districts should use new flexibility provided under the Every Student Succeeds Act (ESSA) to target Title I funds toward high-poverty high schools.

- New research on brain science suggests that adolescents need opportunities to develop critical-thinking skills; otherwise, the neural networks responsible for complex reasoning will remain underdeveloped, making it more challenging for individuals to engage in higher-order thinking as adults. Because assessments affect instruction significantly, states should encourage district and school leaders to provide opportunities for students to develop critical-thinking skills by using new flexibility provided under ESSA to embed complex performance tasks into statewide assessments.[9] (For more information about the opportunities ESSA offers states and districts to connect policies and practices to adolescent learning and development research, see All4Ed's report *Synapses, Students, and Synergies: Applying the Science of Adolescent Learning to Policy and Practice.*)

- The implementation of the Strengthening Career and Technical Education for the 21st Century Act (Perkins V), the reauthorized version of the Carl D. Perkins Career and Technical Education Act, presents an important moment to support SAL. States should use new opportunities in the law to create partnerships among school districts, institutions of higher education, and employers to provide historically underserved students with college and career pathways that include work-based learning to develop

students' higher-order thinking skills while preparing them for postsecondary education. Work-based learning allows adolescents to engage with their communities and learn the codified language of an industry that ultimately increases adolescents' interest in a career field. In addition, state accountability systems can encourage schools to offer college courses and provide pathways for students to earn industry credentials while still in high school. Additionally, Perkins V offers policymakers an opportunity to support educators in providing developmentally appropriate motivation for adolescents and draw on Perkins V resources to promote college and career planning and experiences.

- The reauthorization of the Higher Education Act (HEA) also provides an opportunity to help adolescents contextualize the importance of secondary education as it relates to their personal and professional goals and develop agency over their future. For example, to combat the notion that only some students are "college material," HEA should provide U.S. students a "Fast Track" to and through college by providing academically prepared eleventh graders—one-third of whom typically are from low-income families—the chance to enroll in a full load of college-level courses in the twelfth grade and graduate from high school with a full year of college credit. This will help students, particularly first-generation college students, feel that postsecondary education is within their reach. HEA also can give adolescents greater control over their learning by allowing high school students to enroll in dual-credit and early college programs using Pell Grants to cover the costs. In addition, state accountability systems under ESSA can encourage school districts to offer college courses and provide pathways for students to earn industry credentials and obtain work experience while still in high school.

- Evidence suggests that adolescents are more likely to excel in their academic pursuits if they are taught in ways that connect to their culture and values. Therefore, as Congress considers the reauthorization of HEA it should provide opportunities for prospective educators to learn evidence-based culturally responsive practices through Title II and Title III teacher and leader preparation programs. Similarly, federal funding for teacher preparation programs and preservice teacher loans should include provisions that require teacher preparation programs to train aspiring educators on adolescent self-regulation, identity development, and agency development.

- The relationships that adolescents develop with peers and adults heavily influence how they integrate into social, professional, and political settings as adults. Because class and racial segregation influence the people and institutions with which adolescents interact, it is important for public policy to promote diversity and prevent racial isolation. For example, the U.S. Departments of Justice (DOJ) and Education (ED) recently rescinded guidance aimed specifically at achieving diversity and reducing racial isolation in elementary and secondary schools. This guidance should be restored immediately. Also, district leaders can create school attendance zones that consider the relative racial composition of areas in combination with the average household income and educational levels of parents in those areas. All students in a given area would then, regardless of their individual race, receive the same consideration when applying to a school based on how much their zoned area would contribute to increasing diversity or reducing racial isolation in that school.

- States should incorporate rigorous standards for high-quality service-learning opportunities aligned with state academic standards into high school graduation requirements. This could be a set of criteria that districts would use to approve service-learning projects. A state also could provide sample high-quality projects that districts could use to gauge the quality of their service-learning projects.

- Policymakers should find ways to support and incentivize teen mentorship programs—for example, by expanding funding for the Mentoring Opportunities for Youth Initiative available through DOJ's Office of Juvenile Justice and Delinquency Prevention. Given the increasing influence of peers in the lives of adolescents, and their growing sensitivity to social evaluation, providing adolescents with positive peer role models is critically important. Policymakers should find creative ways to grow mentoring programs in partnership with community groups and nonprofits by providing needed funding and incorporating mentoring into school programming (e.g., include mentorship in college and career pathways so older students can support younger students in navigating work experience, training, and college classes and experiences).

- A range of factors outside the classroom affect a student's ability to learn. Quality instruction is critical but insufficient on its own to ensure that students from historically underserved

backgrounds have the support they need to excel. Therefore, Congress should expand funding for integrated student support through programs such as the Student Support and Academic Enrichment Program, Promise Neighborhoods, and Full-Service Community Schools. In addition, ED and the U.S. Department of Health and Human Services (HHS) should issue guidance to states and school districts about how they can integrate resources from ED and HHS to support students comprehensively.

- Authorization for the Education Sciences Reform Act of 2002 expired in 2008, although Congress has continued funding the law since that time. When Congress reauthorizes the statute, it should prioritize research on effective ways to incorporate culturally responsive practices into the nation's education system.

- Adolescents seek engagement in the institutions that govern their lives. Consequently, federal, state, and local policymakers should build on existing internship programs and create new youth programs that introduce students, particularly those who are historically underserved, to government structures; the local, state, and federal legislative and legal processes; current policies and laws; and issue advocacy and campaigning.

- Adolescents are at a stage in which their self-regulatory abilities still are developing. The difference in developmental patterns between adolescents' self-regulatory systems and their sensitivity to emotion makes them more susceptible to poor decisionmaking. Policymakers can enact legislation that limits traditional school delinquency policy by encouraging restorative justice techniques. Policymakers also can consider reworking laws as they pertain to adolescents who have committed crimes to account for varying developmental trajectories and reduce the school-to-prison pipeline. For example, state and local policymakers should limit the use of juvenile court penalties and sanctions for activities and behaviors that are only illegal because the "offense" is committed by a juvenile (e.g., truancy).

Conclusion

Adolescence presents a significant period for both learning opportunity and risk. As the brain prepares for adulthood, its development depends strongly on the learning environment and experiences provided during adolescence. Consequently, during middle and high school, students must practice the types of complex cognitive and interpersonal skills necessary for postsecondary success. At the same time, changes in the reward systems of the brain affect what motivates adolescents to engage in certain behaviors. Adolescents are building their understanding of their social surroundings, exploring the meaning and purpose of their lives, and developing their personal identities. All of these processes influence their mindsets about their abilities to learn and succeed.

Meanwhile, research shows how school culture influences adolescent learning and development. When students feel that their schools recognize and value their personal identities, culture, and community beliefs, their motivation to engage in academic and extracurricular activities increases. By contrast, adolescents are less likely to engage in academic learning if school environments do not promote growth mindsets, connect academic learning to students' interests and values, and allow adolescent students to build supportive relationships with their peers and adult educators. Adolescents need school- and community-based opportunities to take positive risks and practice self-regulation through activities that capitalize on their natural tendencies, rather than work against them.

> 66 **Adolescence presents a significant period for both learning opportunity and risk."**

As school and district leaders work to ensure that middle and high schools meet the developmental and learning needs of adolescent students, they must understand how adolescent students' mindsets, individual motivations, and relationships with peers and adults affect their willingness to engage in school. Policymakers and educators should improve their understanding of adolescent development and behavior to ensure that continuous improvement efforts at the secondary school level are developmentally appropriate and meet adolescents' academic, social, emotional, physical, and health needs. Federal, state, district, and school leaders should align

their efforts to create organizational structures that connect academic learning to college and career goals, foster positive relationships, support adolescent students in taking risks that will enhance their educational experience, and capitalize on the learning opportunities that diverse cultures and communities offer. By understanding the range of neurological developments, physical changes, social influences, and environmental factors that affect adolescent learning, educators and policymakers can design developmentally appropriate learning environments that better support adolescents and their academic and postsecondary success.

Photo by Allison Shelley/The Verbatim Agency for
American Education: Images of Teachers and Students in Action

Appendix

The following researchers, all members of All4Ed's Expert Advisory Group, endorse the principles of adolescent learning and development and continue to support All4Ed's SAL initiative in their respective areas of expertise:

A. Wade Boykin, **PhD**, Howard University

B. Bradford Brown, **PhD**, University of Wisconsin–Madison

Linda G. Castillo, **PhD**, Texas A&M University

Richard Clark, **PhD**, University of Southern California

Laurie Cutting, **PhD**, Vanderbilt University

Ronald E. Dahl, **MD**, University of California–Berkeley

Adriana Galván, **PhD**, University of California–Los Angeles

Simona Ghetti, **PhD**, University of California–Davis

Jay Giedd, **MD**, University of California–San Diego

Iva GreyWolf, **PhD**, Society of Indian Psychologists

Mary Helen Immordino-Yang, **EdD**, University of Southern California

Ben Kirshner, **PhD**, University of Colorado–Boulder

Sebastián J. Lipina, **PhD**, Unidad de Neurobiología Aplicada (UNA, CEMIC-CONICET)

Na'ilah Suad Nasir, **PhD**, Spencer Foundation

David Osher, **PhD**, American Institutes for Research

Amado Padilla, **PhD**, Stanford University

David Patterson Silver Wolf, **PhD**, Washington University in St. Louis

Royleen J. Ross, **PhD**, Society of Indian Psychologists

Laurence Steinberg, **PhD**, Temple University

Kaveri Subrahmanyam, **PhD**, California State University–Los Angeles

Ming-Te Wang, **PhD**, University of Pittsburgh

Kathryn Wentzel, **PhD**, University of Maryland

Endnotes

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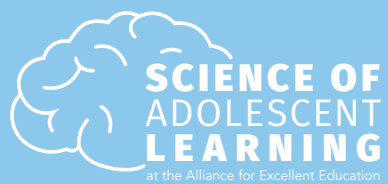
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