

Adolescents' Development of New Skills for Prospective Cognition: Learning to Anticipate, Plan, and Think Strategically

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Adolescence is an important age period for the development of prospective cognition. Teenagers become able to reason about the future, including anticipating events and formulating plans to reach goals. This article focuses on adolescents' development of skills for strategic thinking: for anticipating possible scenarios in a plan and formulating flexible plans that take these into account. We have studied teens' work on projects within youth programs (such as arts, leadership programs) because they provide real-world-like contexts for understanding development of these skills. Two case studies demonstrate the complexity of strategic skills and how they are learned. Effective strategic thinking requires learning to anticipate the particularities of the contexts and people involved in reaching a goal, for example, how to communicate effectively with a specific audience through a specific medium. It also requires learning general "meta" concepts and strategies that apply across situations, such as formulating plans that take uncertainties into account.

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To prepare for adulthood, adolescents need to develop advanced skills for conscious and deliberate prospective thinking. They need skills to set goals, formulate plans, and work over time to achieve the goals. Most importantly, they need to do this in ways that anticipate the open-ended and not-always-logical dynamics of real-world environments. These skills are required to get a job or start or change a career (Meijers, 1998), and more jobs now require achieving targets or goals in unstructured, open-ended situations (Levy & Murnane, 2004). Abilities to anticipate and navigate real-world complexity are also essential to addressing personal life problems and thus are related to adult mental health (Little, Snyder, & Wehmeyer, 2006). Moreover, society urgently needs a new generation with these prospective skills to address serious social, economic, and ecological problems.

1 The educational context we chose to understand how youth learn these skills are extra-
 2 curricular and community youth programs. More specifically, we focused on programs in
 3 which participants conduct projects (e.g., lobbying a school board; planning events; creating
 4 works of art, websites, and videos). Most school assignments are prestructured and do not
 5 require extended planning or navigating real-life complexity (with notable exceptions, e.g.,
 6 PE1 Zimmerman, in press). In civics classes, for example, students generally learn static declarative
 7 knowledge (i.e., “facts”) concerning how the government is supposed to work rather than
 8 the more complex conditional knowledge concerning how it actually works and how to make
 9 it work (Torney-Purta, Lehmann, Oswald, & Schultz, 2001). In contrast, youth programs present
 10 adolescents with open-ended, unstructured problems and require their learning to anticipate
 11 the challenges entailed in reaching the project goal (Halpern, 2009; Heath, 1998).
 12 Furthermore, youth programs are educational contexts in which teens are typically highly
 13 motivated and invested in these projects; program leaders have time to provide youth guidance
 14 and support as they encounter twists and turns in their work; and other features frequently
 15 are present that have demonstrated positive effects on learning (Eccles & Gootman,
 16 2002; Larson & Rusk, 2011; Shernoff, 2013).

17 In this article, we examine what the youth learn in these open-ended projects and how
 18 they learn. Our grounded theory research has led to the identification of a prospective skill
 19 set, *strategic thinking*, that the youth learn in this context. These skills entail those for planning,
 20 anticipating dynamic processes, and executing a strategic plan of action that is adapted to
 21 these processes (Heath, 1998; Larson & Angus, 2011a, 2011b; Larson & Hansen, 2005).

22 Our research also examines *how* the youth develop these strategic skills through their
 23 projects. Adolescents, our findings suggest, become able to learn from experiences in new
 24 ways, ways that entail active prospective and retrospective cognition. The youth are active
 25 producers of their learning processes. We think that better understanding these learning
 26 processes—as experienced and enacted by adolescents themselves—is important to training
 27 program leaders (and teachers in schools) to support project-based learning. In this article,
 28 we first review our findings on the skills the youth learn from projects and then employ two
 29 case examples to illustrate the dynamics of youth’s learning processes. We are only starting
 30 to understand the critical roles that effective leaders and educators play in supporting youth’s
 31 learning process, so that is not a main focus of this manuscript. But we conclude with preliminary
 32 observations about these roles.

33 Let us also note that, although we developed this grounded theory from the accounts of youth,
 34 we since found that research and theory on prospective cognition (Jordan, 2013; Kinsbourne &
 35 Jordan, 2009) is both compatible with and makes significant contributions to our work. Strategic
 36 thinking involves anticipatory entrainment, is embedded in social interactions (e.g., collaboration,
 37 intersubjective cognition, modeling), and is certainly supported by multiscale anticipatory
 38 neural dynamics. Despite the focus of our article on “conscious” learning, we recognize the
 39 ambiguities of that concept, and we recognize the vital role that nonconscious nested neural
 40 processes play in scaffolding what our participants experienced as conscious and deliberate.

42 ADOLESCENTS’ DEVELOPMENT OF NEW EXECUTIVE AND 43 STRATEGIC SKILLS

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45 In this first section, we describe the concept of strategic thinking, situating it in the science of
 46 adolescent development and presenting our core findings on what the skill set entails.
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The New Cognitive Potentials of Adolescence

Volumes of research have established that adolescents gain increased capacity to develop an array of powerful new executive tools—tools we believe contribute to strategic thinking. These include capacities for reasoning about abstract propositions, hypotheticals, probabilities, and multiple interacting systems—all of which can aid processes of anticipation and planning (Fischer & Bidell, 2006; Kuhn, 2009). In the last 20 years, brain science increasingly suggests that these abilities are related to the maturation of the prefrontal cortex as a command and control center, coupled with greater coordination, synchronization, and differentiation among different functional regions of the brain (Paus, 2009).

These developing executive skills contribute to adolescents becoming able to construct an expanded horizon of future time and events. Younger children have a constricted future horizon (Nurmi, 2004). They are less able to make reasoned conjectures about unfolding real-world events. Their planning typically employs simplistic magico-phenomenalistic thought about cause and effect: If A happens, then B will necessarily follow (Geldhof & Little, 2011). Teens' capacity to think systematically about the future and future events expands. They become better able to think about how complex events unfold over time (Fischer & Bidell, 2006). This includes reasoning about the past and future dynamics of human psychosocial systems (Habermas & Bluck, 2000); for example, they become better at “perspective taking”—making reasoned conjectures about what someone else is thinking and feeling—and what they would think or feel in response to a future action (Selman, 2003). Adolescents also become able to theorize about how people and human events can affect each other (Pasupathi & Weeks, 2011). As a whole, development of these abilities allows adolescents to actively project themselves into the future—to hypothesize, anticipate, strategize, and plan (Nurmi, 2004)—providing a basis for strategic thinking.

Development of these abilities, however, depends on experience. Research indicates that maturation of the brain provides neural infrastructure for development of these tools and skills. But as with any cognitive skill, strategic skills have to be adapted to context, practiced, and coordinated across domains and scales (Jordan, 2013; Paus, 2009).

The Demand Conditions of Projects

An important learning affordance of the projects in youth programs is that they demand reasoning about the future. Planning an event or making a film entails what Heath (1998) called “an arc of work.” The types of projects done in programs for high school-aged youth often involve an arc of weeks or months, thus helping stretch their horizon of active thinking. Projects also stretch the youth by bringing them into contact with complex real-world systems (including adult institutions, technical systems, and the demands of a given pursuit, e.g., theater or horticulture) and by requiring them to anticipate and strategize across these systems. In programs, the youth work on team or individual projects, holding responsibility for organizing their efforts over the arc toward the intended goal. This includes dealing with the challenges associated with their project (Halpern, 2009; Heath, 1998), including irregular dynamics, contradictions, and catch-22s (Larson & Hansen, 2005). The youth are engaged as active agents, developing strategies to navigate challenges on a distal scale of time and events.

The Strategic Skills That the Youth Report Learning

We have interviewed several hundred high school-aged youth over time as they worked on projects, with the goal of understanding their experience as their projects unfolded. The

1 youth were ethnically diverse (predominantly Latino, African American, and European
2 American) from low- to middle-income communities. They came from two dozen pro-
3 grams, urban and rural, including arts; science, technology, engineering, and mathematics
4 (STEM); leadership; and civic activism programs. We used grounded theory and related
5 qualitative techniques to understand their experiences, actions, and learning in context, in
6 their words.

7 Our first study with 700 interviews from 107 youth yielded this definition of strategic think-
8 ing: “use of advanced executive skills to anticipate possible scenarios in the steps to achiev-
9 ing goals and to formulate flexible courses of action that take these possibilities into account”
10 (Larson & Angus, 2011a, p. 290). The learning youth reported and included both knowledge
11 of how things work and strategies for influencing these things to reach their goals. Thus, for
12 example, the youth in two civic activism programs learned about how real-world institutions
13 worked and strategies for influencing those institutions (Larson & Angus, 2011a; Larson &
14 Hansen, 2005). The youth’s learning included not only knowledge and strategies for influ-
15 encing external real-world dynamics but also skills for working effectively in a team (Larson,
16 Jensen, Kang, Griffith, & Rompala, 2012; Perry, 2013) and managing motivation and emotions
17 (Larson & Brown, 2007; Rusk et al., 2013). Across these dimensions, the youth described learn-
18 ing to anticipate divergent scenarios, deal with obstacles and challenges, and formulate flexible
19 strategies to handle them.

20 A critical point that we shall return to in the case studies is that youth’s learning entails
21 “situated” knowledge and strategies. The learning is closely tied to the ongoing events and
22 activities in the context. Thus, the youth in an urban agriculture program reported learning
23 to make use of “every inch of dirt.” A young woman in a Chicago youth activism program
24 learned, “If you got an idea, you can talk to somebody else who might have connections
25 and then they, in turn, talk to somebody else. So it’s all about making connections.” The
26 members of a program leading a summer camp for 8–11-year-olds came to recognize that
27 getting the campers charged up was key to the success of their activities: “If one person is
28 excited, everyone else around would get excited, and they’ll wanna do something.” In many
29 programs, the youth developed skills to communicate strategically with people who are
30 targets of their work (e.g., the audience for a play, government officials whom they are lob-
31 PE2 bying). Situated knowledge, however, doesn’t necessarily transfer to other contexts (Pugh &
32 Bergin, 2005).

33 Yet the youth also reported learning more general and metaknowledge and transferring
34 it to other contexts such as schoolwork. For example, they describe learning as, “You have to
35 plan a thousand steps ahead,” “think it through,” and “strategize instead of going into things
36 head first.” A common theme is learning to anticipate the unexpected and adapt to it:

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- 38 • “Nothing turns up like you planned, but you just got to work around everything and
- 39 change little things.”
- 40 • “Compromise some things.”
- 41 • “Things can get out of hand and then you need to know how to deal with it.”
- 42 • “Always having a backup plan”
- 43

44 When we phoned the youth in our first study 2 years later, they described applying these
45 strategies to other arenas, including to planning their careers and navigating difficult situa-
46 tions in their jobs (Larson & Angus, 2011a).

A Closer Look at the Process of Doing a Project

But how do the youth learn these strategic skills? What is the process? To answer this question, we must examine youth's experiences in their projects over time.

Our research helped us appreciate the challenges adolescents face in completing a lengthy project. In the language of prospective cognition, youth's projects are on a scale of human action that is abstract and "very distal indeed" (Jordan, 2013). They present massive requirements for coordinated and sustained prospective action over time. Kinsbourne and Jordan (2009) point out: "Anticipation is a wager based on previous experience" (p. 103). The uncertainties at each step in a youth's project can be seen as a cumulative sequence of wagers.

Moreover, in most domains of action, teens are strategic novices; they are learning beginning skills. As a result, projects can careen in unexpected directions. The youth encounter roadblocks and difficult choices. Obstacles can also emerge within the dynamics and emotions of a collaborating team. Experienced program leaders play important roles structuring projects, monitoring youth's progress, and providing ongoing consulting and direction to youth's work, and these reduce uncertainties and support the youth through ups and downs (Denner, Meyer, & Bean, 2005; Kirshner, 2008). Yet even expert leaders can find themselves in difficult situations trying to balance supporting youth's agency while helping keep them on track (Larson & Walker, 2010).

We return to the role of adult leaders in the conclusion, but our focus here is apprehending the youth's active learning process. We think it is critical to first understand the different scenarios (including difficulties) that the youth encounter in their efforts to reach distal real-world goals—and to apprehend how the youth respond to these scenarios. Case studies are a valuable method for investigating these processes because they reveal the dynamics of youth's thoughts, actions, and learning through these encounters.

A GOOD PLAN THAT WENT AWRY

Our first case study illustrates the challenges entailed in developing and executing an effective strategic plan and provides insight into the ways in which the youth acquire situated and transferrable strategic thinking skills. Tina and Laurie (ages 17 and 15 years) were passionate about racial justice. They had grown up in a poor urban neighborhood in which they experienced racial profiling, de facto racism, and disproportionality in school disciplinary policies and practices. They decided to join a social justice program, ActNow,¹ which would help them challenge these structural barriers to their own growth and life opportunity. It also provided training and gave them experience working side-by-side with group members to learn skills for organizing and advocacy. They felt they could contribute to the struggle against inequality, including helping to bring more youth aboard.

After a year in ActNow, Tina and Laurie volunteered to lead the first of several 2-hr sessions for training 30 new recruits to the program. They had 2 months to prepare their training session. Compared to the youth doing projects in other programs we studied, this was an especially challenging strategic task, because they didn't know the recruits and wanted to teach them complex concepts.

Tina and Laurie worked hard to create a plan—a strategic mental model—for how they would use those 2 hr. From prior experiences, they knew it was critical to think through their session from the recruits' point of view—in terms of their motivation, emotions, and learning processes. The plan they developed started with an icebreaker, followed by a discussion

1 of the rules of group comportment they would need to learn to be effective organizers and
2 advocates. Then, Tina would engage the youth with issues relevant to them, such as the re-
3 cent discovery of toxic waste in their neighborhood and its links to high rates of cancer and a
4 police officer's killing of an unarmed African American teenager.

5 Tina and Laurie recognized that some of the concepts they wanted to teach would be difficult
6 for the trainees. For example, they wanted trainees to learn to identify and analyze "dispropor-
7 tionalities": instances in which members of a particular race or cultural group are overrepre-
8 sented or underrepresented relative to the general populations, for example, in how frequently
9 they are stopped by police or placed in special education classes. Tina and Laurie had many expe-
10 riences in school leading groups, and they were confident that they could explain these concepts.
11 In fact, Tina and Laurie were so calm and confident that when the adult leader of ActNow gave
12 them the opportunity to practice their session with current ActNow members, they declined.

13 On the day of the training, the icebreaker and first 30 min of their presentation went well.
14 But then, signs of restlessness began to appear among the trainees. Some asked their neigh-
15 bors for help with a concept; others chatted about unrelated topics. Several of the concepts
16 were hard for them to understand, and they were frustrated that Tina was talking *at* them,
17 without being aware of the difficulty they were having.

18 Tina experienced this chatter as rudeness—as a violation of the principles of comport-
19 ment she was trying to teach them. "You kids need to learn how to act," she told them. This
20 led to an uproar of audience grumbling. As it grew, Tina and Laurie became increasingly
21 exasperated. Their tone of voice became caustic, and they threatened to remove some trainees
22 from the room. Fortunately, lunchtime arrived, providing an opportunity for the program
23 leaders to help Tina and Laurie cool down, make adjustments, and get off on a new footing
24 with the recruits by starting the second half of the session with role plays.

25 On the whole, we should recognize that Tina and Laurie did a pretty good job of planning:
26 They had used perspective-taking skills and the role of social-emotional processes in learning
27 to think through the session from the recruits' frame of experience. But there are several ways
28 in which their action plan fell short. They underestimated how difficult it would be to convey
29 abstract ideas, such as disproportionality. They also overestimated the recruits' patience. Al-
30 though their plan included warming them up and capturing their attention with urgent social
31 injustices, they didn't realize how fragile that attention can be—how quickly people get antsy.

32 At its core, communicating ideas to an audience is really hard. Although their planning
33 was good, Tina and Laurie did not have the experiences they needed (and the memory prim-
34 ing it provides) to execute their plan in response to the ongoing situation. They had never con-
35 ducted a session on this topic or for this time length before. Their experiences as respected
36 leaders at their school may not have prepared them for presenting to a group of recruits who
37 they didn't know and who didn't know them. Furthermore, they appeared not to have antici-
38 pated how their own negative feelings could quickly trigger a reciprocal cycle of hostility.

39 A fundamental challenge for strategic learning is that *people often don't know what they*
40 *don't know*. Human reasoning—including forethought—is subject to blind spots, distortions,
41 and wishful thinking (Kahneman, 2011). In the real world, forecasts are almost always made
42 with incomplete information (Hermans, 2012). Planning and strategic thinking are based on
43 suppositions, estimates, and "wagers"—all of which can be wrong.

44 But these are skills that adolescents can learn. Tina and Laurie did much better in the
45 second half of their session. Furthermore, after watching Tina and Laurie's session, the Act-
46 Now members leading the subsequent sessions adjusted what they did: They reduced time
47

lecturing, moved to their interactive activities more quickly, and geared what they did to what they had learned about these recruits.

Our second two-part case study provides a more in-depth illustration of how the youth learn strategic skills. At ActNow, we did not have direct accounts of youth's experiences. This next example comes from research in which we interviewed the youth about their experiences, thoughts, and actions over the course of a project.

LEARNING FROM CHALLENGES

High Definition is a media arts program aimed at helping the youth develop career and college readiness skills. The 14 Latino members' main project for the spring semester entailed working in teams to create video documentaries on the theme of identity. The groups chose topics that they cared about—that they wanted to communicate to others. One group wanted to express concern about discrimination against undocumented youth; another wanted to examine "sneaker culture"; another wanted to share their passion for Chicago R&B music.

Making a video was a real-world work experience for the youth, complete with a tight deadline and a steady stream of challenges. They had to develop their theme, plan, shoot video clips, conduct interviews, produce and edit the video, add music, and finally, present the finished product in a showcase event attended by a local filmmaker and members of a local university's communications department. At each step, there were challenges and obstacles.

Managing Time

One frequent challenge was time management. Carisa and her two partners were working on a video that contrasted the identities of their working class Latino neighborhood with a hip neighborhood known for its gay nightlife. But they encountered a setback when they assembled their footage and saw that it did not flow well, requiring additional work. They became worried that they were moving too slowly:

We thought we should be putting the sound or the effects [into the video] right now. But then, we're like, "No, we don't want to move that fast because if we do it really fast, we're not going to catch our mistakes."

The adult program leader had told the youth about past project participants who had run into stumbling blocks and could not finish on time. Carisa's group recognized this as a problem they had with their schoolwork and were resolved not to let that happen to them with their video.

Carisa's group responded to this challenge by rethinking their plan and rescheduling their work to allow extra time for the steps that were most uncertain. But they also recognized that working too fast could have a down side. The group, Carisa said, had concluded

The main thing is just relax because if you get really nervous, everything is going to blank out and you're gonna go paranoid. You are going to try to do everything at once; it's going to turn out bad.

This statement demonstrates a sophisticated forecast of how future unplanned events in their work could create an abstract mental state—anxiety—that might trigger processes that would further disrupt the timing of their work. One domino could lead to another.

1 Carisa’s group’s reorganization of their timeline was based on prospective anticipation of
 2 possible scenarios in their work. Rather than magically thinking that their plan will go exactly
 3 as expected, they built in room for Murphy’s law (“If anything can go wrong, it will.”).

4 When the video was completed, Carisa concluded that the wisdom of their time manage-
 5 ment strategy had been proven: “Me and Valeria talk about it, like ‘Imagine if we would have
 6 left it to the last day or last week or something, we would have never done it. It wouldn’t have
 7 come out as good.” This reflects a frequent pattern we observed in how young people learn
 8 from projects (Larson, 2011). Learning starts with up-front strategic thinking in which the
 9 youth anticipate scenarios. Then, this up-front thinking is verified (or modified) by the out-
 10 comes of their work. The learning process is not just “trial and error”; it is reasoned strategic
 11 forecasting which is then informed by outcomes.

13 *Communicating With an Audience*

14
 15 Xavier, a youth in the group working on Chicago R&B music, was challenged by how to
 16 organize their video footage in a way that would really have impact: “Some people think
 17 AQ3 music is not really a big part of anything and is not really important. But we just want to show
 18 that for some people, it *is* really important and that’s why we have the type of music that we
 19 have today.” They decided to profile the career of a young solo artist and wanted their view-
 20 ers to be able to identify with him and feel drawn into his world. Like Tina and Laurie, they
 21 focused on finding a way to connect the audience to the emotions and meaning of their topic.
 22 Unlike Tina and Laurie, they had opportunities to evaluate early versions of their video and
 23 make adjustments. These allowed them to learn through multiple iterative steps.

24 The group brainstormed and “juggled things around,” playing with different ideas. At first,
 25 they decided to start the video with the sound of a gunshot to get the audience’s attention. How-
 26 ever, Mr. Hawkins, a film expert advising the youth, suggested that this could be experienced as
 27 a cliché and might not help draw viewers into the content. As Xavier explained, Mr. Hawkins
 28 “liked the idea, but showed us how to refine it and make it more towards what we wanted to say.”

29 With this help, Xavier and his partner began to develop a strategy for gradually building
 30 the audience’s emotional connection to the vocalist. They decided to give a lot of emphasis to
 31 shots of their subject in action. “Instead of [showing footage of the singer] saying something
 32 straight forward like ‘I like making music because it makes me happy,’ you can show *how* it
 33 makes him happy.” They looked for footage that conveyed his joy in making music.

34 As they worked further, they not only began to cue into what types of footage communi-
 35 cated this enjoyment but also developed a plan for interweaving that footage with their inter-
 36 view with the artist. Xavier said they chose shots where

37
 38 You can see how *emotional* he gets while he’s doing it, like he’s making all these hand
 39 gestures and he’s moving around. You can tell that it’s a really big part of him and
 40 that’s what he *loves* doing. And then, it [the video] would maybe go back into the inter-
 41 view. And then, you could tell he was serious about it.

42
 43 Notice how this entire passage is positioned from the vantage point of the viewer (“you”).
 44 He is using perspective-taking skills to imagine the audiences’ thoughts and feelings. Their
 45 strategy became juxtaposing evocative shots of the artist in action and shots of the artist talk-
 46 ing about his identity—why he does what he does and what his music means to him.
 47

To recap, Xavier's group's strategy advanced from (a) starting with a bang, (b) to focusing on emotion, and (c) to skillfully building a set of experiences for the audience that weave together emotionally evocative clips of the artist's impassioned performances and clips of him talking seriously about the meaning of his music. After grasping that there was no shortcut to engaging the audience (no magic bullet), they developed strategies for telling a story built with abstract visual/auditory cues layered with the artist's own words. "We learned how to say things without actually saying it," Xavier reported. Rather than tell a concrete story, he said their story was organized by what he called the "meaning under it."

As with Carisa's group, we can see how these youth's learning was driven by their engagement with the challenges of their work (Larson, 2011b). Xavier's group had the chance to learn from several short recursive cycles of anticipating, planning, and adjusting plans. At the end of the program, members of High Definition reported learning from the long cycle concluding with the showing of the video. Across these experiences, they extracted a wide range of context-specific and more general metalevel strategic concepts, including concepts for organizing their work in a project and concepts for thinking systematically about an audience, forecasting their responses, and shaping a product based on this forecasting.

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HOW THE YOUTH LEARN PROSPECTIVE STRATEGIC SKILLS AND HOW THIS LEARNING CAN BE SUPPORTED

Adolescents need to prepare themselves to live—and act—in a world that is incredibly complex. In an essay on human agency, Bandura (2006) argues that conscious and deliberate prospective cognition is central to humans' ability to navigate this complexity: "Humans can create visualized futures that act on the present; construct, evaluate, and modify alternative courses of action to secure valued outcomes; and override environmental influences" (p. 164). This research suggests how young people can develop abilities for this prospective thinking.

The Youth's Process of Learning

Both supporters and detractors of project-based learning have described youth's experience with projects as a journey or adventure. The youth set off with a sometimes vague goal into the unknown—into a distal future horizon of hypothetical pathways with uncertain probabilities of success. The youth typically conduct projects with limited experience and abilities for forecasting all the challenges and hazards that may lie ahead. Even experienced youth, such as Tina and Laurie, can find that a well-prepared plan does not work out as expected.

However, when high school-aged youth in community or after-school programs engage in projects, powerful learning processes occur. The youth become engaged and invested in their goals. As a result, they think about their work at deeper levels, including thinking about the processes entailed in achieving their goals (e.g., how to work around or address thorny real-world obstacles or manage emotions that arise in the work). Often, the youth work in teams. This allows them to analyze, formulate plans, anticipate contingencies, and learn *collaboratively*, which can substantially increase their learning (Larson et al., 2012; Perry, 2013).

Our research suggests youth's learning process often stems from the challenges they face in their projects. Some of their learning occurs up-front—prospectively—when they encounter or begin to anticipate a challenge. The youth learn from analyzing problems, reasoning conjectures about the dynamics of a situation, and thinking through possible strategies (Larson, 2011; Ozer & Wright, 2012). We saw this in how Carisa and her collaborators actively

1 analyzed the outcomes of possible pathways (e.g., waiting until the last minute, sticking to
2 their initial schedule) and then formulated an effective strategy based on this analysis.

3 This prospective learning is then informed and modified through youth's experience of
4 the outcomes. They analyze how decisions they made worked, how events affected outcomes,
5 and how outcomes differed across different situations (Larson, 2011; Perry, 2013). This retro-
6 spective analysis confirmed the wisdom of Carisa's team's decision to redo their plan to allow
7 for the unexpected. Xavier's group assessed strategies for capturing their audience's attention
8 after three cycles in their work, and this process allowed them to progress from the simple
9 idea of a gunshot to a more sophisticated strategy. The youth are regularly looking backward
10 and forward to sculpt memory-primed strategies fitted to the challenges they face ahead.

11 We think youth's ability to learn through these processes is enhanced by their expanding
12 executive capabilities (e.g., for hypothetical and analytical reasoning). We have found that
13 older youth in our samples (aged 18–19 years) are able to conceptualize more complex multi-
14 scale processes than our youngest youth (aged 11–14 years). Of course, learning from experi-
15 ence is subject to the biases and distortions of human thought processes (e.g., Kahneman,
16 2011). We have no illusion that the human brain is fully rational. But youth's learning often
17 benefits from multiple cycles and program advisors' input, recursive information from col-
18 laborators, and observation of others (Larson & Angus, 2011a; Perry, 2013).

20 *Leaders' Contributions*

21
22 What is the role of leaders and educators in supporting youth's "journeys" into the
23 unknown—in helping projects move forward and helping them learn to plan and anticipate?
24 Our research and others' begin to identify numerous important roles played by experienced
25 leaders:

- 26
- 27 • In many programs, leaders provide initial training in the basic skills the youth will
28 need for their projects (e.g., Denner et al., 2005; Kirshner, 2008). This helps the youth
29 develop concepts, vocabulary, and mental models (Barron, et al., 1998).
- 30 • Leaders create structures for youth's projects (e.g., deadlines, expected product) that
31 allow the youth manageable degrees of freedom and reduce possibility of failure. The
32 amount of leader prestructuring often varies, for example, by youth's abilities and the
33 number of the youth a leader must manage (Larson, Walker, & Pearce, 2005).
- 34 • Leaders structure regular opportunities for the youth to receive feedback on their work,
35 including process and product feedback (Barron, et al., 1998).
- 36 • Leaders serve as role models of strategic thinking (Halpern, 2009), in some programs
37 working side-by-side with the youth as coparticipants (Heath, 1998).
- 38 AQ5 • Leaders support the youth's experience of agency and ownership by giving them space
39 to make mistakes and learn from them (Larson & Angus, 2011b).
- 40 • Yet leaders also provide judicious input to help keep the youth on track and to ulti-
41 mately succeed in their work; advice is often provided in the form of questions that
42 AQ5 prompt thought (Heath, 1998).
- 43 • Experienced leaders help the youth interpret past events and anticipate future uncer-
44 tainties (Priest & Gass, 1997). They facilitate youth's looking backward and forward to
45 synthesize prior experiences and better strategize, including for their lives beyond the
46 program.
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The biggest questions, we think, concern *when and how* effective leaders take each of these roles (Kaplan, Katz, & Flum, 2012). The answers are likely to be contingent on the situation, the youth, and the leaders' style and philosophy. Our current research is aimed at better understanding the situational guidelines experienced leaders follow in playing these roles and how they adapt them to youth's active learning processes. It is important for researchers, practitioners, youth organizations—and ultimately schools—to work together to better support adolescents' development of these critical skills for conscious and deliberate prospective thought and action.

NOTE

1. Names of programs and people are pseudonyms. Data for this case study came from a researcher observing the setting.

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