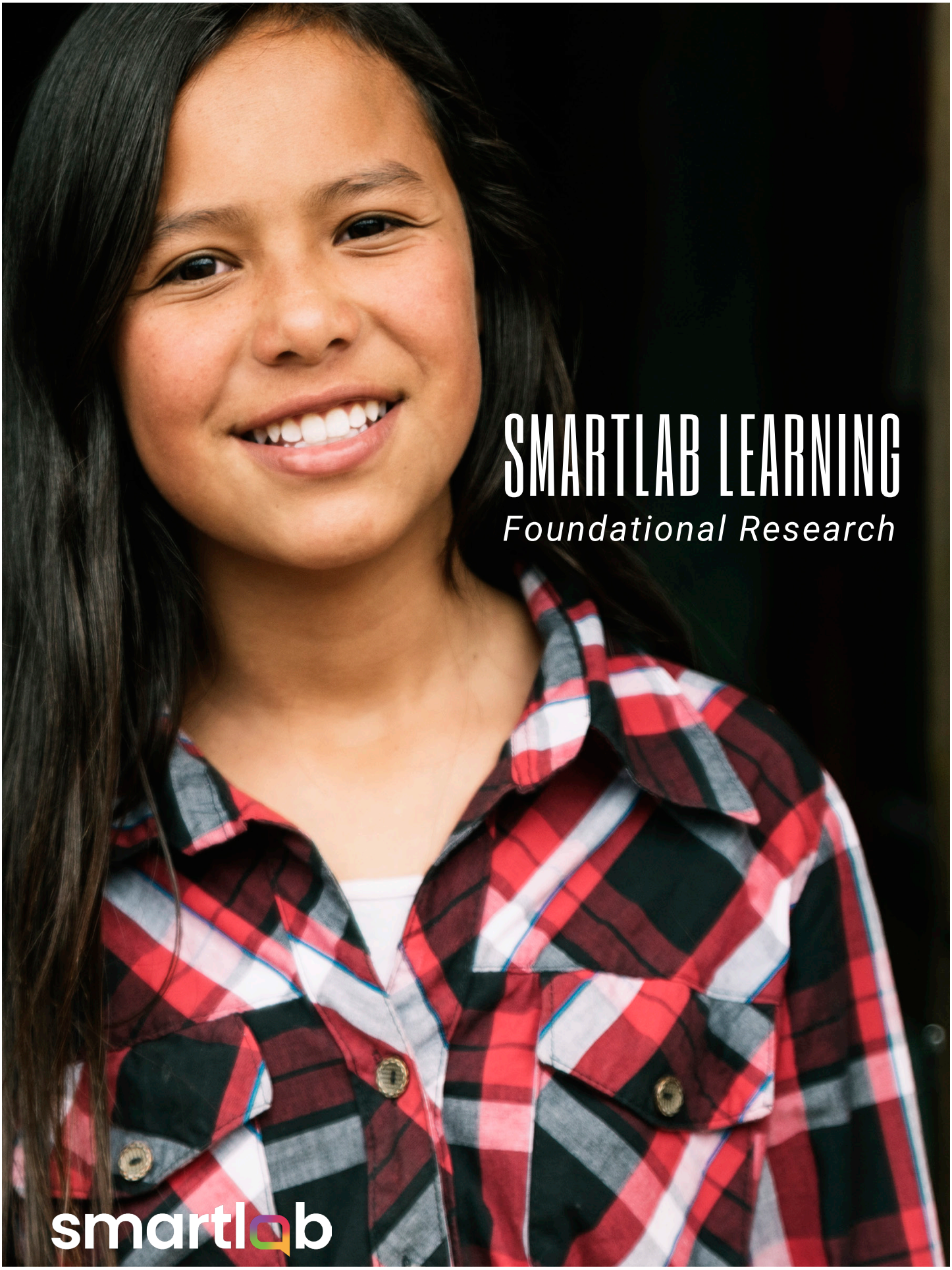
SMARTLAB LEARNING
Foundational Research
smartlab

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ABSTRACT

SmartLab Learning by Creative Learning Systems, is a student-led, learning solution that engages and empowers students by combining technology-rich learning experiences with the theory of constructivism.

Constructivism is built on the idea that knowledge is not fixed and cannot exist independently outside of the learner, but that learning is a process of adapting to new experiences or stimuli (Jenlick & Kinnucan-Welsch, 1999, Cornu, 2005).

Adapting to our surroundings is what causes us to learn (Piaget, 1954) and SmartLab Learning provides a framework to channel those experiences to meet academic objectives.

In addition to supporting academic objectives, SmartLab Learning provides a foundation for all students to gain essential generational skills. These are not necessarily new skills; however, they are the skills learners must have for future success.

Through our standards-aligned supplemental curriculum, SmartLab Learning is a research-based learning solution that helps meet academic objectives while also engaging and empowering learners through personalized, experiential, and collaborative learning. This process both inspires students' curiosity and builds their capacity.

INTRODUCTION TO SMARTLAB LEARNING

With each generation, learners need to gain unique skills and knowledge to help them succeed. The need for generational skills first became relevant in the 19th century as the industrial era gave way to a knowledge economy (Svarc, 2017). In 1892, the noted psychologist William James gave several lectures advocating for educators to incorporate students' interests into their education. Meanwhile, other educators were actively building a modern education system:

> "Our schools are, in a sense, factories, in which the raw products (children) are to be shaped and fashioned into products to meet the various demands of life. The specifications for manufacturing come from the demands of 20th century civilization, and it is the business of the school to build its pupils according to the specifications laid down." *—Ellwood Cubberly, Dean of Education, Stanford University*

This factory-based model of education, however, had limitations and philosophers like Piaget, Erickson, Montessori, Dewey, and Vygotsky aimed to create an education system based on knowledge and applying that knowledge. This transition required that educators develop new skills to teach students to innovate and adapt to a rapidly changing understanding of the world. Educators were encouraged to incorporate personalized learning experiences and to take a holistic approach to skills-based education. Thus, the theory of constructivism was born.

Constructivism is a pedagogical approach where learners create meaning as they experience the world and reflect on those experiences to gain understanding (Piaget, 1954). When students follow their curiosity, they engage in the world around them and become more active citizens and connect with their peers and community more deeply (Garrison, Anderson, & Archer, 2010). The foundational research on constructivism is tied directly to observing and engaging students in subjects that they are interested in—exactly what James was advocating for in 1892.

SmartLab Learning by Creative Learning Systems began in 1987 as a program to apply the theory of constructivism to a technology-rich learning space—a SmartLab. Since then, our solution has grown, and we have successfully helped hundreds of thousands of students gain those essential generational skills to succeed. We do this by providing:

- An action-driven, repeatable process that empowers students to make decisions and solve problems;
- A technology-rich space where learners follow their curiosity, use age-appropriate tools to solve real-world problems, and collaborate with peers;
- Rich, opened ended, personalized curriculum that is aligned with math and science standards; and
- Robust professional development that trains educators to become facilitators.

COLLABORATIVE, EXPERIENCE-BASED LEARNING.

In a constructivist setting, learning activities include collaborating, cooperating, seeking multiple perspectives, sharing real-world examples, scaffolding, self-reflecting, and social negotiating (Greywind, 2020).

We build those components into every learning experience. Our Student Learning Process, which empowers students to solve problems and make decisions, is an action-driven cycle: explore, plan, do and reflect, and share.

This repeatable process builds on the students' prior knowledge while supporting them to take the next step and act on the knowledge that they've acquired. This constructivist approach allows them to grow their capacity and construct their own meaning.

More broadly, our program focuses on the "design of activities, learning assessment, and instructor's roles regarding learning activities" (Greywind, 2020). To support this effort, we follow the five key elements of constructivist design (Driscoll, 2005):

1. Facilitators have a deep conceptual knowledge of constructivism theory.
2. Learning comes from the learner and cannot be fully scripted by the educator.

3. Schools must create effective environments that reinforce student-led learning.
4. Students' prior knowledge and beliefs are key and must be integrated into each lesson and unit.
5. Self-reflection on one's learning is essential, and students must be given ample time to reflect.

In addition to these elements, the instructor becomes a coach, guide, and mentor who acknowledges, assesses, and provides feedback to student learning (Koo-hang, et.al, 2009, Greywind, 2020). This facilitation, coupled with student observation, is a cornerstone of SmartLab Learning. Our professional development program is designed to support educators as they transition from instructor to facilitator, and our master trainers have first-hand experience during their time working in their own SmartLabs.

While effective facilitation is a key component of our approach to constructivism, our focus is to ensure that students have age-appropriate pre- and professional tools and resources they need to create and execute projects successfully. SmartLab Learning builds on the constructivist principle that students actively construct or make their own knowledge, and that their reality is determined by their experiences.

MEETING GENERATIONAL NEEDS

"It seems that today's teachers have an almost impossible task—to prepare students to become contributing citizens in a world that does not yet exist and cannot yet be clearly defined" (Greywind, 2020). With technology evolving so quickly, educators continue to shoulder the burden of teaching students to exist in a world that can scarcely be imagined. The future is unclear; however, what is clear is that every generation needs certain skills to be successful.

At the end of the 20th century, educators focused on providing students with the skills they needed for the new century. Today, progressive education institutions are guiding educators as to how they can best address generational skills.

In 2008, the International Society for Technology in Education (ISTE) released the ISTE National Educational Technology Standards (NETS) to define 21st century skills and the most widely utilized technology standards. In 2016, the standards were updated to include:

- Digital citizenship
- Knowledge construction
- Innovative designer
- Computational thinker
- Creative communicator
- Global collaborator
- Empowered learner

These standards go beyond the 21st Century Skills initially developed by The Partnership for 21st Century Schools (P21, 2004). Instead, "the ISTE standards serve as a framework for students, educators, administrators, and coaches to rethink education and create innovative learning environments" (Robacker, 2019).

To support these generational skills, technology has become an essential tool for schools in the 21st century. "We now live in a world where you can't understand science without technology, which couches most of its research and develop-

ment in engineering, which you can't create without an understanding of the arts and mathematics" (Jenlick & Kinnucan-Welsch, 1999).

Technology-rich classrooms, like the SmartLab HQ, differ from traditional ones in many ways. In a technology-rich environment, social interactions among students and between students and teachers are more fluid. Learning is seen as a more natural process and students make deeper connections when using technology (Hannafin, 1997).

Additionally, since learning is an active process and requires motivation to both begin and continue the process (OECD, 2000), technology often provides a pathway to engage and motivate students.

SmartLab Learning integrates both the physical space and cutting-edge technology to create a hands-on, minds-on learning experience. Additionally, our online learning platform provides open-ended, standards-aligned content, and authentic evidence of learning.

GUIDING PRINCIPLES

It is critical to use the most effective models of teaching to educate students and help them learn how to learn (Greywind, 2020). We do this every day by developing student-led, project-based learning experiences that allow learners to engage in projects that are relevant to them. When designing our learning solutions, we use five guiding principles to inform every decision.

ENGAGED LEARNERS

Teacher and student engagement can drastically impact the education landscape. Engaged teachers have more engaged learners (Fullan, 2013), and engaged learners have fewer truancy issues and higher graduation rates (Trowler, 2010).

John Dewey posited that curriculum should be relevant to students' interests, communities, and lives, which simply reinforced James' theory that a learner's interest can transform their education. Dewey also encouraged that topics be integrated rather than taught separately because life is not discretely separated into functional domains (Dewey, 1923). By integrating the subjects, students can make connections between pieces of information, and through those connections, learners construct knowledge (Miller, 1999).

Each student constructs meaning through their own interests, which result in increased engagement across the curriculum (James, 1892). With SmartLab Learning, every solution begins with student engagement because by engaging students through interesting and engaging activities, their interests transfer to the content they are studying (James, 1892).

To ensure a high level of engagement, we:

- Curate learning kits by evaluating potential tools and selecting those that drive maximum student engagement and durability for long-term use.
- Design educational environments that provide students with resources and materials appropriate for their abilities.

- Write open-ended curriculum to engage students at a variety of grade levels and allow them to integrate their own ideas and creativity.
- Leverage project-based learning to allow students to lead their own learning.
- Encourage self-reflection that informs and enriches the learner's next activity, their ability to establish their own learning goals, while increasing metacognitive awareness (Desautel, 2009).

EMPOWERED LEARNERS

Erik Erikson identified age-based developmental learning stages; however, cautioned educators that they should not expect children to perform the same skills at the same time, rather distinguished a range of development that children experience in their own time (Erickson, 1966). By empowering learners to move at their own pace rather than following grade level designations, students can interact with our content at appropriate levels, and students are empowered to progress through the curriculum at their own pace.

Additionally, with SmartLab Learning, students are empowered to approach challenges with creativity. To support this, we develop open-ended activities that allow students to integrate their prior knowledge with new findings so they can develop creative solutions to real-world problems (Fasko, 2010). As students complete projects, they learn how to persist, apply past knowledge to new situations, and reflect on their thinking. All of this helps learners develop the confidence needed to live in a rapidly evolving world (Kassean, Hemant, et. al, 2015).

To empower learners, we:

- Give them access to all of the curriculum for their age range so they can experiment and select the activities that most interest them, complement their skills, and allow them to progress at their own pace.
- Train educators to "support students to be metacognitive, to get to know themselves as learners. The students, it is hoped, come to know what thinking is, what learning is, and about the different processes involved in learning" (Marshall, 2007).
- Allow them to own their learning because when students become self-directed, they are more readily able to apply creativity and problem solving in their careers (Feehan, 1999).

- Provide appropriate tools that they learn how to choose and use effectively to accomplish a task (NETS, 2018).
- Present them with our Student Learning Process that teaches them to solve problems and make decisions, which will help them navigate life (NETS, 2018).

EXPERIENTIAL LEARNING

Jean Piaget, famed for stating that cognitive construction is better than instruction, claimed that "children construct their knowledge by giving meaning to the people, places and things in their world. By this he meant that children learn best when they are actually doing the work themselves and creating their own understanding of what is going on instead of being told by adults" (Forman, 1977). This freedom allows children to experiment with materials and experience the world around them.

Constructivism states that learners create meaning as they experience the world and reflect on those experiences. When students follow their curiosity, they engage in the world around them and become more active citizens and connect with their peers and community more deeply (Dewey, 1923). By leveraging a learner's curiosity, we evoke deeper connections and an increased investment in learning.

Through experiential learning, students connect core academic subjects to real-world problems so they can use their current knowledge to impact tomorrow's actions. This type of inquiry-based learning and assessment is essential in constructivism theories where students will "learn or are better able to understand a concept, if they themselves have a hand in constructing it" (Greywind, 2020).

To ensure students are immersed in experiential learning, we:

- Develop open-ended, standards-aligned curriculum that provides opportunities for students to showcase authentic evidence of learning.
- Train educators to encourage learners to follow their curiosity, to ask, "why am I doing what I am doing in the classroom," and to take risks and act (Marshall, 2007).
- Curate and supply each solution with hundreds of age-appropriate pre- and professional tools designed for maximum, hands-on engagement.

PERSONALIZED LEARNING

In addition to developing the well-known learning system that teaches children practical life skills in a flexible learning environment, Maria Montessori's hallmark philosophy was to observe her learners then provide them with personalized learning experiences that met the needs and abilities of each learner.

While SmartLab Learning supplements core academic subjects, our process—along with constructivism in general—focuses first on the learner (Gold, 2001) and is centered on the skills they acquire while completing an activity (Greywind, 2020).

Through this method of personalized learning, students are able to use their prior learning and background knowledge as a foundation for new experiences and constructing new meaning (Piaget, 1954). Whereas all students reach developmental milestones at different times and have unique learning styles, needs, and preferences (Erikson 1958, 1963), we integrate the whole student into the learning process. The student brings their environment and their upbringing (Brown, 1996) and they also bring their interests (James, 1892). SmartLab Learning integrates engaging technology with the environment and context of the world around the student, enabling them to engage more richly in the learning and content.

To support personalized learning, we:

- Train facilitators to leverage their students' interests to increase their investment and engagement in their learning (James, 1892).
- Provide students with a range of resources and scaffold them so learners and facilitators can collaborate, and the students can complete projects based on their abilities. (Berk, 1995)
- Ensure learners have voice and choice by providing numerous open-ended engagements so they can choose which one they want to pursue. Through this process, students have a voice in their learning, thereby buying into their learning and increasing their academic achievement (McCombs, 2007).
- Coach facilitators to encourage and celebrate when students bring their whole selves to school (Kessler, 2000).

COLLABORATIVE LEARNING

Constructivism posits that learning should come from social interactions (Hodson, 1998) and that active learners are responsible for their own learning. “Learners, therefore, are not empty vessels to be filled, but rather active organisms seeking meaning” (Driscoll, 2005).

Furthermore, Lev Vygotsky stated that children “appropriate knowledge from external stimuli as much as internal” (Fernandez, 2015). This, he posited, made collaboration an effective means of interacting with the external world and for sharing internal thoughts and analysis.

Through collaborative work, learners use critical thinking to make sense of facts, develop communication skills as they describe their learning, and creatively solve problems (Magana, 2017). Through those interactions they begin to understand the world around them and make sense of their place in society (Prawat, 1999).

To infuse collaborative learning into every experience, we:

- Design learning spaces and experiences where students work in pairs. By working together, it ignites increased innovation, more meaningful connections, and longer lasting learning (Jeong, 1997).
- Ask learners to share their learning with their peers, which makes their learning more concrete. By doing this, learners become aware of the impact they can (and do) have on the world around them (Wentzel, 1997).
- Ask partners to work together to solve real-world problems. Through this process, learners gain the ability to communicate effectively, value the perspective of others, and collaborate—all essential to success in future careers and to maintain healthy relationships (Morel, 2014).
- Train educators to become facilitators and to act together as partners in learning. As facilitators, they allow students time for reflection, encourage effort and collaboration, monitor student performance, and motivate their students (Greywind, 2020).

CONCLUSION

By providing learners with hands-on, collaborative experiences, students are better able to understand and learn complex concepts because they have had a hand in constructing them (Greywind, 2020).

Through the Student Learning Process, educators are able to leverage their learners' curiosity to evoke deeper connections and to make an increased investment in their own learning. This iterative process teaches students that problems can be solved through a series of actions.

This results in learners who are able to persist, apply past knowledge to new situations, consider their own learning, and become self-directed learners who can manage themselves in a variety of situations.

Finally, SmartLab Learning provides educators and students with learning solutions that support both academic objectives and generational skills. These experiences are enhanced by ensuring learners are engaged and empowered through experiential, personalized, and collaborative learning.

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