Equity in Learning with BrainPOP®:

Fostering Access and Impact for All

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Executive Summary

Educators are charged with developing learning experiences that address the needs of all students. This includes identifying appropriate content, designing flexible learning pathways, and creating classroom environments that consider learner variability. Ensuring meaningful and equitable access for a diversity of learners can be complex and labor intensive.

The goal of many online educational platforms is to support teachers with developing learning experiences that meet the varying needs of their students. Platforms designed based on learning science research provide teachers with resources to develop meaningful and engaging experiences for all students. However, many online educational platforms address only some components necessary for equitable instruction, creating more work as teachers have to piece together additional resources to support all learners.

A promising solution to this challenge resides at the intersection of multiple equity-driven, research-based pedagogical frameworks, including Universal Design for Learning ("UDL"), Differentiated Instruction ("DI"), and CASEL's Social and Emotional Learning("SEL").

Section 1

Working in Unison to Create "Access for All": The Intersection of UDL, DI, and SEL Frameworks

This section details substantive alignments and linkages across three equity-driven, research-based pedagogical frameworks to offer an alternative cross-disciplinary frame, known as "Access for All" ("AfA").

Section 2

Empower Teachers with Instructional Equity: AfA and BrainPOP

BrainPOP content, tools, and educator support resources are guided by learning science research on how to effectively meet the needs of a diversity of learners. This section explains that while integrating the principles of AfA into a product is essential, there is more to ensuring equitable access to *meaningful learning*. Online learning platform design must also center learning science research on cognitive and affective learning outcomes, like the development of transferable thinking skills.

Section 3

Impact for All: Evidence of Learning with BrainPOP

This section describes how BrainPOP is *also* designed to support the development of a broad range of transferable skills including critical, creative, and computational thinking.

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Introduction

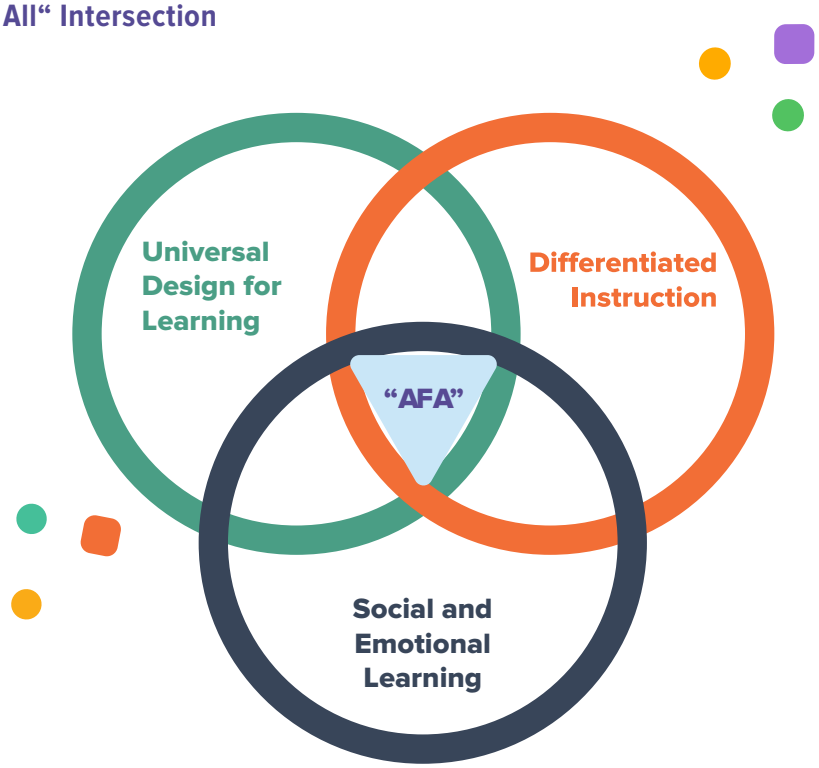
Learning is an active process. We build knowledge by exploring the world around us—observing and interacting with phenomena, conversing and engaging with others, and making connections between new ideas and prior understandings. Yet, students enter our classrooms not only with different skills, knowledge, and abilities, but also with social and emotional experiences that influence what they value, how they perceive themselves and others, and how they will engage in the learning process. (Ambrose, et al., 2010).

Learner diversity, or "learner variability" as termed in learning science research (Meyer, Rose & Gordon, 2014), is the recognition that all students navigate their learning process differently. Educators are charged with designing learning pathways and classroom environments that tend to learner variability (Rose, 2016) while targeting the unique needs of some learners, such as students with disabilities ("SWDs") or English-language learners ("ELLs"). Designing meaningful and equitable access for a diversity of learners can be complex and labor-intensive resulting in teachers spending hours each day evaluating, aligning, and adapting materials and instruction.

Online educational platforms aim to support teachers in providing equitable learning opportunities. Yet, many online educational platforms—even ones driven by learning science research—only address some components necessary for equitable instruction, requiring teachers to piece together additional resources to support all learners. In addition to having to find and evaluate the quality of an online educational platform, teachers must also puzzle through how to leverage it to create learning experiences that are accessible to all students.

A promising solution resides at the intersection of several equity-driven, research-based instructional frameworks: Universal Design for Learning ("UDL"), Differentiated Instruction ("DI"), and CASEL's Framework Social and Emotional Learning ("SEL") in combination with essential practices for supporting SWDs and ELLs as illustrated in Figure 1: "Access for All" Intersection. The substantive alignments and linkages across these frameworks offer an alternative cross-disciplinary frame for creating accessible instruction, hereinafter termed "AfA").

Figure 1: "Access for All" Intersection



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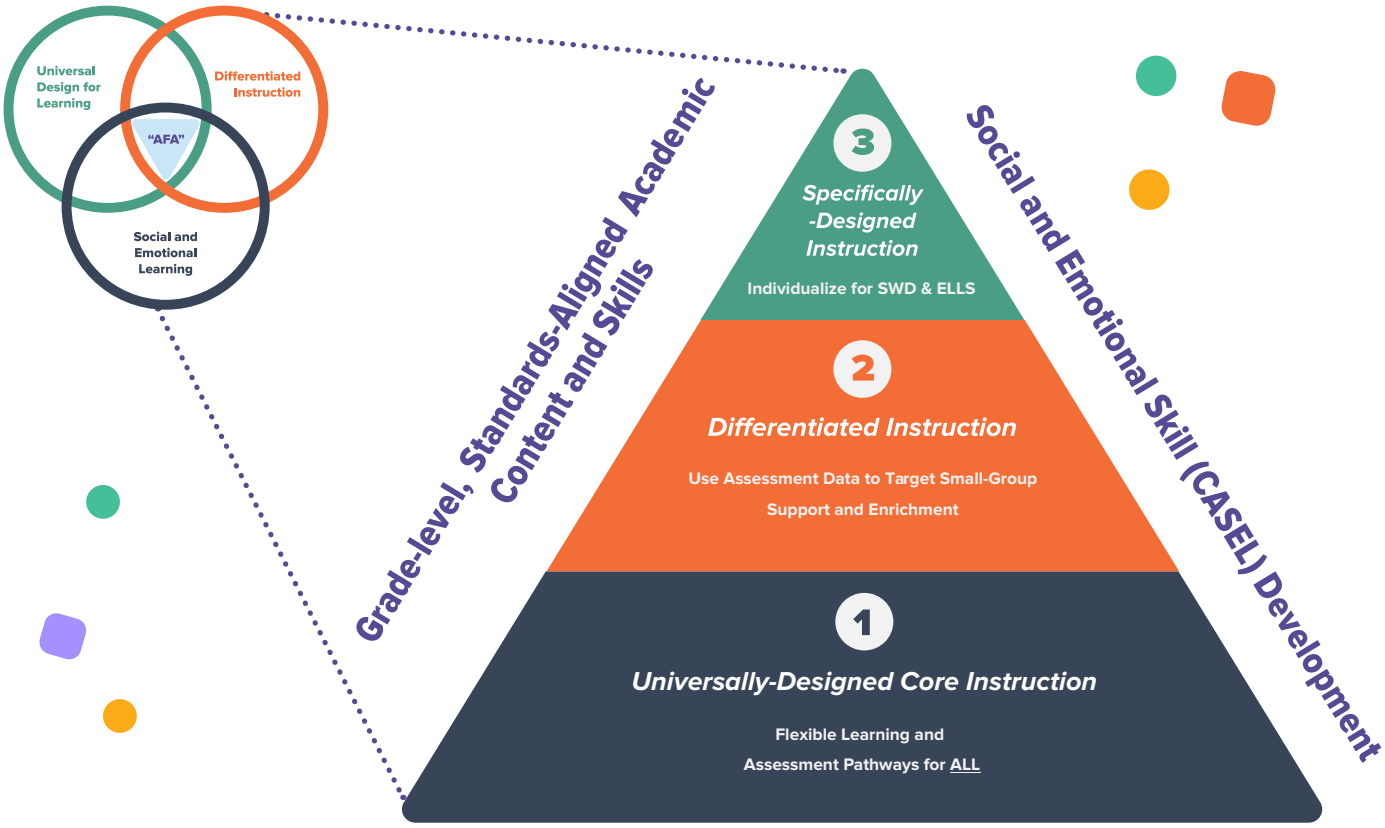
Envisioning the intersection of the three research-based, equity-driven instructional frameworks in action is complex. An adapted Multi-tiered System of Support ("MTSS") model helps illustrate how AfA can support instructional access for a diversity of learners.

The MTSS model focuses on the "whole child," supporting both academic achievement and social and emotional needs with increasing levels of support at each tier of instruction. (McIntosh & Goodman, 2016). More simply, this model focuses on the entirety of instruction instead of its disparate parts. Figure 2 below expands the AfA intersection (Figure 1) to illustrate *how* UDL, DI, and SEL work together, within an adapted MTSS model, to support instructional access for all learners. Grade-level, standards-aligned academic content and SEL development goals guide the content within each tier. Figure 2 also acknowledges that some students are guaranteed individualized or "Specifically-Designed Instruction" (detailed further in Section 1) and is, therefore, an essential component of supporting *all* learners.

Figure 2: AfA Expanded within MTSS model



*Google search conducted on October 15, 2018 https://www.google.com/search?rlz=1C2AZAA_

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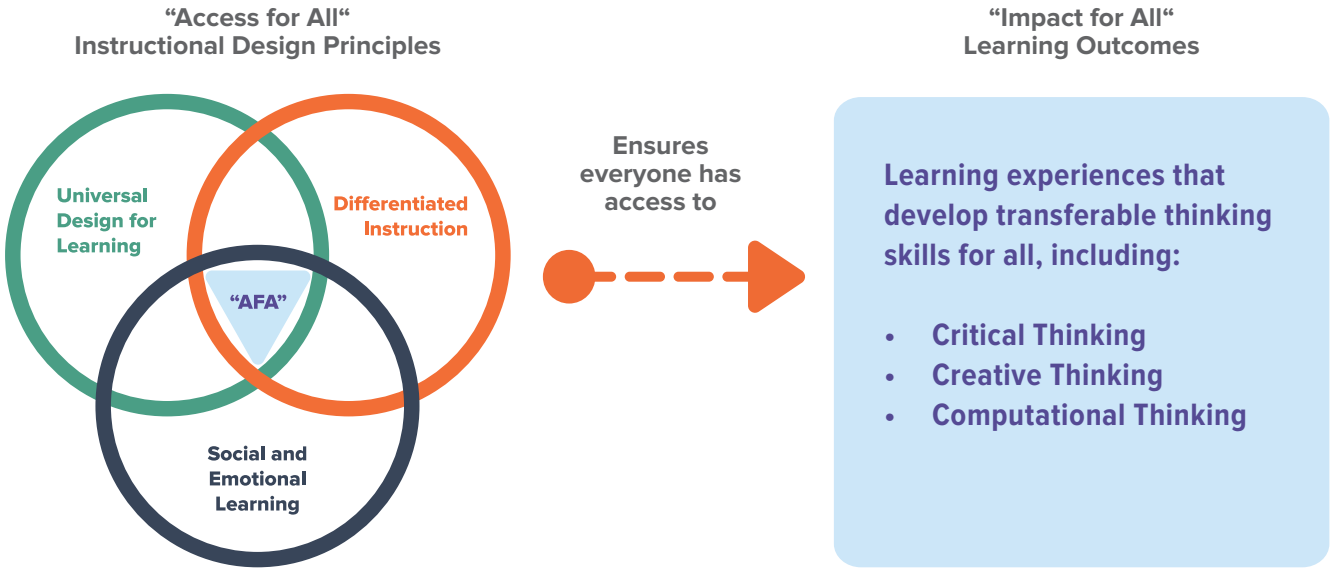
Guided by the AfA framework, BrainPOP seamlessly embeds a variety of learning pathways at every tier of instruction. Section 1 of this paper, *Working in Unison to Create "Access for All": The Intersection of UDL, DI, and SEL Frameworks*, describes the learning science research that grounds the three frameworks and explores how the research can translate to practices within each tier. Section 2, *Empower Teachers with Instructional Equity: AfA and BrainPOP*, details how the design of BrainPOP tools and content, along with its educator support resources, are anchored by learning science research.

While embedding the principles of AfA is essential, there is more to ensuring that all students have equitable access to meaningful learning. Online learning platform design must also apply research on what leads to cognitive and affective learning outcomes, such as the development of transferable thinking skills. Section 3, *Impact for All: Evidence of Learning with BrainPOP*, explains how BrainPOP is also designed to support the development of a broad range of transferable skills, such as critical, creative, and computational thinking. Figure 3 below illustrates how creating "Access for All" in instructional design can lead to "Impact for All".

Figure 3: From "Access for All" to "Impact for All"



Section 1

Working in Unison to Create "Access for All": The Intersection of UDL, DI, and SEL Frameworks

This section describes the research on which UDL, DI (including a focus on essential practices for students with disabilities and English language learners), and SEL frameworks are based, and articulates "guidelines" for designing instruction accessible for all learners.

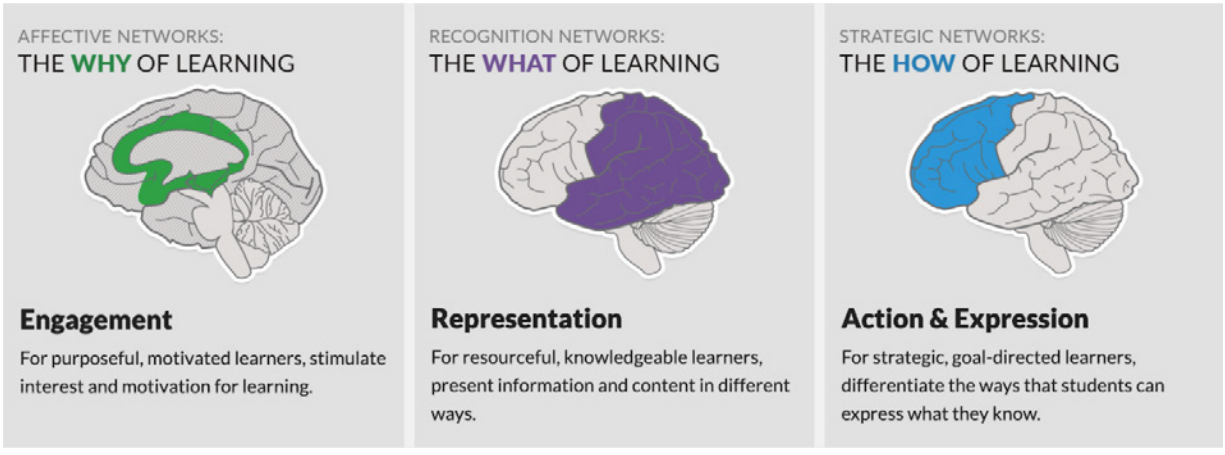
Universal Design for Learning (UDL)

The inspiration and roots of UDL comes from architecture's universal design movement, which advocates for design that is usable by all people in the same way without the need for adaptation or specialized design. *Flexibility* and *simplicity* are at the core of universal design.

Influenced by these principles, the Center for Applied Special Technology (CAST) explored how education could be individualized through a flexible approach to teaching methods and materials, which they termed "Universal Design for Learning" (CAST, 2018). CAST's explanation that "addressing the divergent needs of special populations increases usability for everyone" (Rose and Meyer, 2002, section 4.2), has resulted in the UDL framework embracing learner variability as both the "norm" and an asset when planning and implementing instruction.

CAST developed enduring principles of UDL (CAST, n.d.) based on research of how individuals engage three major learning networks in the brain. Figure 4 below, from CAST's UDL Guidelines, illustrates the function of each network and its relationship to learning.

Figure 4: CAST's Universal Design for Learning Guidelines



Each domain of learning is expanded into the nine UDL guidelines as follows:

1. Provide multiple means of **engagement** (Affective network - "Why"): Stimulate learners' interests, offer appropriate challenges, and increase motivation by providing options for:

   1.1 Recruiting interest;
   1.2 Sustaining effort and persistence; and
   1.3 Self-regulation.

2. Provide multiple means of **representation** (Recognition network - "What"): Present information and content in various way by providing options for:

   2.1. Perception;
   2.2 Language and symbols; and
   2.3 Comprehension.

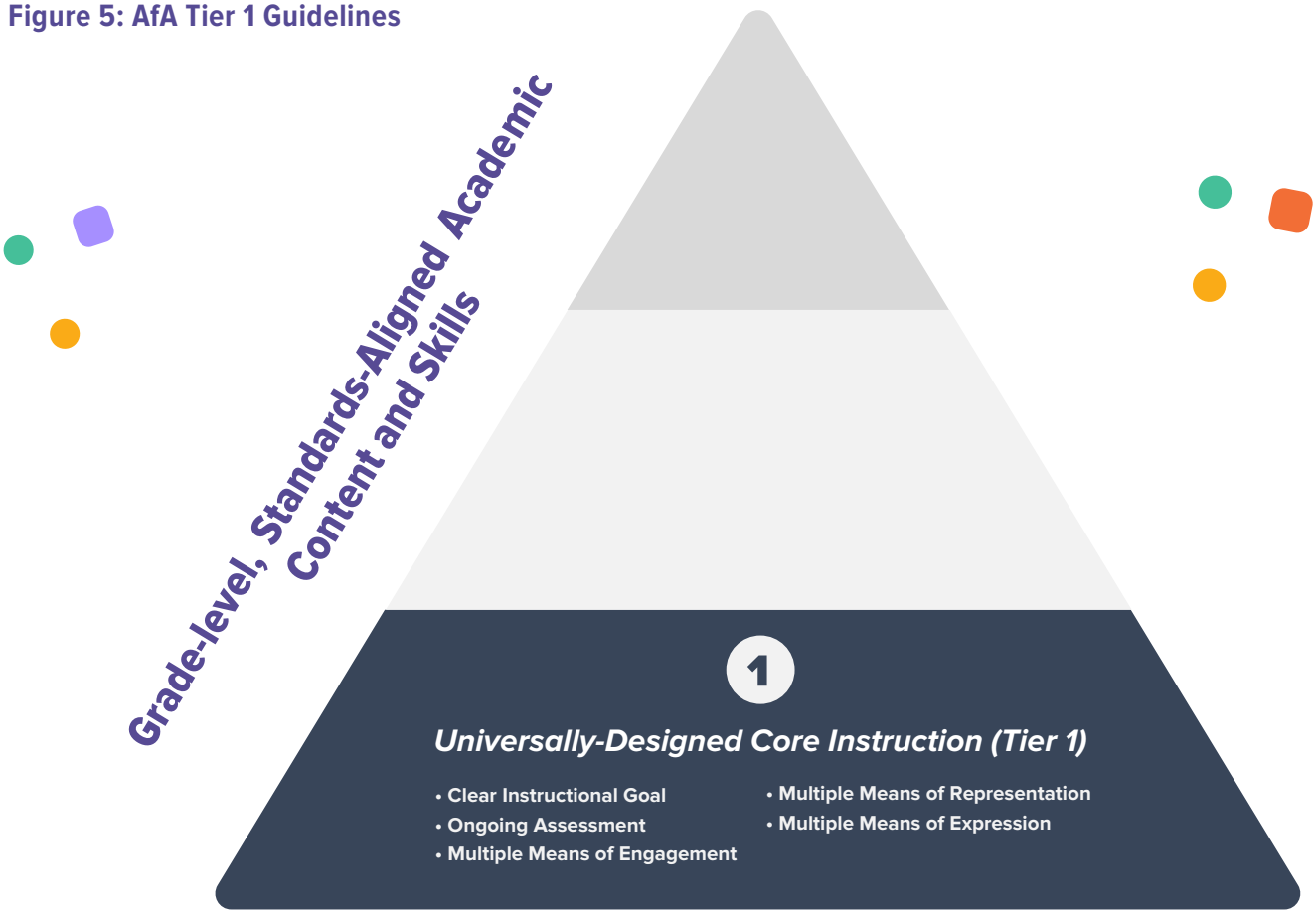
3. Provide multiple means of **action and expression** (Strategic network - "How") Differentiate ways students can demonstrate what they know by providing options for:

   3.1. Physical action;
   3.2 Expression and communication; and
   3.3 Executive functioning.

At the heart of universally-designed core instruction is a **clear instructional goal** that students can meet in a variety of ways. Supporting students with agency addresses learner variability and "builds in" **flexible** pathways for learning. **Ongoing assessment** shapes future universally-designed core instruction (Meyer, Rose & Gordon, 2014). Within this model, students become "expert learners"—learners who are purposeful and motivated (the "why" of learning), resourceful and knowledgeable (the "what" of learning), and strategic and goal-directed (the "how" of learning).

Online educational platforms designed based on UDL principles (summarized in Figure 5) reduce teacher planning time while providing students access to the core curriculum. This flexibility effectively supports the needs of all learners (Rose & Meyer, 2006).

Figure 5: AfA Tier 1 Guidelines



Differentiated Instruction, UDL, and Essential Practices

The DI framework recognizes that each learner is unique in their readiness levels, interests, and learning profile. For learning to be accessible for all, UDL must work in tandem with DI. Using assessment and observational data, teachers respond to students with a range of strategies in order to differentiate **content**, the **process** by which they make new meaning, and the **product** by which they demonstrate mastery of essential concepts, principles, and skills.

Both UDL and DI frameworks recognize learners as variable (UDL) or unique (DI) and value setting clear goals aligned to grade-level standards with ongoing assessments. UDI and DI differ, however, in who chooses the learning pathway. UDL proactively builds in flexible options that position students as the drivers. DI emphasizes the central role of the teacher in targeting instruction for unique learning profiles of smaller groups of students.

Carol Ann Tomlinson and Susan Allan, well-known for their work with DI, put it best: "Differentiation is simply a teacher attending to the learning needs of a particular student or small groups of students, rather than teaching a class as though all individuals in it were basically alike" (Tomlinson & Allan, 2017).

DI is also an opportunity to implement research-based instructional practices that are essential to supporting SWDs and ELLs, while also being useful to many other students. The National Center for Learning Disabilities' ("NCLD's") report "Forward Together" (2019) outlines **essential practices to help schools better serve SWDs.**

These **key practices** include:

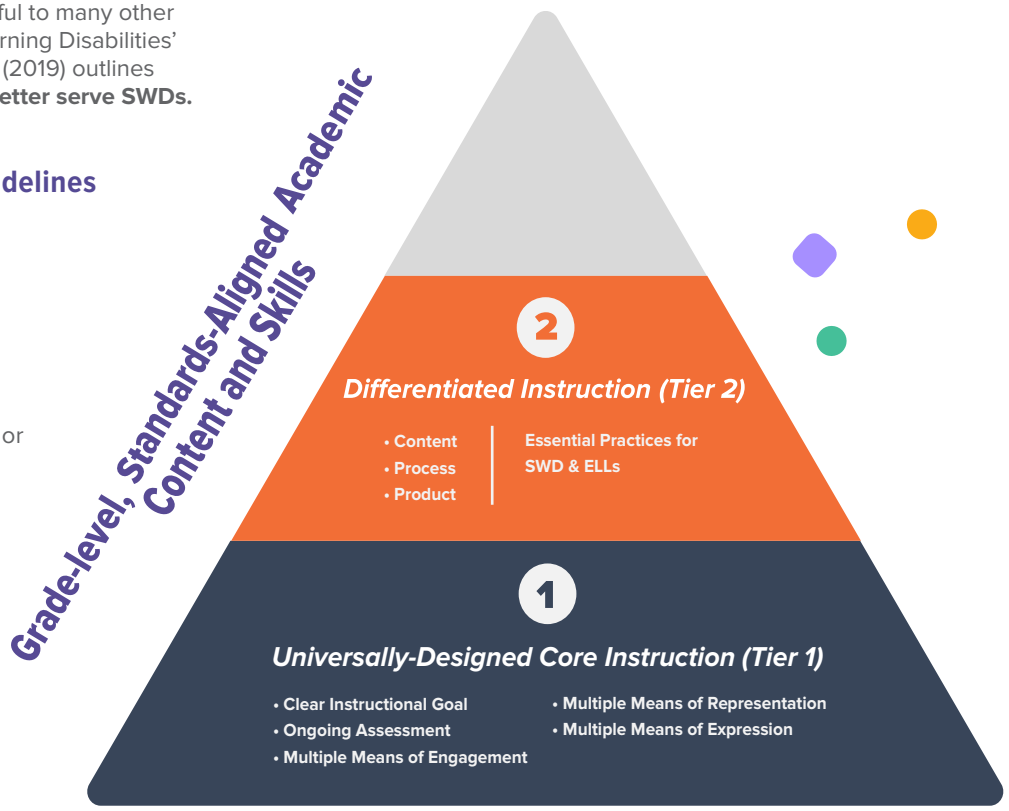
- UDL (for core instruction)
- Explicit, targeted instruction
- Strategy instruction
- Flexible grouping
- Evidence-based content instruction
- Positive behavior supports

In addition, WIDA, a leading organization that provides language development resources to support the academic success of multilingual learners, outlines several **high-leverage differentiation strategies for ELLs** (WIDA Consortium, 2012) including:

- Flexible grouping
- Content and language targets
- Identifying cognates across home language and new language
    - Students' strengths in their home language can be used to support their language development in both English and in the home language.
- A focus on images and domain-language when describing a topic
- Opportunities to compare and contrast concepts within a topic

Figure 6: AfA Tiers 1 and 2 Guidelines

To support coherent and inclusive learning for all students, an online educational platform's design must allow for the flexibility of universally-designed Tier 1 guidelines and for differentiated, targeted instruction for groups of learners who need support or acceleration beyond Tier 1 (Figure 6).



Specifically-Designed Learning to Support IEP Goals and Intervention

Differentiated instruction guides teachers to use what they know about their students to target the needs of small groups. Yet, even with universally-designed core instruction (Tier 1) that is differentiated (Tier 2), some students need and/or are guaranteed access to "specifically-designed," or Tier 3 instruction.

The Individuals with Disabilities Education Act (IDEA) articulates that students with educational disabilities who qualify for special education services are guaranteed "specifically-designed instruction" ("SDI") defined as:

"adapting, as appropriate to the needs of an eligible child under this part, the content, methodology or delivery of instruction (i) to address the unique needs of the child that result from the child's disability; and (ii) ensure access of the child to the general curriculum, so that the child can meet the educational standards within the jurisdiction of the public agency that apply to all children." (34 CFR Sec. 300.39(b)(3).

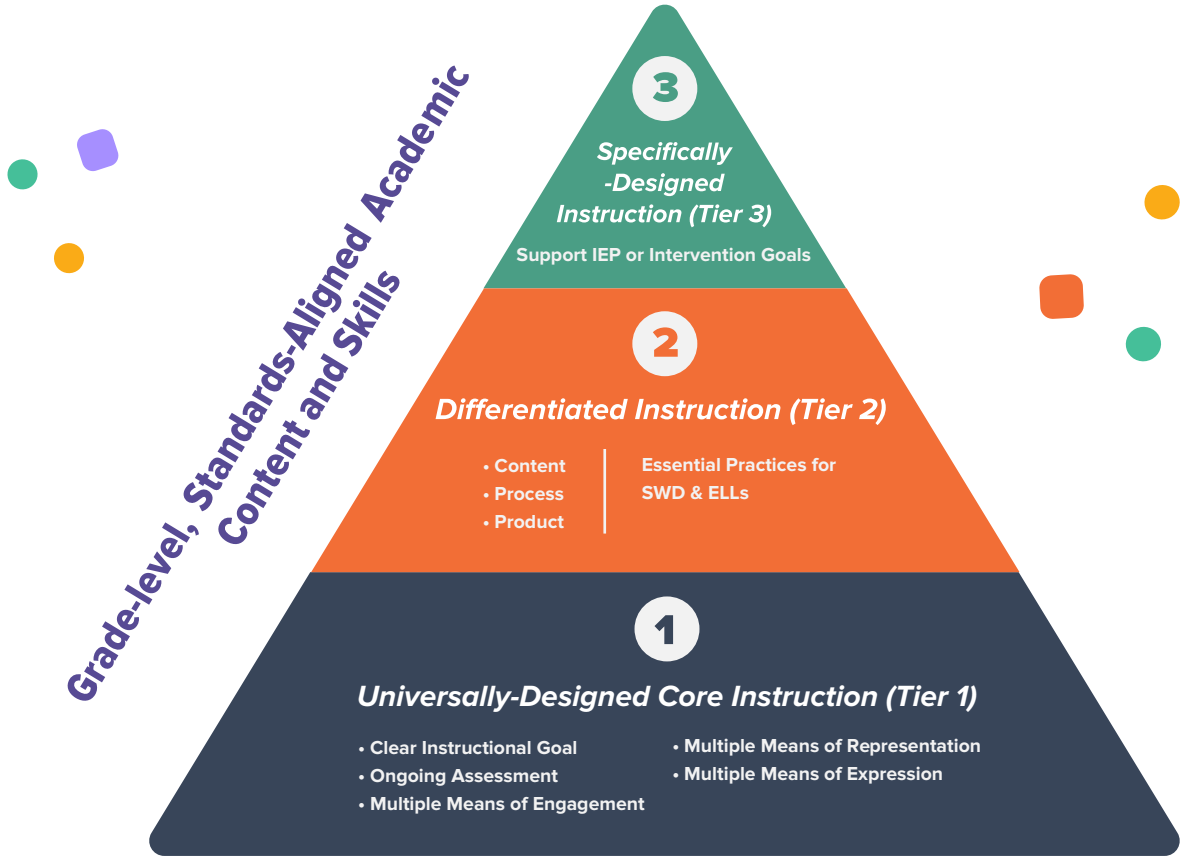
More practically, SDI:

- directly addresses and monitors progress towards meeting the goals of the student's Individualized Education Plan ("IEP");
- is instruction that is delivered to the student, not differentiated instruction or other activities designed to facilitate learning for all students; and
- can address any area of individual need, including academic, behavioral, social, or communication.

Students with disabilities are guaranteed SDI by law. However, within an MTSS model (as described in the Introduction), **Tier 3 i**nstruction is, by definition, specifically designed to also provide intensive, individualized intervention for general education students in order to close grade-level skill gaps or prevent new content area gaps through ongoing progress monitoring.

For an online educational platform to truly support ALL learners, its tools and features must be flexibly designed to allow UDL, DI, and SDI to work in unison toward grade-level instructional goals (Figure 7).

Figure 7: AfA Tiers 1, 2, and 3 Guidelines



Social and Emotional Learning (SEL), UDL, and DI

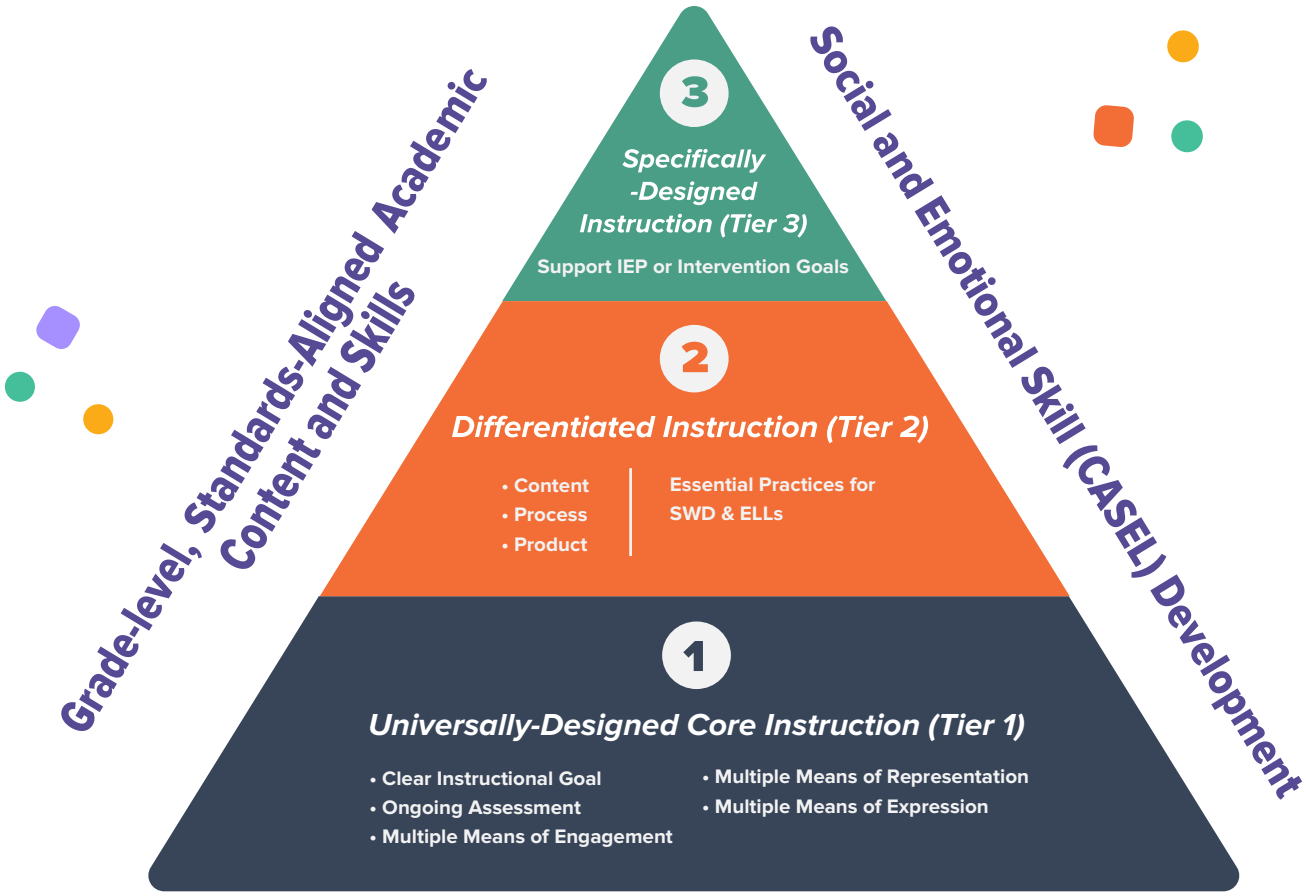
UDL and DI (including SDI) are inextricably linked to SEL. Research shows (CASEL, n.d. "SEL Impact") that when we focus on helping students identify and regulate their emotions, understand how to interact in social situations, and persevere when they encounter difficulties or disappointments, they are more likely to excel academically.

The Collaborative for Academic, Social, and Emotional Learning (CASEL), an authority on high-quality, evidence-based social and emotional learning, developed a framework that promotes intrapersonal, interpersonal, and cognitive development through five core competencies: (1) Self-awareness (2) Self-management (3) Social Awareness (4) Relationship skills (5) Responsible decision-making. Integrating SEL skill development into learning is essential for implementing UDL guidelines like sustaining persistence, self-regulation, communication, and executive functioning.

SEL lesson planning and implementation also benefit from being universally-designed with opportunities for differentiation. SEL instruction is also central to supporting many IEP and MTSS intervention goals. The Access for All ("AfA") framework articulates key guidelines at each "tier" for both academic and social and emotional learning necessary for the complex task of creating meaningful and equitable access for a diverse range of learners (Figure 8).

When designing an online educational platform guided by the AfA framework, a key theme emerges: the critical need of purposeful opportunities for flexibility, individualization, and ongoing assessment opportunities. As Neal Kingston, the director of the Achievement and Assessment Institute at the University of Kansas, recently stated "There's a need for flexibility with any solution companies offer...[Versatile options] for personalized learning, with embedded assessments, will be one of the emerging keys to addressing learning loss." (Molnar, 2020).

Figure 8: Complete AfA Guidelines



Section 2

Empowering Teachers with Instructional Equity: AfA and BrainPOP

BrainPOP, an educational platform designed with learner variability in mind, offers digital content in subjects across the curriculum in the form of animated movies, student creation and reflection tools, coding projects, learning games, and interactive assessments. BrainPOP also hosts a site for educators that supports them with various forms of planning resources and professional development opportunities. BrainPOP has continued to hone and expand its content, tools, and other resources over the past two decades, with the goal of providing students with tagency to explore and "show what they know" in creative and individualized ways.

This section describes how the design of BrainPOP resources, including animated movies, creative tools, and educator support materials are guided by AfA guidelines (see Figure 8 above). Each subsection, organized by an AfA tier, describes how the guidelines translate to actions for students and teachers, including illustrative examples of how BrainPOP resources enable instructional access to learning goals. For an overview of BrainPOP tools and features visit the **Tools and Features Support page**.

Section 2.1

BrainPOP and AfA Tier 1: Universally Designed Core Instruction

Effective delivery of Tier 1 (core instruction) via an online educational platform requires integration of UDL features. This includes offering students options in the presentation of new information, and in how they make meaning and express understanding of new concepts. This model encourages students to become "expert learners" who are purposeful and motivated (the "why" of learning), resourceful and knowledgeable (the "what" of learning), and strategic and goal-directed (the "how" of learning).

Universally-designed Tier 1 instruction requires the following actions by teachers and students:

Teachers:
- Establish and communicate a clear instructional goal, aligned to grade-level standards.
- Align ongoing assessments.
- Design and implement instruction that represents (a) content in different ways; (b) information; and (c) options for expressing understanding and engagement.

Students:
- Understand the instructional goal.
- Approach a task using their preferred tools and strategies.
- Choose a means for expressing understanding optimized toward their strengths.

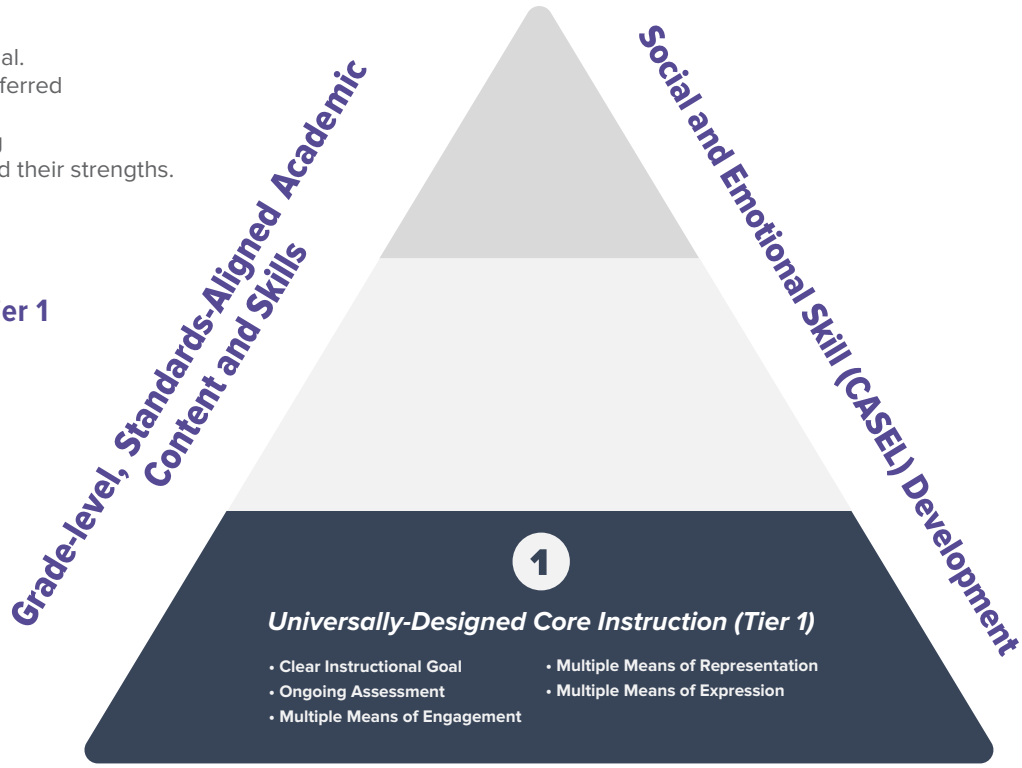


Figure 9: BrainPOP and AfA Tier 1

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BrainPOP is not a curriculum, which means teachers establish their own instructional goals and ongoing assessment schedule based on their school curricula or state academic standards. Using universal design, teachers create lessons representing content in multiple ways that include options for expressing understanding and opportunities for engagement that allow students agency in how they reach the instructional goal. BrainPOP's research-based design enables teachers to seamlessly integrate UDL principles into their core instruction.

The following tables highlight high-impact examples of how BrainPOP facilitates integrating multiple means of representation (Figure 10), multiple means of action and expression (Figure 11), and multiple means of engagement (Figure 12). Each table provides examples of how UDL principles are evident in a tool or feature. As discussed throughout this paper, BrainPOP tools and features embrace flexibility. Accordingly, the features of a single tool, like Make-a-Map (a concept-mapping tool), support instructional access across all domains of the UDL framework.

Figure 10: Multiple Means of Representation with BrainPOP

Providing Multiple Means of Representation - The "What" of Learning	
BrainPOP Tools and Features	**Evidence of UDL Principles**
Animated Movies: Playful animations that address topics across the curriculum, embedding key learning concepts within fun narratives.	• Images and diagrams within character-driven narratives • Visuals to represent abstract concepts • Cues to important keywords and concepts • Closed-captioning options • Options for controlling the speed of the movie without auditory or visual distortion
Make-a-Map: Concept mapping tool that prompts students to visually express thinking by making authentic connections between existing and new ideas.	• Images and re-playable animated vocabulary • Different shaped nodes, colors, and connectors • Highlight connections to familiar ideas, contexts, analogies, and metaphors with editable nodes and cross-topic images • Opportunities for scaffolding and support (e.g., assigning partially-completed concept maps) • Opportunities to use a student's home language (if different from English) with editable blank nodes
Make-a-Movie: Express learning by creating a BrainPOP-style movie using images, labels and computer or student-recorded narration.	• Flexibility to create scenes with animations, images, simple text, and varying background colors, using voice over or computer narration • Opportunity to illustrate a point, concept, or process • Cues attention to critical information and key ideas • Opportunities to provide a range of examples and/or non-examples

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The flexible nature of BrainPOP makes it easy for teachers to provide multiple means of action and expression that yield both quantitative and qualitative assessment of student learning. Figure 11 below illustrates how BrainPOP tools and features provide many ways to make meaning of and express learning.

Figure 11: Multiple Means of Action and Expression with BrainPOP

Providing Multiple Means of Actions and Expression - The "How" of Learning	
BrainPop Tools and Features	**Evidence of UDL Principles**
BrainPOP Quiz: Auto-graded, multiple choice quiz that engages higher-order thinking and assesses knowledge of content covered in the movie. **Quiz Mixer**: A tool for creating BrainPOP-style quizzes with original questions or modify ones provided by BrainPOP or other teachers.	• Auto-graded quizzes offer "graded" or "review" mode. • Review mode ensures students know the correct answer before moving on to the next question. • Quiz Mixer supports a variety of response formats including multiple choice text or images, open response, and poll.
Challenge: Interactive tasks that prompt students to apply critical thinking skills in playful, ways to demonstrate topic understanding.	• Auto-graded activities features these skills: concept mapping, diagram labeling, matching, text highlighting, multiple response, sequencing, Venn diagramming, and fill-in sentences
Make-a-Map: Concept mapping tool that allows students to visually express thinking by making authentic connections between existing and new ideas.	• Vary mode of expression with images, re-playable vocabulary from the movie, classification options like different node types, colors and connectors. • Students can respond in home language with editable blank nodes.
Make-a-Movie: Express learning by creating a BrainPOP-style movie using images, labels and computer or student-recorded narration.	• Students can craft their movies around a BrainPOP-generated question or create their own questions. • Develop higher-order thinking skills like sequencing and cause and effect when storyboarding a movie project. • Develop language skills by focusing on vocabulary or recording voice narration in English and listening back.
Creative Coding: Block- and text-based projects prompt students to express learning on BrainPOP topics across the curriculum.	• Scaffolded and delivered at the topic level, the projects are specifically designed so students express understanding while developing computational thinking skills through coding.
GameUp: Top quality, award-winning learning games spanning all curriculum areas and grade levels.	• Sortify and Time Zone X challenge students to apply skills like categorizing and sequencing to express content understanding and provide quantitative feedback. • Quandary and Guts and Bolts pose adaptive challenges that foster creative, interactive problem-solving and strengthen critical and systems thinking. • The "Snapthought" tool allows students to capture their thinking and reflect on the decisions they made at moments of gameplay.

Figure 11 Cont.: Multiple Means of Action and Expression with BrainPOP

Providing Multiple Means of Actions and Expression - The "How" of Learning	
BrainPOP Tools and Features	**Evidence of UDL Principles**
Dashboards and Educator's Site: Student and teacher dashboards serve as hubs for students to submit work and for teachers to provide feedback. BrainPOP's Educators site offers tools and resources for teachers and students to give and get feedback and monitor progress, including rubrics for creative tools.	• Teacher Dashboard: Teachers access interactive assessment data, student creative projects, and a way to provide ongoing and meaningful feedback. • Student Dashboard: Students to view and submit assignments, track assignment progress and receive teacher feedback. • BrainPOP Educators site offers rubrics for Make-a-Map, Make-a-Movie, and Creative Coding that students can use as guidelines for assessment.

BrainPOP supports instructional access. Its tools and features allow for multiple means of content representation, while its creative and assessment tools support action and expression. These multiple means of engagement, as illustrated in Figure 12 below, support the affective aspect of learning that is integrated through BrainPOP's holistic design.

Figure 12: Multiple Means of Engagement with BrainPOP

Providing Multiple Means of Engagement - The "Why" of Learning
BrainPOP movies, creativity tools, and other features work together to engage students' interest by: • Encouraging **exploration of 1,000+** topics to find subjects of interest and/or ones related to what they're learning in school. • Providing choice in how they build background knowledge, apply learning, and demonstrate mastery. • Offering tool options (e.g. Make-a-Movie, Creative Coding) to create content that is personalized within a real-world scenario contextualized to their lives.
BrainPOP supports motivation and perseverance by: • Infusing inquiry. Every BrainPOP movie and Make-a-Movie project begins with a driving question. A teacher can prompt students in Make-a-Map with a question, too. • Driving questions articulate clear learning goals, allowing students to monitor their progress and stay on track. • GameUp games and Creative Coding projects develop perseverance and stamina in problem solving.
BrainPOP's **Social and Emotional Learning (SEL) collection** supports students' self-regulation. • **SEL Topics** align to CASEL competencies and range from setting goals to managing emotions. • **SEL Movies** are designed to be socially relevant and contextualized to students' lives.

Universally-designed Tier 1 core instruction is the foundation of creating meaningful and equitable access to rigorous academic instruction and SEL skill development. Tier 1 instruction provides flexible options, encouraging students to be the drivers of their learning.

Subsection 2.2

BrainPOP and AfA Tier 2 - Differentiated Instruction and Essential Practices

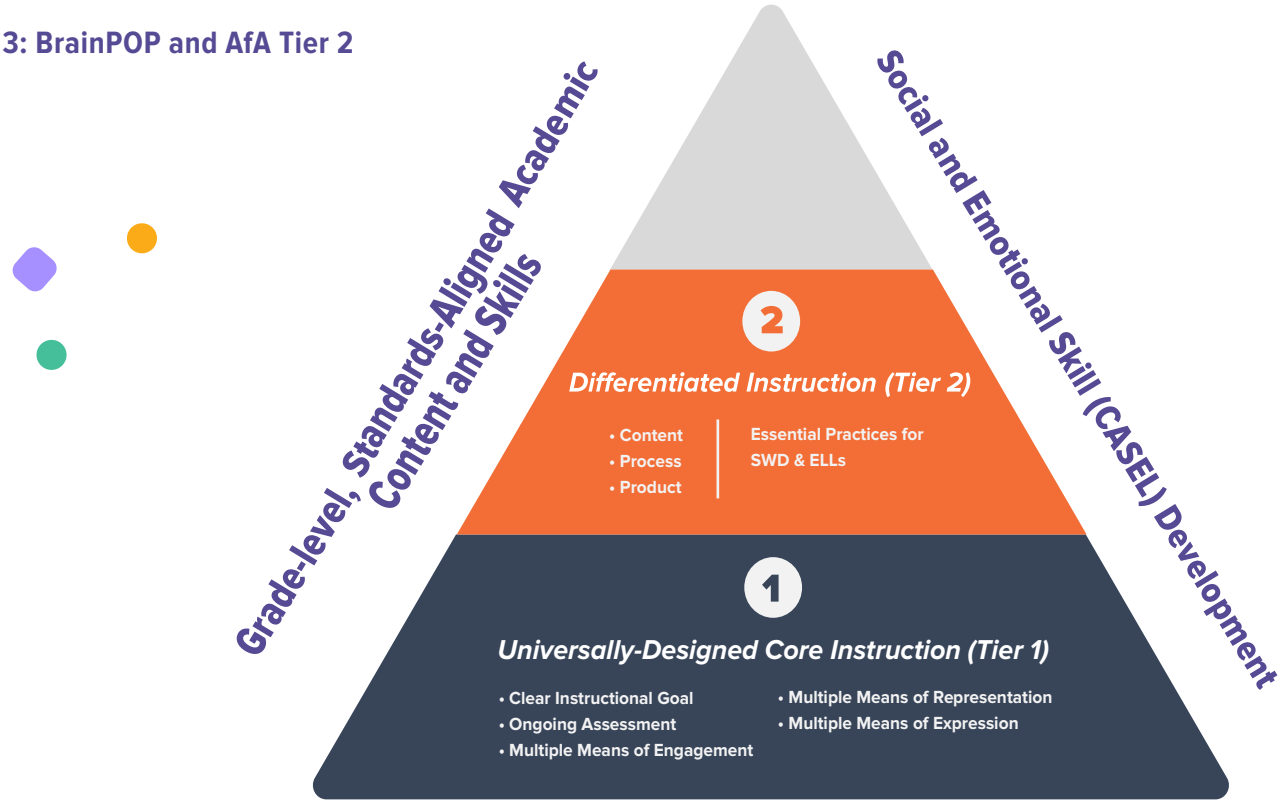
During Tier 2 instruction teachers provide targeted instruction for the unique learning profiles of smaller student groups. Online educational platforms must be flexible in order to also support differentiated instruction and essential practices for SWDs and ELLs.

Differentiated and targeted Tier 2 instruction requires these actions from the teacher and students:

Teachers:
- Analyze ongoing assessment data to inform targeted instruction.
- Differentiate content, process, and product for small groups based on assessment data.
- Embed essential practices for SWDs, ELLs, and students with similar learning characteristics.

Students:
- Engage with teacher-designed targeted instruction (i.e., content and process), based on learning strengths and needs.
- Demonstrate understanding through assessments (i.e., products), based on learning strengths and needs.

Figure 13: BrainPOP and AfA Tier 2

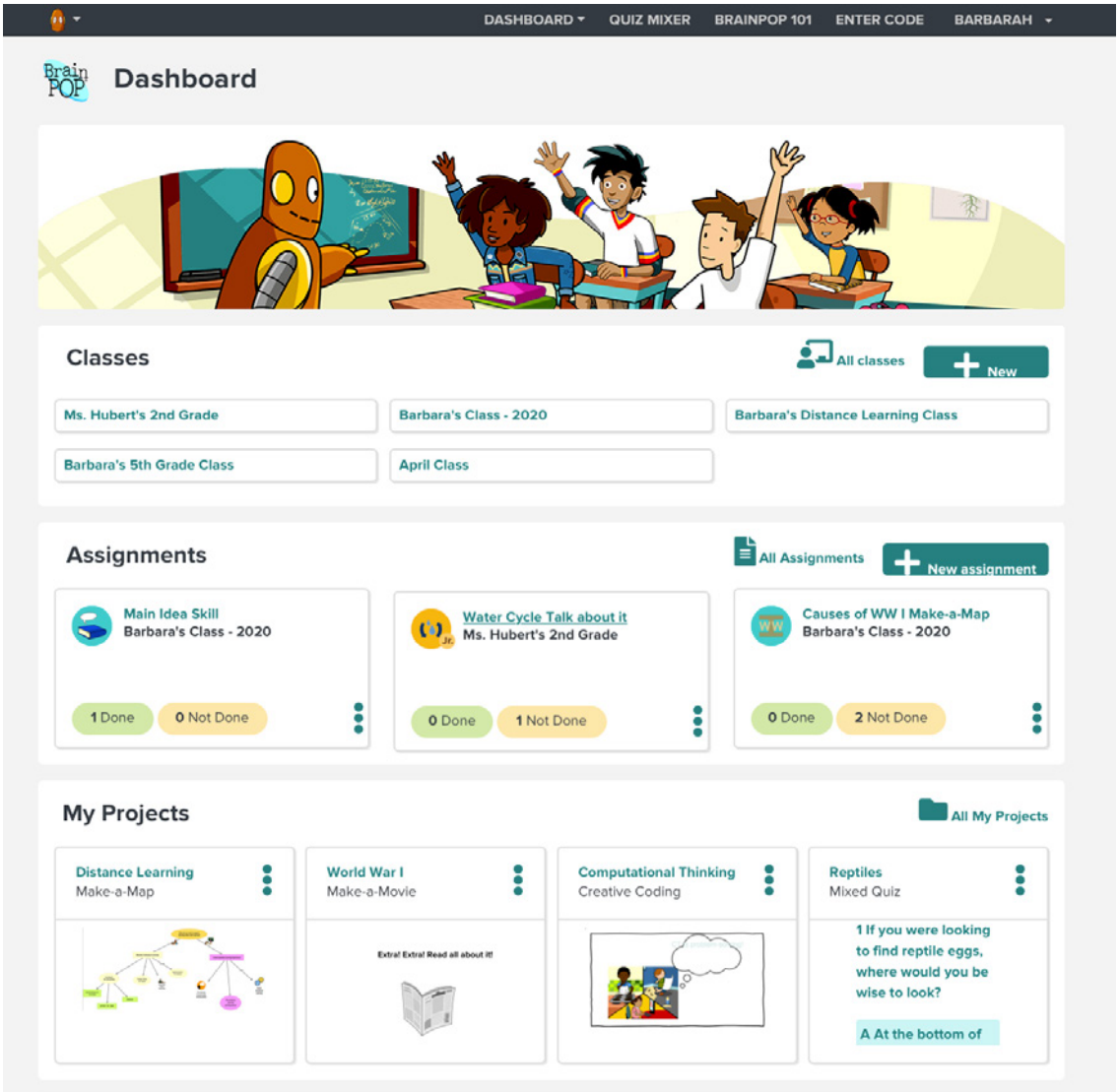


Assessment for Differentiated Instruction with BrainPOP

Knowing your learners is essential to creating effective differentiated instruction. BrainPOP offers a variety of tools to use for formative or summative assessment. BrainPOP's interactive assessments provide teachers with quantitative data on concept mastery, while the creative tools provide qualitative data on student thinking and understanding. Teachers can analyze this data to differentiate future instruction.

- **Teacher Dashboard:** A central hub that stores multiple classes, assignments, quantitative auto-graded assessment results, and qualitative assessments resulting from artifacts created with Make-a-Map. Make-a-Movie, and Creative Coding.
- **Class Summary:** A high-level view showing class mastery of a concept using quantitative data from interactive assessment tools. The summary enables quick intervention and guides targeted and differentiated instruction at all levels.
- **BrainPOP Rubrics**: Content agnostic rubrics help assess student artifacts made with BrainPOP creative tools, including Make-a-Map, Make-a-Movie and Creative Coding. Each rubric is downloadable and adaptable for the learning goal or project task.

Figure 14: Teacher Dashboard



Differentiated Instruction Using Essential Practices and BrainPOP

BrainPOP is designed for flexible use within every tier of instruction. Teachers can design and implement differentiated instruction with the same familiar tools and features that they engage with during universally-designed Tier 1 core instruction. It also involves giving students choice and agency in how they take in, make meaning of, and express new ideas. In contrast, Tier 2 differentiated instruction is responsive to small group and individual needs. Teachers direct how students take in, make meaning of, and express new ideas.

After gaining a robust understanding of student needs and learning preferences, teachers can use BrainPOP's Assignment Builder to flexibly group students and differentiate by content, learning process, and student product, while integrating essential practices for SWDs and ELLs. **Assignment Builder** enables teachers to assign whole class, small group, or individualized learning pathways with different movies, tools, and features. Teachers can assign creative projects they've developed, partially completed projects that provide scaffolds, or open-ended projects, adding specific prompts for the specific group or student.

Figure 16 below highlights examples of how teachers can use Assignment Builder to differentiate instruction and embed essential practices for SWD (NCLD, 2019) and ELLs (WIDA Consortium, 2012). The table illustrates how BrainPOP tools and features support differentiating the content presented to students, the process by which they engage new ideas or the product through which students demonstrate learning. Additionally, several examples are also coded "ELL" or "SWD" to signal alignment with essential practices.

Figure 15: BrainPOP's Assignment Builder

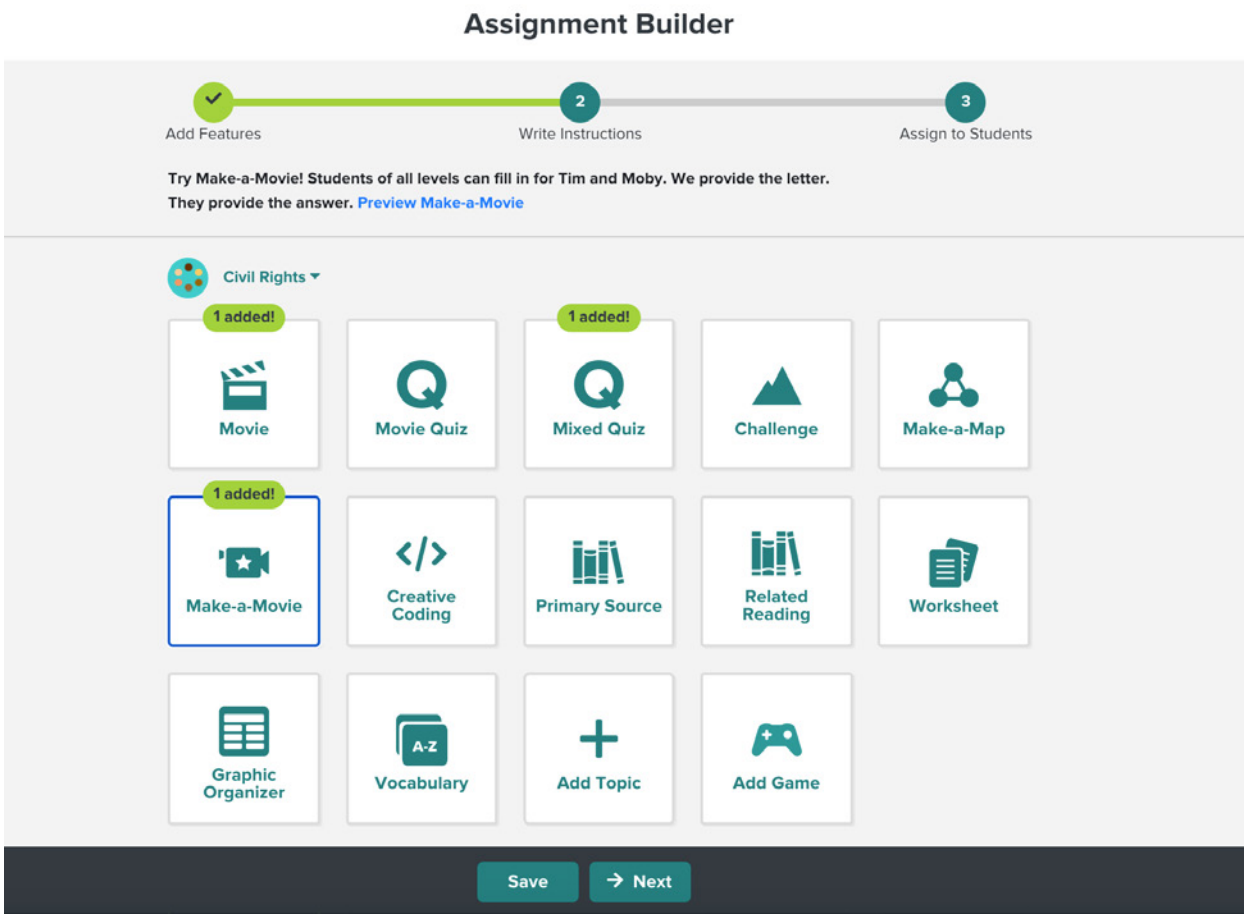


Figure 16: Differentiated Instruction and Essential Practices with BrainPOP

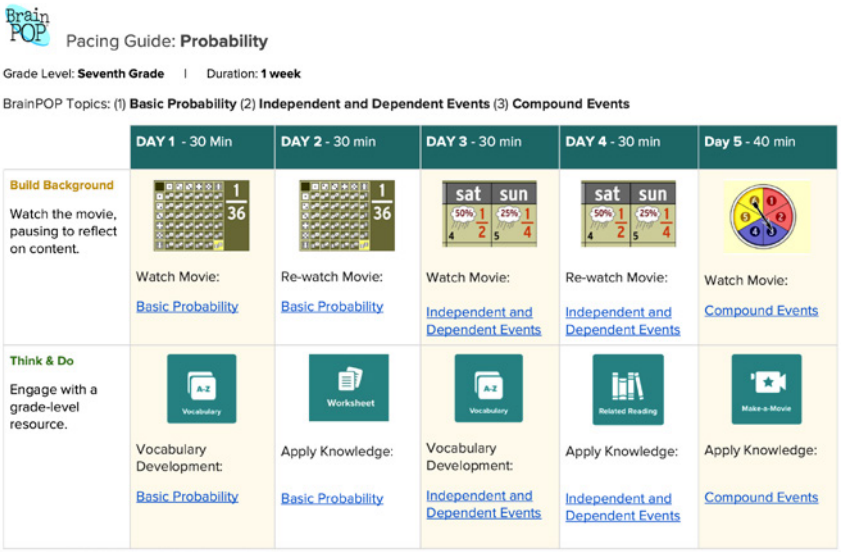
Differentiate Learning **Content**	Differentiate Learning **Process**	Differentiate Learning **Product**
Use **BrainPOP Movies** to differentiate **content** by: **Chunking** - Direct students to focus on a portion of the movie. **Compacting** - Assign an additional related movie. **Highlighting images and domain-language** - Instruct students (in English or home language) to focus on images and domain-language used to explain concepts or ideas in the movie (ELL). **Providing explicit instruction** - Target academic skills (e.g., identifying main idea, dividing decimals.) and SEL skills (e.g, identifying emotions, managing stress) with skill-specific movie topics (ELL/SWD).	Use **BrainPOP Movies and Quizzes** to differentiate process by: **Setting a purpose for viewing** - Use assignment directions to set purpose. **Instructing to watch the movie multiple times** - Watch movie with or without closed captioning or at a slower speed. **Chunking process** - Instruct students to pause at specific time stamps and add nodes to their Make-a-Map or scenes to their Make-a-Movie. **Reinforce important information** - Assign Quiz or Challenge in "Review" mode to reinforce important information (SWD).	Use **Interactive Assessments** to differentiate product by: **Varying the level of question complexity and response format** - Use Quiz Mixer to write your own questions or create text or image multiple choice, open answer, or poll response questions. **Varying the number of quiz questions or answer choices** - Use Quiz Mixer to limit or expand the number of questions or responses. **Creating quiz in student's home language** - Use Quiz Mixer to write questions in any language (via teacher fluency or translator). **Assessing content and skills** - Assign "graded" version of Challenge to assess content and thinking skills (i.e., sequencing, identifying key information, etc.).
Use **Make-a-Map** to differentiate content by: **Highlighting key ideas and connections** - Use images, movie clips, and vocabulary from the movie to make connections. **Chunking and scaffolding** - Add more and increasingly complex connections as more information is presented. **Compacting** - Include complex connections across topics with related movies and connector directionality. **Providing content in home language** - Include a combination of English and home language in blank nodes (ELL).	Use **Make-a-Map** to differentiate process by: **Considering learner preference** - Assign students to take notes on the topic using their preferred method (images, key words, home language, etc.). **Chunking** - Instruct students to add new ideas or key details each time they pause the movie. **Providing scaffolding** - Assign partially completed maps with examples or use a template to structure student thinking (SWD).	Use **Make-a-Map** to differentiate product by: **Varying level of complexity** - Create a concept mapping assignment with anchor question complexity matched to student need. **Varying means of expression** - Instruct students to create their concept map with one or more asset (e.g., images, key vocabulary, blank nodes). **Varying parameters of task** (i.e., include 3 images, 1 key word and 1 blank node. Make 2 connections). **Making connections in home language** - Allow use of home language use in blank nodes and connections and focus on domain-language in English when describing topic (ELL).

Figure 16 Cont.: Differentiated Instruction and Essential Practices with BrainPOP

Differentiate Learning **Content**	Differentiate Learning **Process**	Differentiate Learning **Product**
Use **Make-a-Movie** to differentiate content by creating a teacher-made movie: **Vary input** - Modify the amount of text, speech, and/or images in the movie. **Target a skill within content** - Highlight skills like sequencing or cause and effect (SWD & ELL). **Prioritizes student's home language** - Use text to speech or voice narration in home language.	Use **Make-a-Movie** to differentiate process by: **Chunking** - Instruct students to add new scene with a "main idea" each time they pause the BrainPOP movie or gather new information. **Compacting** - Instruct students to generate their own starting question and add ideas from related movies.	Use **Make-a-Movie** to differentiate product by: **Varying level of complexity** - Customize the opening question that guides the movie students will make to address different levels. **Varying parameters of task** - Instruct students to create their movie with one or more features (images, key vocabulary, labels). **Varying means of expression**- Direct students to record narration or use text to speech. **Express learning in home language** - Allow students to narrate or use key words in English or home language.

BrainPOP Educators is a site that provides an array of resources and professional learning opportunities to support teachers in creating meaningful access for all students at all tiers of instruction. CCSS and NGSS-aligned **pacing guides and lesson plans** (available in all subjects, including SEL, for grades K-8) demonstrate how teachers can use BrainPOP to implement explicit targeted instruction—an essential practice for supporting students with disabilities and when teaching learners with similar characteristics. BrainPOP Educators provides **content, webinars, in-person professional training, and intensive online certification courses** to help teachers in developing pedagogical practices that support thinking strategy instruction, another essential practice.

Figure 17: BrainPOP Educators Pacing Guide



Pacing Guide: **Probability**

Grade Level: **Seventh Grade** | Duration: **1 week**

BrainPOP Topics: (1) **Basic Probability** (2) **Independent and Dependent Events** (3) **Compound Events**

	DAY 1 - 30 Min	**DAY 2** - 30 min	**DAY 3** - 30 min	**DAY 4** - 30 min	**Day 5** - 40 min
Build Background Watch the movie, pausing to reflect on content.	Watch Movie: Basic Probability	Re-watch Movie: Basic Probability	Watch Movie: Independent and Dependent Events	Re-watch Movie: Independent and Dependent Events	Watch Movie: Compound Events
Think & Do Engage with a grade-level resource.	Vocabulary Development: Basic Probability	Apply Knowledge: Basic Probability	Vocabulary Development: Independent and Dependent Events	Apply Knowledge: Independent and Dependent Events	Apply Knowledge: Compound Events

Subsection 2.3

BrainPOP and AfA Tier 3: Specifically-Designed Instruction

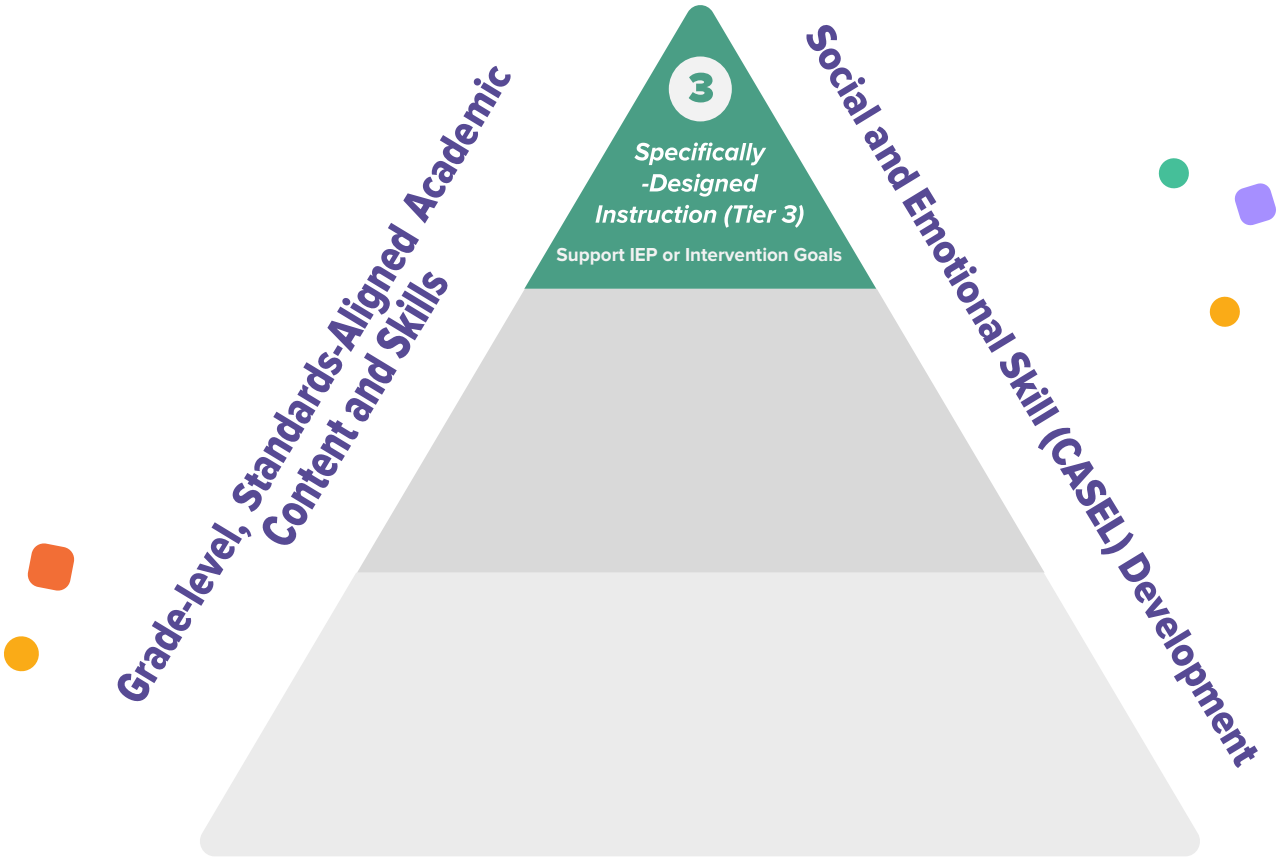
The Individuals with Disabilities Education Act guarantees students with disabilities "specifically-designed instruction" ("SDI"). SDI is delivered to the individual student and is distinct from differentiated or other instruction designed to facilitate learning for all students. While not guaranteed by law, students in a general education setting receiving Tier 3 intensive intervention within a Multi-tiered System of Support (MTSS) also receive SDI to close grade-level skill gaps.

Specifically-designed Tier 3 instruction requires these actions from the teacher and students:

Teachers:
- Target skills that directly address academic and social and emotional IEP or intervention goals.
- Monitor progress towards goal and adjust instruction as needed.

Students:
- Engage with teacher-designed specifically-designed instruction and ongoing assessment based on IEP or intervention goals

Figure 18: BrainPOP and AfA Tier 3



Targeting Skills to Meet IEP or Intervention Goals with BrainPOP

Teachers can use BrainPOP to address IEP or intervention goals related to developing reading Comprehension, Writing, Math, and SEL skills. Below are two examples (one academic and one SEL) of how a teacher can use BrainPOP to develop targeted academic and SEL skills with direct instruction (an essential practice for students with disabilities). The specific tools and features assigned can vary depending on the goal, student readiness, and learning preferences.

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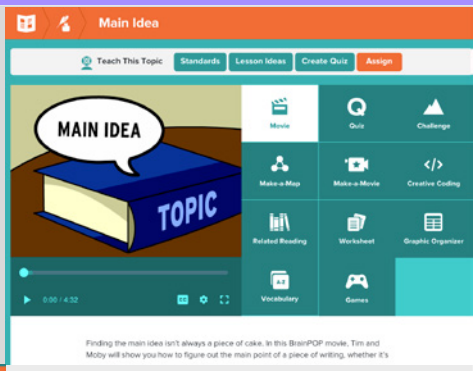
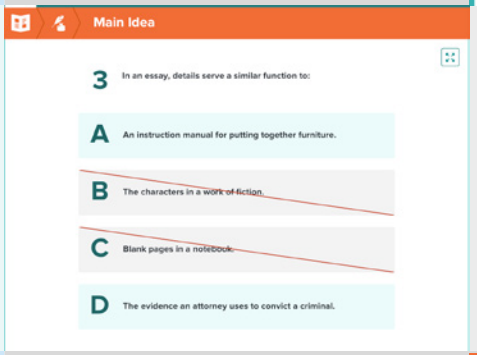
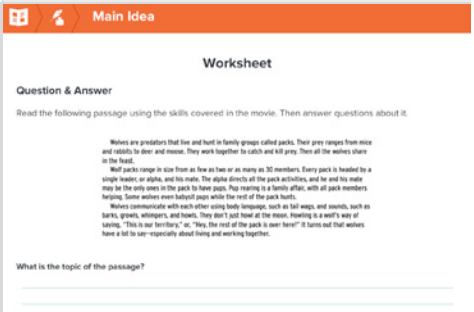
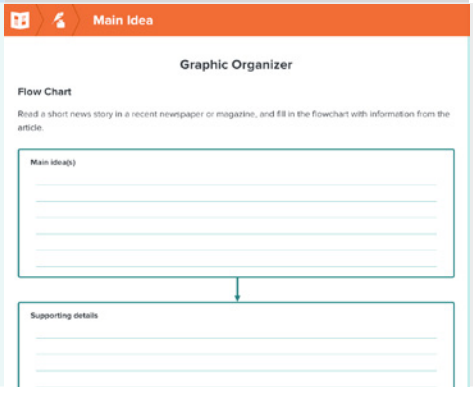
Example 1:

- Academic Standard: Determine the main idea of a text. Recount the key details and explain how they support the main idea.
- Sample IEP Goal: By the end of the IEP period, when given a grade-level nonfiction passage, the student will identify the main idea and provide at least three details related to the main idea with 90% accuracy in three out of four trials.
- Explicit Instruction of Skill:

Purpose	BrainPOP Tools and Features	
Model skill with clear explanation and verbalized think aloud.	Assign the BrainPOP movie "Main Idea." This movie explains what a main idea is, why it is important for reading comprehension, and how to identify it when reading.	
Reinforce skill with guidance.		Assign "Main Idea" Review Quiz. Students proceed to the next question only when they have selected the correct answer, allowing for immediate feedback and self-assessment opportunities.
Provide opportunities to practice a skill with scaffolded guidance.	Assign "Main Idea" Worksheet. Students apply skill by identifying main idea in a pre-selected paragraph with scaffolded questions.	
Opportunities to practice a skill independently for feedback.		Assign "Main Idea" Graphic Organizer. Students independently apply understanding of skill by identifying main idea in a text of their choice.

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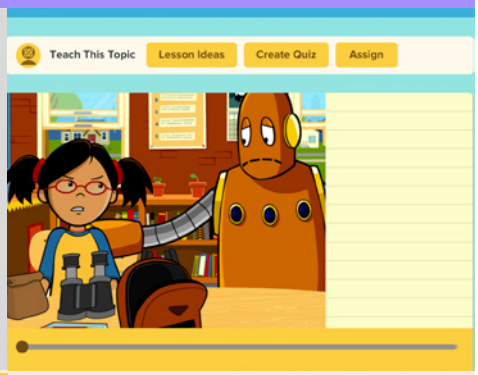
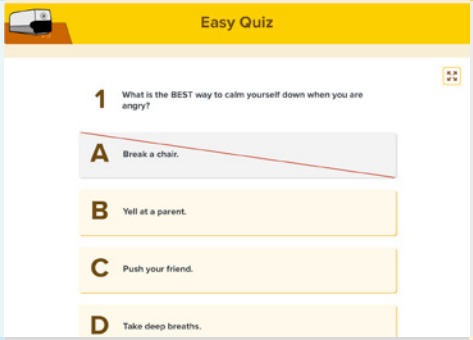
Example 2:

- Sample IEP Goal: When student becomes upset, frustrated, or angry, they will **use a self-regulation/coping strategy** (e.g., movement break, deep breathing, quiet space break, deep pressure/heavy work activity, etc.) to avoid engaging in an unexpected behavior, on 4 out of 5 opportunities, as measured by observations and documentation.
- Explicit Instruction of Skill:

Purpose	BrainPOP Tools and Features	
Model skill with clear explanation and verbalized think aloud.	Assign BrainPOP Jr. movie "Anger" that explains the feeling of anger, what students can do when they are angry, and how they can help others when they feel angry.	
Reinforce skill with guidance.		Assign "Anger" Easy or Hard Quiz (depending on student's level). Students proceed to the next question only when they have selected the correct answer, allowing for immediate feedback and self-assessment opportunities
Opportunities to practice skill with scaffolded guidance.	Assign the "Anger" Talk About It activity. Students brainstorm ways to cope with anger.	
Provide opportunities to practice skill independently for feedback.		Assign "Anger" Activity. Students independently demonstrate anger coping skills through a skit.

Monitoring Progress Toward IEP or Intervention Goals with BrainPOP

Teachers can monitor progress toward IEP or intervention goals by viewing student progress on assignments via the Teacher Dashboard and leaving feedback that redirects student thinking or supports skill gaps.

Figure 19 below an example of the Teacher Dashboard. It shows student work submitted to target the goal from Example 1 (i.e., " By the end of the IEP period, when given a grade-level nonfiction passage, the student will **identify the main idea and provide at least three details** related to the main idea with 90% accuracy in three out of four trials.") Teachers can view Quiz answers or student work (as in Figure 20) to assess if the student has met the target goal.

Figure 19: Example Teacher Dashboard for Student with an IEP

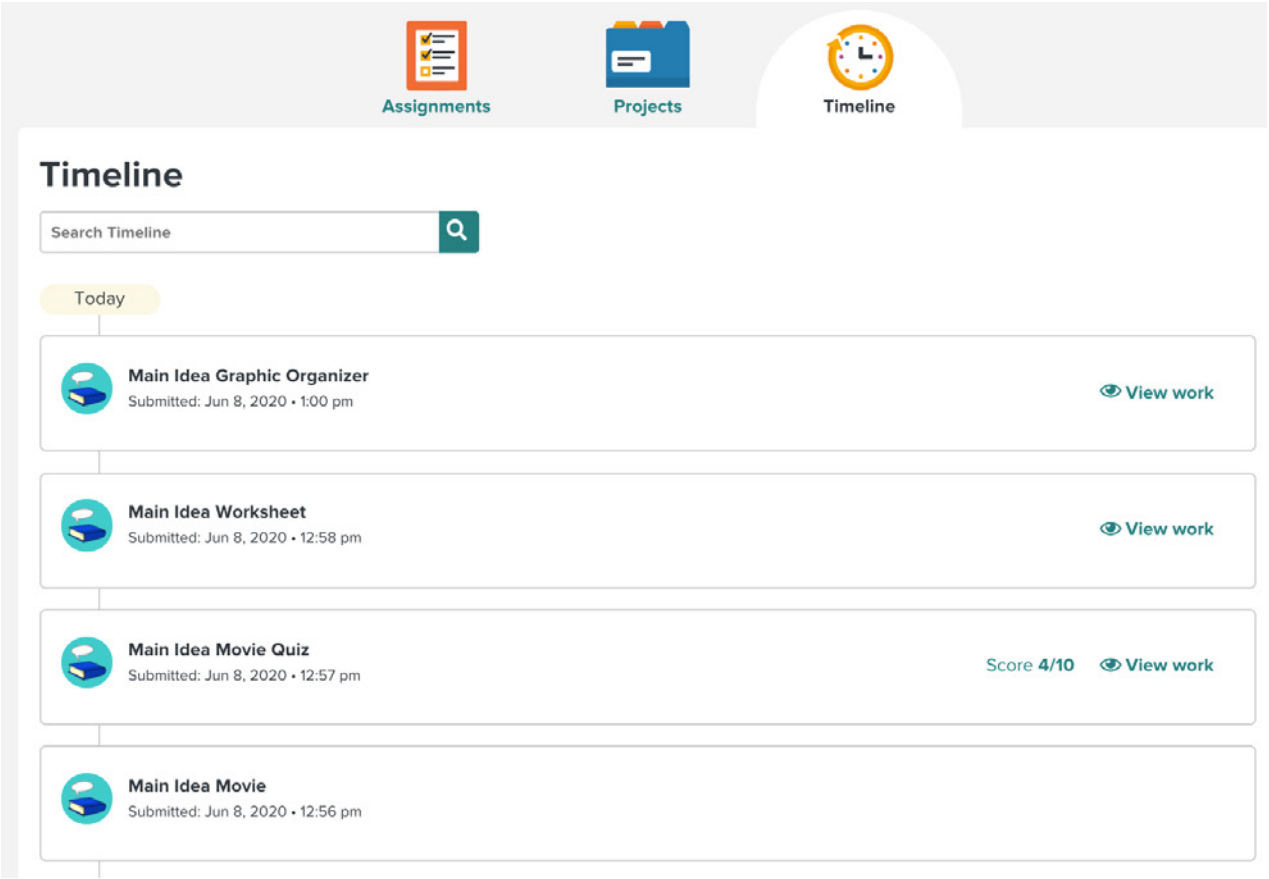
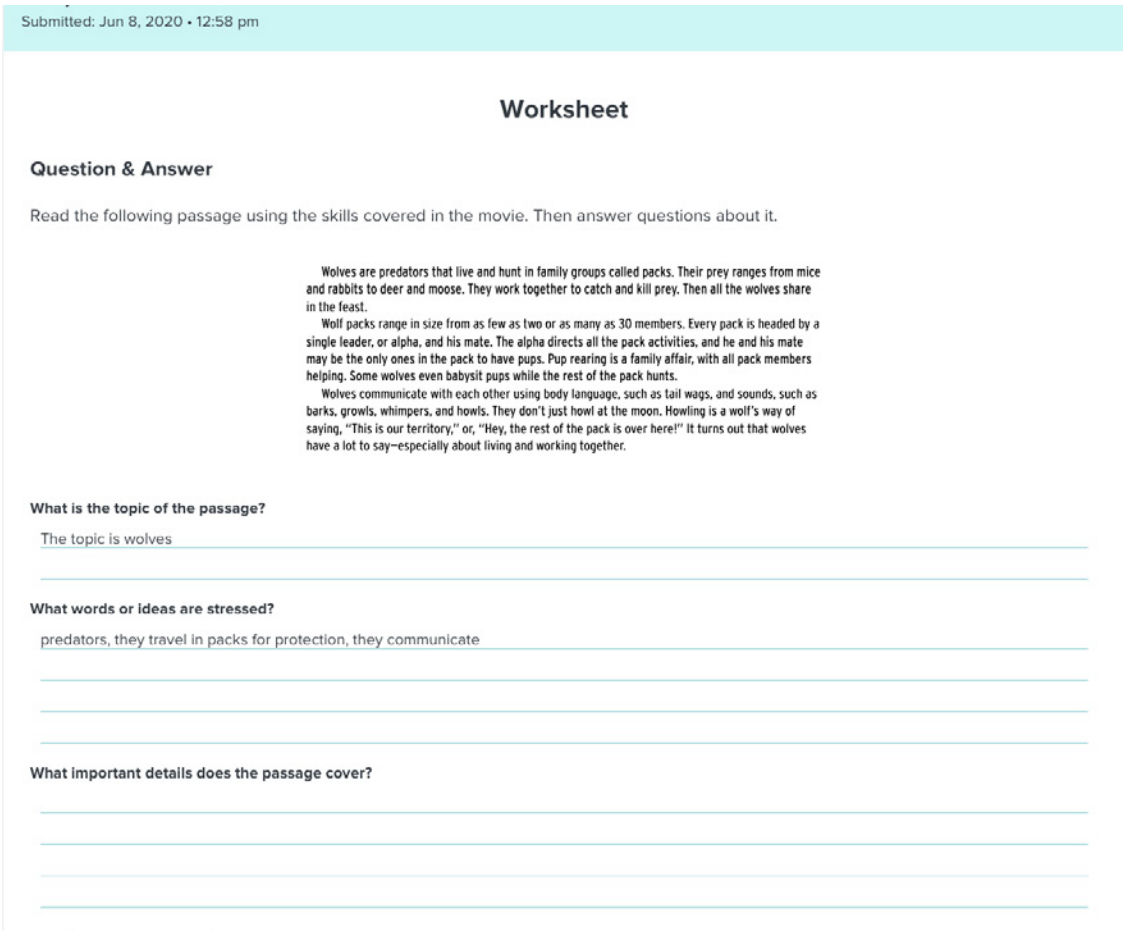


Figure 20: Example IEP Goal-Related Work Product



Submitted: Jun 8, 2020 • 12:58 pm

Worksheet

Question & Answer

Read the following passage using the skills covered in the movie. Then answer questions about it.

Wolves are predators that live and hunt in family groups called packs. Their prey ranges from mice and rabbits to deer and moose. They work together to catch and kill prey. Then all the wolves share in the feast.

Wolf packs range in size from as few as two or as many as 30 members. Every pack is headed by a single leader, or alpha, and his mate. The alpha directs all the pack activities, and he and his mate may be the only ones in the pack to have pups. Pup rearing is a family affair, with all pack members helping. Some wolves even babysit pups while the rest of the pack hunts.

Wolves communicate with each other using body language, such as tail wags, and sounds, such as barks, growls, whimpers, and howls. They don't just howl at the moon. Howling is a wolf's way of saying, "This is our territory," or, "Hey, the rest of the pack is over here!" It turns out that wolves have a lot to say—especially about living and working together.

What is the topic of the passage?

The topic is wolves

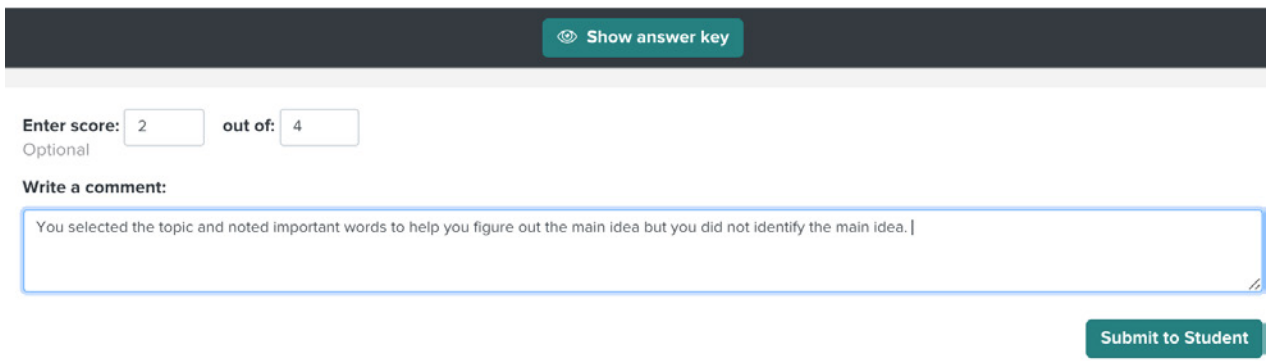
What words or ideas are stressed?

predators, they travel in packs for protection, they communicate

What important details does the passage cover?

In this example, the student has not met the goal as they did not identify the main idea or provide three details. The teacher has provided feedback (Figure 21 below) and can adjust instruction accordingly, such as assigning Make-a-Map or Make-a-Movie tasks that focus on finding the main idea with three supporting details.

Figure 21: Example IEP Goal-Related Feedback



Show answer key

Enter score: 2 out of: 4

Optional

Write a comment:

You selected the topic and noted important words to help you figure out the main idea but you did not identify the main idea.

Submit to Student

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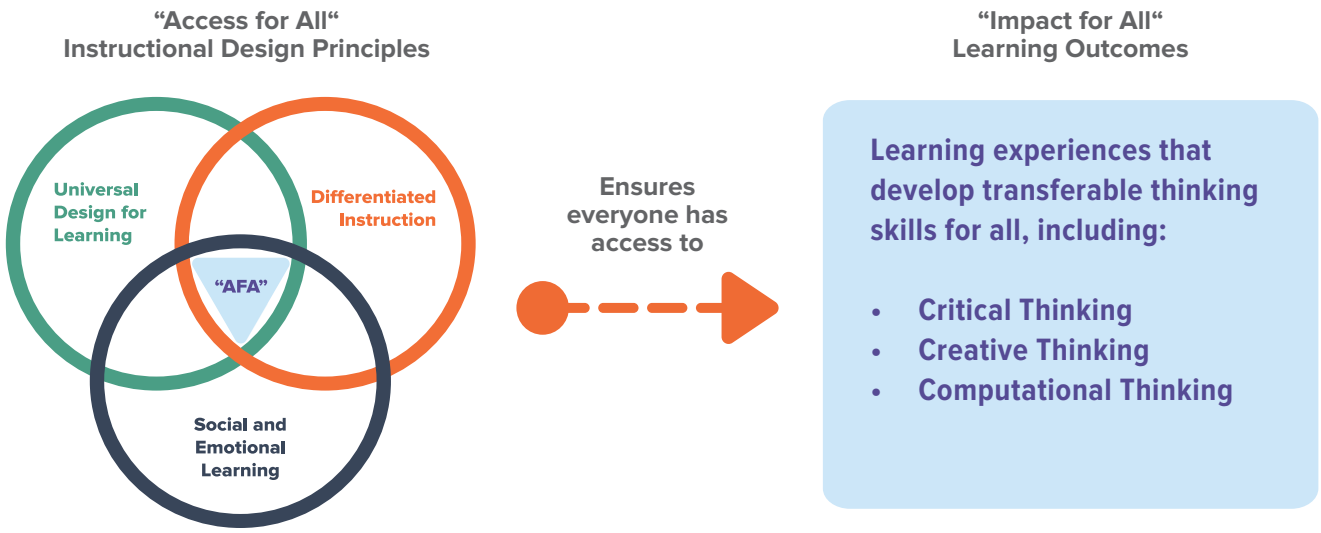
As Section 1 and Section 2 of this report demonstrate, BrainPOP embeds core elements of UDL, DI and SEL within the AfA framework to create equitable experiences at all tiers of learning. However, ensuring instructional access is one layer of BrainPOP's research-based design. The next section details how BrainPOP is also designed with principles proven to impact learning outcomes for all students.

Section 3

Impact for All: Evidence of Learning with BrainPOP

An online educational platform that is guided by the "Access for All" framework" holds the rich promise for supporting accessible instructional design. To ensure "Impact for All," the design must also take into consideration research findings on cognitive and affective learning outcomes, such as what leads to the development of transferable thinking skills.

Figure 22: Leading from "Access for All" to "Impact for All"



The Introduction and Section 1 demonstrate BrainPOP's commitment to integrating research on the science of learning into its development and design. Sections 2 and 3 show how BrainPOP has incorporated rigorous research about how people learn. While Section 2 illustrates how research, and particularly AfA, shaped BrainPOP tools and features, Section 3 describes how BrainPOP tools and features are designed to support the development of a broad range of transferable skills including critical, creative, and computational thinking

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Animated Movies

Animated movies are the heart of BrainPOP. Animations may be used for several learning purposes, from attracting students' attention to a specific area of the instructional material; through a demonstration of concrete or abstract procedures to be further understood and performed by the learner; to helping learners understand the functioning of dynamic systems that change over time (Berney, & Betrancourt, 2016). Animation is a dynamic representation that can be used to make change and complex processes such as natural phenomena, social processes or mechanical devices explicit to the learner (Schnotz, & Lowe, 2003). Computer animation is highly effective in the demonstration of processes that cannot be viewed naturally or that are difficult to demonstrate in the classroom or even in the laboratory. Regarding possible disadvantages, animation can be challenging for students, especially because of the amount of information to be processed or its transient nature. This in turn can lead to cognitive overload and inaccessible information (Mayer, & Moreno, 2002).

BrainPOP applies the following design principles to its animated movies to foster a high level of student engagement and knowledge transfer, balanced with grade appropriate cognitive load (Rosen, 2007; Barak, Ashkar, & Dori, 2011).

Conceptual: BrainPOP movie storylines feature big ideas and fundamental concepts, offering mental models for students to hang knowledge on, rather than laundry lists of said knowledge.

Contextual: BrainPOP movies build up to new concepts on a foundation of prerequisite knowledge. Guidance from teachers along with BrainPOP tools, such as its concept-mapping tool, Make-a-Map, help students connect new ideas to their existing models. While ideally, students will have some background knowledge on the movie's topic, the characters and storyline will provide context that deepens students' understanding.

Engaged. BrainPOP movies actively engage students with high-interest and timely topics they are curious about.

Original. BrainPOP movies provide an original slant on topics students are learning about in school. The story-like, narrated format makes BrainPOP different from other traditional forms of content delivery.

Visual. Thoughtful animation brings even complicated concepts to life, making them easier to understand.

Compress. BrainPOP movie narrators use conversational language making the featured concepts and ideas easy to understand and follow.

Metaphors. BrainPOP movies use metaphors as a way to promote mental modeling.

Advance. BrainPOP movies offer advanced topics for kids with deeper knowledge and motivation to learn and challenge themselves.

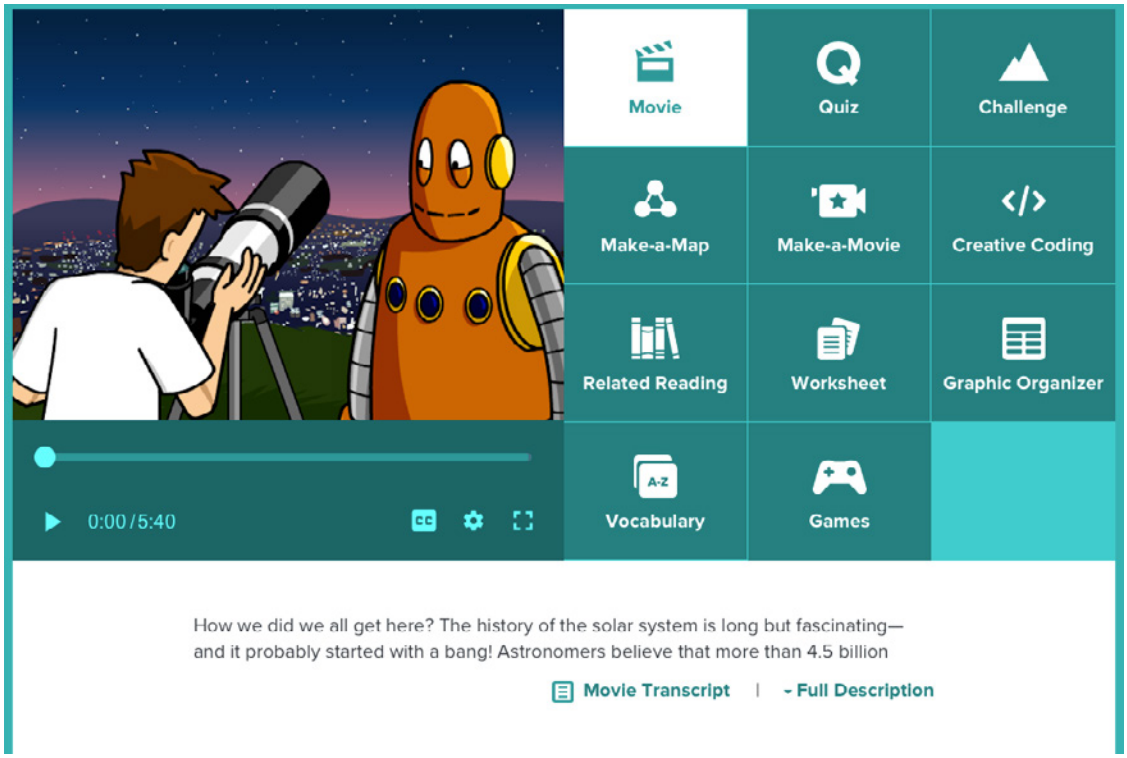
Completism. BrainPOP movies feature important concepts, events, biographies, and ideas but they don't try to cover everything in the textbook on a topic. Students may engage with the creative tools and playful assessments to explore a topic further.

Challenge. BrainPOP characters wrestle with the "how" and "why" of phenomenon, different viewpoints, and mysteries. These design principles on which BrainPOP movies are developed impact learning outcomes, engagement, and learning motivation.

Creative Tools

Learning experiences with BrainPOP typically begin with building knowledge by watching a movie followed by active development of knowledge and skills using creative tools, including: Make-a-Map, Make-a-Movie, and Creative Coding. These tools are designed with flexibility to not only create access to quality information on the selected learning topic (as detailed in Section 2) but to foster higher-order thinking skills such as, creative, computational, and critical thinking. Tutorials for each creative tool are available on BrainPOP's Educator site.

Figure 23: Core learning user interface on BrainPOP



In this section we will focus on three key creative tools utilized by students as part of the BrainPOP learning experience and associated target skills: Make-a-Map (fostering critical thinking), Make-a-Movie (cultivating creative thinking), and Creative Coding (advancing computational thinking). While each creative tool engages more than one essential skill, we describe each tool in association with the focal skill based on the key use cases in participating schools.

Fostering Critical Thinking with Make-a-Map

Concept map is an interactive, two-dimensional diagram that allows students to illustrate and represent their understanding of a concept or phenomenon by organizing, structuring and representing knowledge (Novak, & Cañas, 2008). Lines connect concept boxes to show a connection and arrows can be used to represent relationships between concepts. Ideally, concept maps should also be able to add mediating factors that influence the relationship between two concepts. Finally, cross-links represent a connection either between two concepts in different areas within a concept map, or between concepts in two separate concept maps.

A concept map is a cognitively challenging task that fosters critical thinking, leading with the following skills (Rosen, & Tager, 2014):

- Analyze and evaluate evidence, arguments, claims, and alternative points of view
- Synthesize and make connections between information and arguments
- Interpret information
- Make inferences using reasoning appropriate to the situation

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As described in previous sections, Make-a-Map is BrainPOP's concept mapping tool designed for students to visually show connections between ideas with images, clips, and text from the movie. They can also classify different nodes, and highlight connections to familiar ideas, contexts, analogies and metaphors with editable nodes and cross-topic images. Make-a-Map provides scaffolding and supports with partially-completed concept maps and templates. Using the Make-a-Map tool, students are able to create concepts, connect them, set directions for the arrows, observe the outcomes, and make predictions.

In a typical BrainPOP lesson, after watching an animated video on a selected topic, students are asked to demonstrate their understanding by creating a concept map. This activity can be followed by a classroom discussion based on authentic student generated concept maps, opportunities to modify/expand the concept maps based on critical analysis of the topic, and concept maps grading by teachers based on recommended scoring rubrics.

Figure 24: Student-generated Make-a-Map about American composer Duke Ellington

Cultivating Creative Thinking with Make-a-Movie

Creativity involves the development of a novel idea, or problem solution, that is of value to the individual and the larger social group (Kaufman, & Baer 2012). Creativity can be achieved by all students and can be developed through practice. Teachers who foster creativity in their classrooms recognize that creative thinking is not an extracurricular activity, but rather an interconnected part of their everyday curriculum, especially when naturally integrated into domain-specific learning (Beghetto, Kaufman, & Baer, 2014).

BrainPOP adopted the creative thinking definition proposed by Rosen, Stoeffler and Simmering (2020) as the capacity to expand beyond conventional boundaries to create unconventional and valuable solutions. Conventionality can be described as the ways in which something is commonly done, or the common solutions for a problem or challenge. We use the term "challenge" to refer to situations that call for creative approaches (e.g., designing a movie) but do not necessarily present problems to be solved. The understanding of conventionality allows for a better understanding of the boundaries and range of unconventionality and supports the processes of generating unconventional solutions. Creative thinking competency model includes the following five skills that can be cultivated and measured (Rosen, Stoeffler, & Simmering, 2020):

- Explore: Gaining an understanding of the conventions within a domain and/or challenge. The outcomes of exploring might include the identification of conventional features, variables, and boundaries for a domain and/or challenge. This, in turn, includes: inquiring, identifying, understanding, and evaluating the important components of the variables, features, and boundaries around what is considered conventional for both the domain and the challenge.

- Create: Imagining and creating new unconventional ideas based on an understanding of what is common or conventional. The outcomes of Create skill might include: The creation of multiple solutions that are as different from each other as possible, and/or multiple unconventional solutions that would not fall into categories of solutions previously identified as conventional.

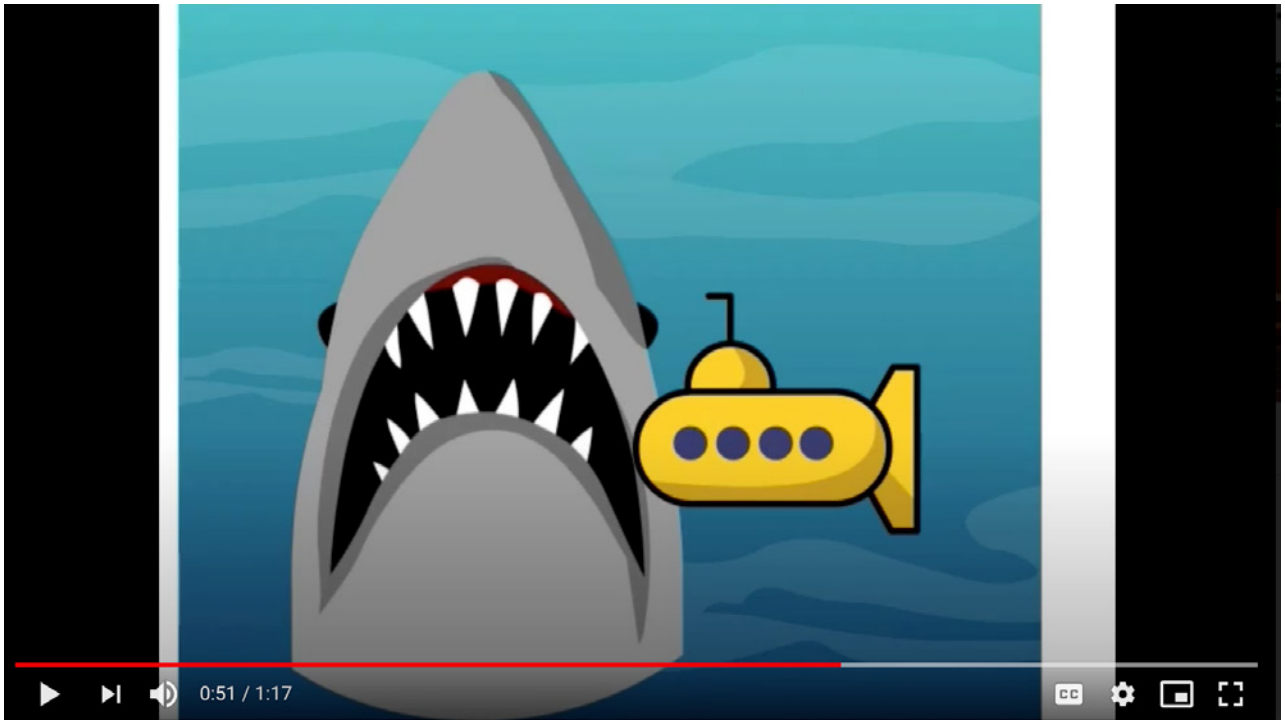
- Evaluate: Used in conjunction with other creative thinking skills throughout the creative thinking process as we seek to both determine what is considered conventional, unconventional, and valuable and also to understand what is influencing that determination. The outcomes of the Evaluation skill might include understanding the degrees of conventionality and unconventionality, feasibility, effectiveness and value of the solution, ideas, or artifacts generated in the Create phase.

- Improve: Further ideation to improve existing ideas and create an optimized solution for the challenge or problem. The outcomes might include the creation of an optimized solution or solutions for the challenge, the improvement of an existing solution based on a new constraint or value criteria, or the modification of a conventional solution to make it more unconventional.

- Communicate: The creation of communication solutions that make information relatable and accessible across a wide range of audiences. Successful creators are skilled at predicting how others might react to their novel ideas and solutions and being prepared to respond. Creative communication facilitates the representation and sharing of creative ideas using visuals (e.g., showing instead of telling) and text for the purposes of collaboration or application. The focus is on effectively impacting the reception and understanding of messages across a wide range of audiences by making information relatable and accessible.

With Make-a-Movie students produce their own unique BrainPOP-style movies, flexibly creating scenes with animated clips, images, simple text and varying background colors (see Figure 25). Using voice over or computer narration, students can explain a focused point or process.

Figure 25: Student-generated Make-a-Movie on the topic of Megalodon



Advancing computational thinking with Creative Coding

Visual programming environments such as Scratch and Blockly require students to use computational thinking skills to create programs primarily through graphical manipulation and interface with physical space in the external world (Pasternak, Fenichel, & Marshall, 2017; Resnick et al, 2009). These types of environments are highly accessible, do not require extensive prior knowledge of complex programming languages, and teachers can use visual programming environments to measure students' computational thinking. Using BrainPOP's block-based "Scratch" coding projects, students learn to give instructions by dragging and dropping blocks. The projects include six main elements: the subject; the subject's "world"; graphical objects; a library of command blocks or palette of predefined scripts; a canvas to create programs; and a button to run/execute the program. Students attach blocks to create a program of commands (or instructions), then 'run' or test the combination of command blocks to receive feedback, discovering how individual commands work and combine to form "statements." This iterative process of building and running command blocks illustrates the fundamental computational thinking skills needed to develop algorithmic solutions (Shute, San, & Asbel-Clarke, 2017).

According to the National Research Council, computational thinking consists of five essential elements that are universal across domains (National Research Council, 2010): (1) hypothesis testing, (2) data management, (3) parallelism, (4) abstraction, and (5) debugging. When solving a complex problem in any domain, one should generate and test hypotheses systematically to understand how the system works. Brennan and Resnick (2012) presented a computational thinking framework within the context of using Scratch to facilitate computational thinking skills. BrainPOP adopted this model for learning design to foster students' computational thinking that categorizes computational thinking skills into the following three areas:

Computational thinking concepts:

- Sequences: Instructions for computer to execute behaviors
- Loops: Repeat the same instruction for a specified number of times
- Parallelism: Concurrence of multiple instructions
- Events: Triggers for certain actions to happen to create interactive environments
- Conditionals: Constraints on execution of instructions, allowing for different outcome
- Operators: Mathematical and string operations
- Data: Data storage, retrieval, and update

Computational thinking practices:

- Being incremental and iterative: Iterative processes to design and implement solutions, step by step
- Testing and debugging: Trial and error processes to test and remove malfunctions as warranted
- Reuse and remix: Building reusable instructions; building new products on others' work
- Abstraction and modularity: Modeling complex systems with basic elements
- Computational thinking perspectives:
- Expressing: Perception of computation as a way of expression and creation
- Connecting: Perception of computation as a way of interacting and working with others
- Questioning: Raising questions and using technology to solve real life problems

BrainPOP's Creative Coding offers block- and text-based projects spanning the K-12 curriculum. Both coding projects offer opportunities to express understanding of a topic while practicing computational thinking. Scaffolded and delivered at the topic level, the projects are specifically designed so that all teachers can easily introduce and seamlessly integrate coding.

Figure 26: Creative Coding projects types available on BrainPOP

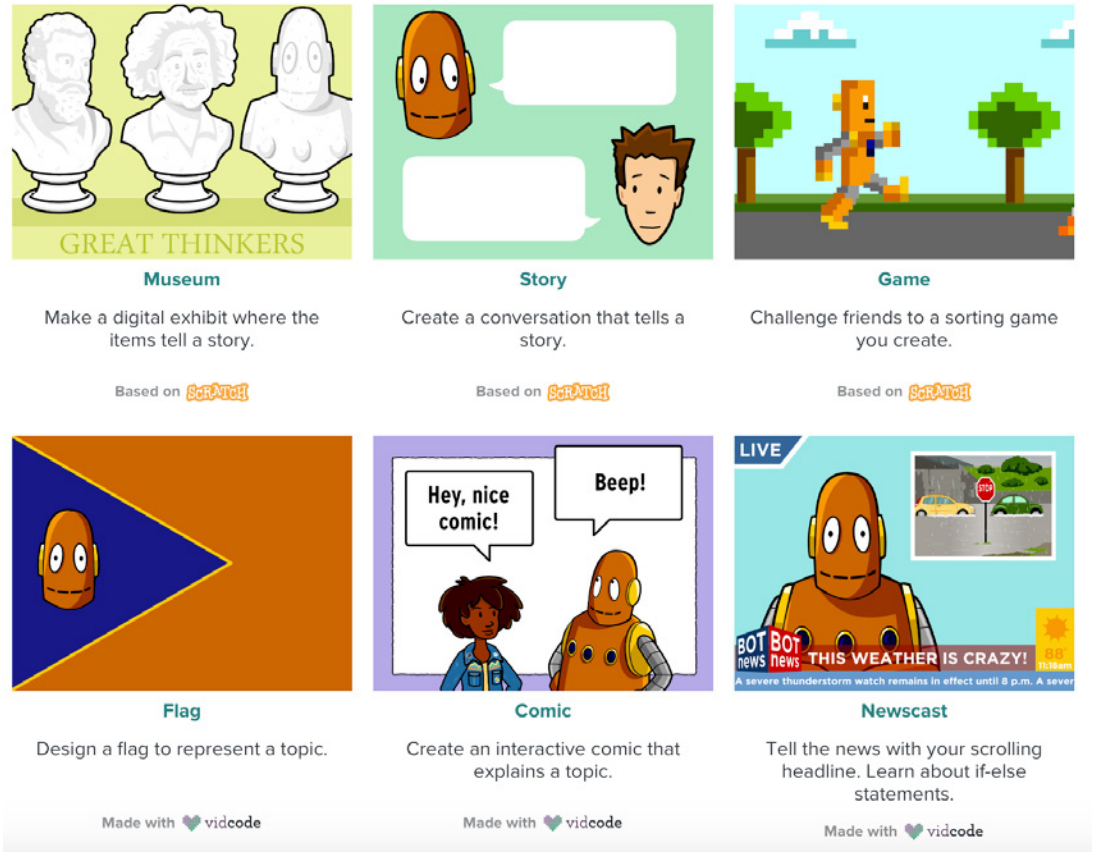
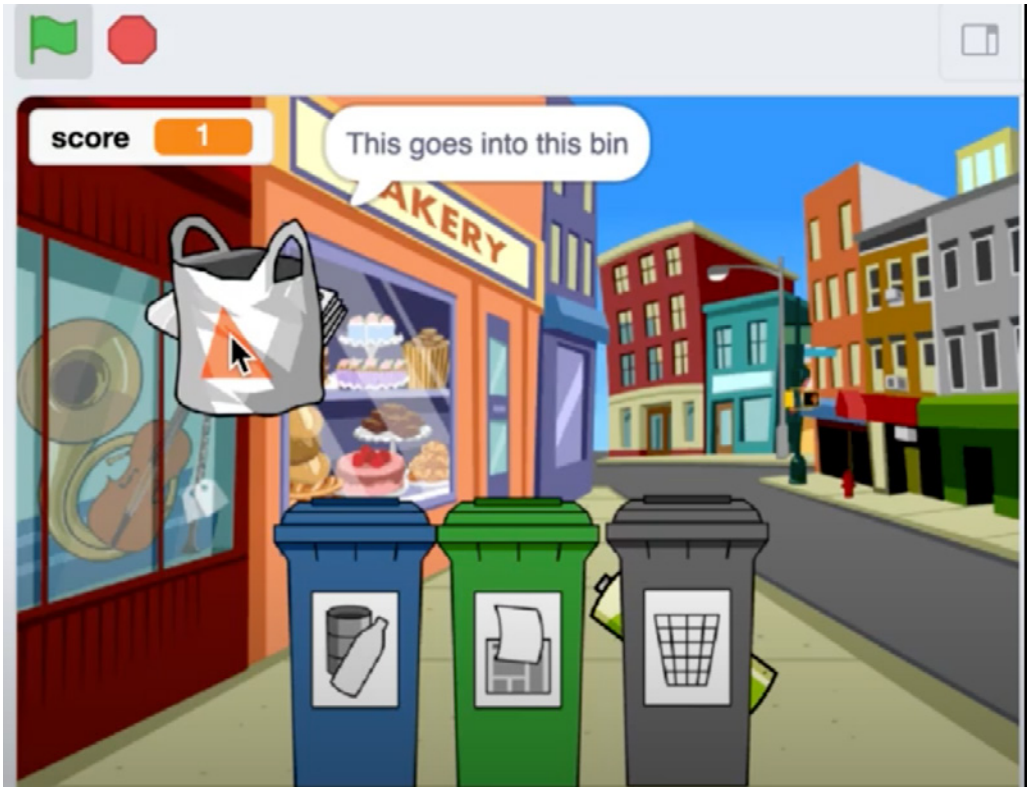


Figure 27: Student-generated Creative Coding game on the topic of recycling



Following is a summary of two efficacy studies that explored the effects of BrainPOP on learning outcomes. Please see Rosen (2009) and BrainPOP (2018) for further details on the rationale, method, and findings from each study.

Efficacy Study I: Effects on Transfer of Knowledge and Learning Motivation
The first efficacy study addressed the following research questions (Rosen, 2009):

1. What is the effect of learning with BrainPOP on transfer of knowledge, within the context of science and technology learning?
2. What is the effect of learning with BrainPOP on motivation for science and technology learning?

The study was conducted in Israel during the 2007-2008 school year, in five elementary and three secondary schools. All participating schools integrated teaching and learning based on the BrainPOP animation environment in their standard curriculum on a subject matter “Science and Technology.”

418 students participated in the study: 250 from 5th grade and 168 from the 7th grade. Students in the experimental group participated at least once a week in science and technology lessons using BrainPOP . for two to three months depending on the topic being taught. None of the students had participated in the past in this type of instruction. The students had full access to BrainPOP during after school hours as well. Eight science and technology teachers volunteered to participate in the study. To eliminate or reduce the teacher effect, in most cases the same teacher taught both the experimental and the control group. All teachers had at least seven years of seniority.

The study consisted of performance-based assessment tasks and a questionnaire administered using the pre-post method:

- Pre-test: Before participation in classes integrating BrainPOP into the learning process.
- Post-test: After the end of the learning period (2–3 months) of the relevant topics for each grade.
- The research revealed the following key findings:
- Learning with BrainPOP significantly increased the ability to transfer scientific and technological knowledge of elementary-school students (ES = 1.00, $t = 11.50$, $p < .001$) and secondary-school students (ES = .93, $t = 8.41$, $p < .001$). During the same period, the findings showed only a low increase in the same ability of the control group.
- Learning with BrainPOP into the learning process significantly increased science and technology learning motivation of elementary-school students (ES = 1.70, $t = 15.28$, $p < .001$) and secondary-school students (ES = .91, $t = 9.90$, $p < .001$). During the same period, the findings showed a decrease in motivation in the control group.
- Pre-post qualitative analysis of students' drawings demonstrated that most of the elementary-school students showed the learner at the center of classroom interactions (58.1% compared with 20.7 before the experiment and with 19.6% in the control group during the same period). The drawings illustrated the use of technology (63.6%) and showed greater emphasis on scientific equipment (38.8%). Most of the students' figures that appear in the drawings showed interest in learning (64.5% compared with 32.4% before the experiment and with 28.3% in the control group during the same time). Only small differences were found in the control group between pre- and post-test drawings. Similarly to elementary-school students, after the integration of BrainPOP animations into the learning experience, most of the secondary-student drawings placed the students in the center of the classroom interaction (51.2% compared with 6% before the experiment and with 13.6% in the control group during the same period). The drawings illustrated technology (45.8%) and emphasized scientific equipment (52.1%). Most of the students' figures in the drawings showed happiness and interest in learning (52.5%). Only small differences were found in the control group between pre- and post-test drawings.

Efficacy Study II: Effects on State Test Scores

The second BrainPOP efficacy study addressed the research questions associated with the impact of the educational platform on students' state test scores in Math, English Language Arts, and Science in grades 3-8 (see BrainPOP, 2018 for further details). This efficacy study takes a broad perspective on the use of BrainPOP in schools. Considering the non-prescriptive nature of BrainPOP's relationship to teaching practices, it's difficult to consider what implementation with fidelity may look like. For the purposes of this research, we considered the broadest use case—simply being a BrainPOP subscriber—to be the most inclusive intervention category that best accommodates the multitude of use cases that occur with BrainPOP. Research that considers which use cases of BrainPOP are most effective at fostering student achievement will be left to further studies. This study determined whether the use of BrainPOP in some form generally leads to higher student performance.

The approach to efficacy used in this paper also allows a determination of product value at a large scale. Studies of efficacy or effectiveness frequently focus on a single district or state. In contrast, this analysis extended the methodology across five states, each with a different achievement test. We chose five states for the analysis that best fit a mix of the following criteria: available and easily accessible public test score data, public test score data that used raw numbers rather than percentiles for schools, states with a significant BrainPOP subscriber base, and states with a relatively large number of schools. The last two criteria were intended to ensure relatively large sample sizes in both the intervention and control groups to best aid statistical testing. These criteria led to the selection of the following five states: California, Colorado, Florida, New York, and Texas.

For this study, we included data from the 2015-2016 school year. A school was considered a BrainPOP subscriber (intervention group) if it had an active subscription to BrainPOP for the entire school year (September 2015 to June 2016). The non-subscriber group (control group) included schools that did not subscribe to BrainPOP, as well as those that had a subscription that either started or ended mid-way through the school year. BrainPOP offers multiple products, but only a subscription to the flagship BrainPOP product was used to segment schools into the intervention and control groups. It is worth noting that many of these schools had a "Combo" subscription, which included BrainPOP Jr. (K-3), BrainPOP Español, and BrainPOP Français. This analysis was also limited to K-8 public schools due to ease of access to public school test scores; private schools (both subscribers and non-subscribers) were excluded from the analysis.

The results qualify as Moderate ESSA Evidence, showing that schools with a BrainPOP subscription had a greater increase in standardized state test scores than a matched control group in all three subject tests: Math, ELA, and Science. The effect was always positive, always statistically significant, and verified in five states. To further validate the results, two additional correlational analyses that qualify as Promising ESSA Evidence were also performed. These analyses found generally positive results that were often statistically significant. The strongest effects were in grade 3-6 and in Math and Science.

Conclusion

Ensuring all learners have equitable access to rigorous learning opportunities is a challenging task. Online educational platforms driven by learning science research have rich potential to support creating instructional access to high-quality learning experiences. BrainPOP has demonstrated its deep commitment to integrating research on learning into the design of its content and tools. The "Access for All" framework is based on rigorous research about how people learn to aid the development of a broad range of transferable skills. This commitment anchored the design of the original BrainPOP platform, is evident in its current form, and will continue to guide its development in the future.

Acknowledgments

This paper would not have been possible without the collaboration and contribution of several others. We would like to express our sincerest gratitude to:
Andrew Gardner and Kevin Miklasz, Ph.D. - For your thoughtful review and feedback throughout the process
Jackie Glassman - For your keen eye and attention to detail and consistency
Enrique Hernandez, Sari Turner, Jinn Liu, and Renae Rodriguez - For your collaboration and design expertise

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