



Mindsets & the Learning Environment: Developmental Neural and Psychosocial Correlates of Learning Mindsets Among Low Socioeconomic Adolescents from Two Cultural Groups

BY JESS HENNESSEY

RESEARCH SNAPSHOT | SUMMER 2018

Scientists have long known that significant neurological development occurs during adolescence. But how might adolescents' mindsets about learning, their broader social-emotional experiences and cognitions, and their social-emotional brain development relate to one another? And how might these relationships be influenced by home and school contexts?

Mary Helen Immordino-Yang and Camille Farrington designed this study to leverage data collected from a longitudinal, cross-cultural project on the social-emotional brain development of adolescents from economically disadvantaged backgrounds. The researchers explored how students' neurobiological predispositions in social-emotional processing interact with their learning environments (i.e., community and family) and cultural influences to shape their social functioning over time.

STUDY DESIGN

This project builds on a larger study that Dr. Immordino-Yang began for her National Science Foundation CAREER Grant, which was awarded in 2012. Her research team recruited youth from economically disadvantaged backgrounds from two distinct cultural backgrounds to participate in the study in order to explore how family, community, and cultural influences may shape individuals' social and neurobiological functioning over time. The team collected extensive data on students' social and academic lives using psychosocial interviews, as well as standardized testing, with a focus on their experiences both in and out of school (see Table 1 for more information about the data collection timeline).

The study participants also underwent fMRI scans. Participants were interviewed about true stories that were designed to elicit strong emotional responses (e.g., the early story of activist Malala Yousafzai) outside of the fMRI scanner. They then saw these videos again during fMRI scanning and reported the strength of the emotions they were feeling. Participants rested while awake in the scanner while their neural dynamics were recorded. In the current project, students' learning mindsets were measured using the BEL Survey (see Table 1) and scores were correlated with neural and psychosocial development.

KEY FINDINGS

- Parental relationships and quality of emotional home life in adolescence were related to learning mindsets and academic behaviors in young adulthood
- Neural and psychosocial functioning in earlier adolescence were correlated with learning mindsets, skills, and motivation in young adulthood
- Youth who showed a more anxious neurological and psychological profile in early adolescence showed a greater fixed mindset about intelligence in young adulthood
- Neural and psychosocial processing of positive prosocial emotions measured in various ways (e.g., empathic perspective-taking, compassion for others' pain, admiration for virtue) were related to adaptive learning mindsets, behaviors, and strategies for achieving future goals in young adulthood
- Youth who made positive developmental gains in their ability to process social emotions during early adolescence reported more adaptive learning mindsets in young adulthood

RESEARCH TEAM

- Mary Helen Immordino-Yang (PI), University of Southern California
- [Camille Farrington](#), (Co-PI), University of Chicago Consortium on School Research
- Christina Krone, University of Southern California
- Xiaofei Yang, University of Southern California

Areas of Expertise: Neuroscience, Psychology, Education, Adolescent Development, Survey Design

The existing data (collected at Time 1 and Time 2) allowed the research team to explore how social and cultural factors shape the development of neural and psychosocial functioning, and the current project correlated these developmental relationships with self-reported mindsets reported at Time 3.

**MINDSET
SCHOLARS
NETWORK**

The Mindset Scholars Network is a group of leading social scientists dedicated to improving student outcomes and expanding educational opportunity by advancing our scientific understanding of students' mindsets about learning and school.

TABLE 1. DATA COLLECTION AND TIMELINE

Time	Participant Age	Data Collected
1	14-16 (mid- adolescence)	<ul style="list-style-type: none"> • Self-reported demographic variables • Social-emotional experiences, purpose, community violence exposure, cultural identity, strategies for achieving future goals gleaned from student interviews • Processing of social-emotional stories during interviews and during fMRI with psychophysiological recording • Parent beliefs about the adolescent gleaned from interviews with parents
2	16-18 (late adolescence)	<ul style="list-style-type: none"> • Time 1 measures re-collected • Executive functioning, IQ, interoceptive sensitivity
3	18-20 (early adulthood)	<ul style="list-style-type: none"> • Becoming Effective Learners (BEL) survey: self-reported learning mindsets and academic behaviors • Personal and professional life outcomes

Notes. Participant data were collected at three timepoints. Time 3 data were collected for the present study, while Time 1 and Time 2 data were collected for prior research conducted by Mary Helen Immordino-Yang and leveraged for the present study.

KEY FINDINGS

Parental relationships and quality of emotional home life in adolescence were related to learning mindsets and academic behaviors in young adulthood

Participants who reported warm and loving relationships with parents and less chaotic home lives were more likely to have higher levels of academic identity, grit, and self-regulation than their peers with weaker parental relationships and more chaotic home lives.

Neural and psychosocial functioning in earlier adolescence were correlated with learning mindsets, skills, and motivation in young adulthood

Students who reported a strong sense of purpose and adaptive strategies for achieving future goals during their second visit reported a stronger sense of belonging in school, less performance avoidance, higher motivation and lower fixed mindset (higher growth mindset) during their follow-up visit in young adulthood.

Youth who showed a more anxious neurological and psychological profile in early adolescence showed a greater fixed mindset about intelligence in young adulthood

Students who self-reported feeling anxiety at school, at home, or in the community, and who showed physiological profiles associated with reactivity and distress (Times 1 and 2) reported a weaker sense of belonging in school and had a more fixed mindset (versus growth mindset) about intelligence in young adulthood (Time 3).

Neural and psychosocial processing of positive, prosocial emotions measured in various ways (e.g., empathic

SAMPLE

- This project leveraged an existing diverse, longitudinal sample of 52 adolescents from economically disadvantaged backgrounds, including 28 East Asian American, 22 Latinx, and 2 Black participants.
- The existing longitudinal dataset included survey and interview data on demographic variables, social experiences and strategies for achieving future goals, parents' beliefs about the adolescent gleaned from interviews with parents (Time 1), and IQ (Time 2). Psychosocial and neuroimaging data were collected at two timepoints, with a 2-year interval: Time 1, age 14-16; Time 2, age 16-18.
- The current project built on the earlier research by collecting a third wave of psychosocial data, which included the [Becoming Effective Learners](#) (BEL) Survey: Time 3, age 18-20 (see Table 1).

perspective-taking, compassion for others' pain, admiration for virtue) were related to adaptive learning mindsets, behaviors, and strategies for achieving future goals in young adulthood

Emotions may be important for the development of learning mindsets, given that there are developmental shifts in the neural processing of social-emotional feelings across adolescence that are associated with subsequent reports of learning mindsets in young adulthood. Participants who showed development in the neural and psychosocial processing of emotional experiences to social stories later reported more adaptive learning mindsets, higher levels of school belonging, and lower levels of performance avoidance.

Youth who made positive developmental gains in their ability to process social emotions during early adolescence reported more adaptive learning mindsets in young adulthood

Young adults who reported more adaptive learning mindsets at Time 3 (age 18-20) had a more advantageous pattern of neural development related to processing social emotions: shifting from what appeared to be a more arousal-regulatory style of processing social emotions at Time 1 (age 14-16) to a more somatosensory / cognitive / salience-detection style at Time 2 (age 16-18). This finding suggests that a developmental trajectory of emotion processing across adolescence may support the development of adaptive learning mindsets.

INSIGHTS & FUTURE DIRECTIONS

Incorporating insights from neuroscience into the field of mindset science can allow us to answer questions that no other field has the tools to address. It allows us to probe with unprecedented depth the dynamic processing of social-emotional experiences and interpretations that could have implications for the development of learning mindsets. For example, how does the brain learn to process feelings of belonging after a sustained period of feeling belonging uncertainty? Or how does a person with a growth mindset versus a fixed mindset experience arousal as indicating a threat or a challenge?

This study begins to explore how the complex neurobiological and psychosocial processing of emotions may develop over time in ways that lead to the development of particular learning mindsets. Environments play a central role in shaping social feelings and their neurobiological processing in adolescence. Initial findings from the current study suggest that the neurobiological processing of emotions in adolescence could influence the development of learning mindsets in later development.

This research provides a first longitudinal look at the role of neurobiological emotion processing in mindset development. Further exploration could be especially important for designing and refining schools and classrooms that support beneficial patterns in young people's neural and psychosocial development, with implications for learning mindsets.

ABOUT THE MINDSETS & THE LEARNING ENVIRONMENT INITIATIVE

The Mindset Scholars Network launched a new interdisciplinary initiative in Fall 2016 to explore how learning environments shape the mindsets students develop about learning and school. The project's aim is to generate scientific evidence about how educators, school systems, and structures can convey messages to students that they belong and are valued at school, that their intellectual abilities can be developed, and that what they are doing in school matters.

Fourteen projects were awarded over two rounds of this initiative. Funding for the initiative was generously provided by the Bill & Melinda Gates Foundation, Joyce Foundation, Overdeck Family Foundation, and Raikes Foundation.