# Instructional Infrastructure:
# The Next Generation of Teaching & Learning Tools

This white paper explains why the design and implementation of *Concept Construxions*® represents a novel classroom system for teachers and learners. The US-patented system (#7,896,651) is designed to promote coherence and creativity, to provide scaffolding that supports certain learners yet pushes others to advance in their thinking—all in the same classroom conversation. *Concept Construxions*® helps concretize academic and professional discourse, giving learners access to the languages of power through visual cues that create intra- and inter-disciplinary connections.

The current landscape of high-stakes accountability, severely limited budgets, raised expectations for students representing a range of demographics and complex needs, and a renewed emphasis on college-readiness standards and 21st century skills, demands much, much more than instructional materials have delivered in the past. Some educational developers have surveyed this landscape and responded with scripted programs tied to strict assessment schemes. At Teachers for Learners, we believe that the opposite approach is necessary. *Concept Construxions*® is the first tool from Teachers for Learners that bridges research and practice to deliver an elegant solution that is:

- **Horizontally articulated** across disciplines
- **Vertically articulated** to support multi-age and multi-level use (ages 10-Adult)
- **Multifaceted**, providing a variety of physical and digital use cases
- **Flexible**, encouraging an array of instructional and communicative purposes
- **Intuitive** for teachers and learners alike, requiring only a short immersive orientation
- **Stable** enough to survive changes in the field
- **Durable** enough for repeated and long-term use
- **Robust** enough to meet the needs of diverse learning settings, teaching styles, years of experience, levels of formality, and learner profiles
- **Low-cost**, permitting modular purchases that fit learning settings appropriately
- **Customizable** within and between a variety of user levels
- **Compounded impact** with additional levels of user implementation (i.e., not just more users, but more powerful usage)

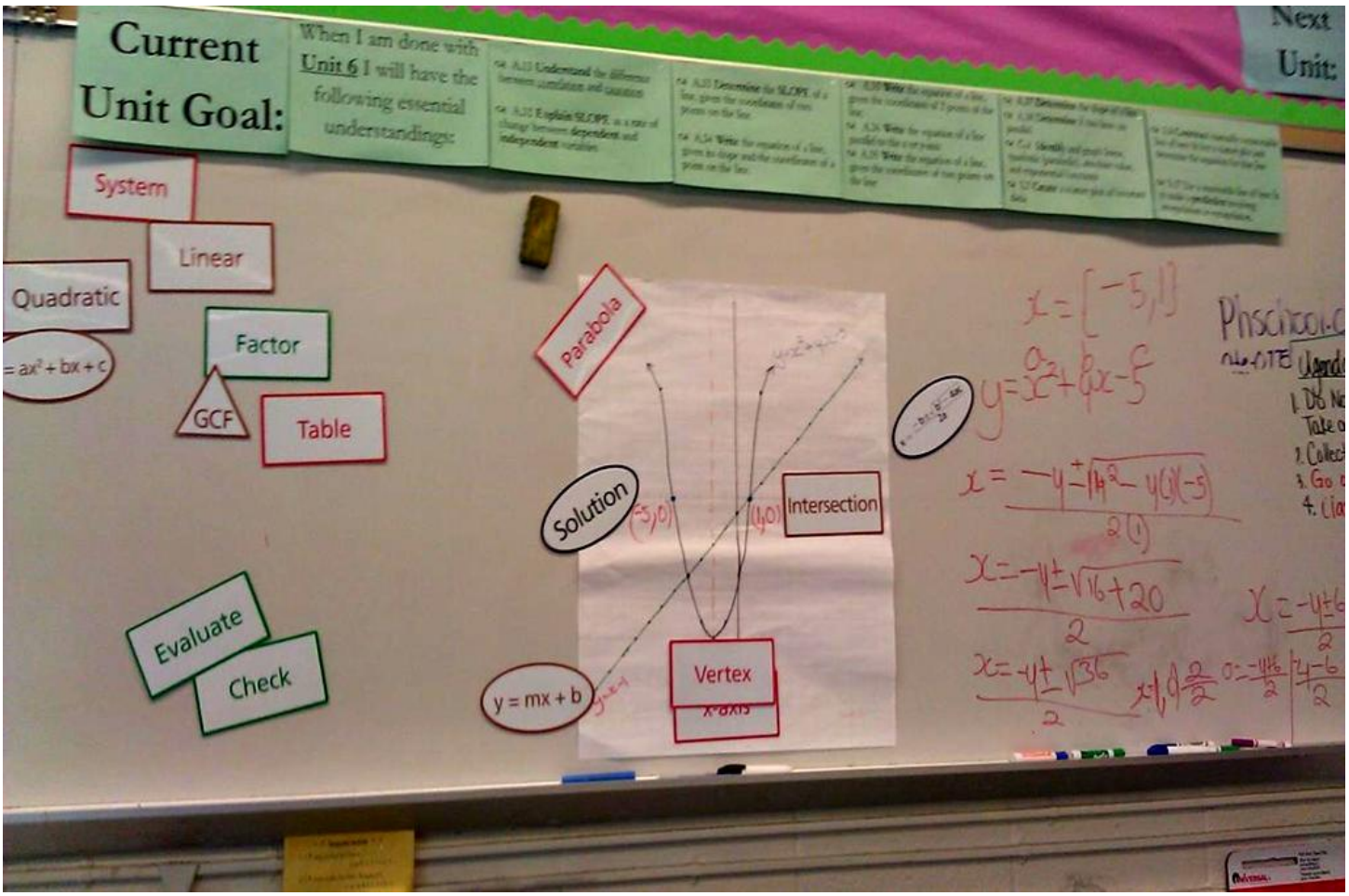
These are not catch-phrases; they are commitments. Teachers for Learners was founded by teachers, administrators, researchers and professional development providers who believe that the most effective teaching tools are based on current research, designed by experienced educators and rigorously tested in a variety of learning environments. Our mission is to contribute our collective expertise to educators at large, through practical solutions that optimize teaching and learning for all.

Teachers for Learners has collected extensive data and consumed copious educational literature to ensure the quality and integrity of our tools. In this paper, we invite the reader to learn about our journey.

The sections of this paper include:

1. **Key Design Elements of the System**
2. **Implementation, Customization and Purchasing Models**
3. **Custom Professional Development Aligned to Local Initiatives**
4. **Ongoing Data-Driven Development: Primary, Market and Case Study Research**
5. **Select Instructional Models That Underscore Classroom Implementation**
6. **Digital Concept Construxions: A Demonstration of Ed. Tech. 2.0**

References are provided at the end of the document, and are cited throughout.



# Key Design Elements of the System

The three main components of the *Concept Construxions*® (CCX) system include:

1. *Concept Cards* (packaged in 225-card Subject Sets and 75-card Accessory Packs)
2. Construxion Site (portable roll-up display panel with carry straps)
3. Converse and Convey Panel (semi-permanent display panel for archiving displays)

**Concept Cards deliver a concept-based approach—**Many products are aligned to specific grade levels, textbooks or assessments. Concept Construxions is designed to focus on key concepts in each discipline/domain, based on national, state and regional standards. The 225 Concept Cards in each Subject Set represent high-frequency concepts that no teacher can live without. 75-card Accessory Packs that focus on special topics may be added to expand the offering.

**A concept-based approach allows the same Subject Set to be utilized at a variety of ages and grade levels**. For example, Concept Cards such as "Equation" or "Line" are used by a large span of math students, even into the university levels. As students grow and learn, their facility and flexibility with these concepts increase. As the math problems become more difficult, students must learn to think and discuss "Equation" and "Line" in new ways. The stable yet flexible nature of a concept-based approach helps students build schema and apply knowledge over multiple contexts.

For increased flexibility, blank cards are included in every subject set, and as seen below, there is an entire Accessory Pack that contains only blank cards. Teachers do not have to worry about losing a Concept Card; they easily can make a new one. They also have the ability to customize the use of the system by adding concepts and ideas that are appropriate for their classroom experience.

We have evidence that this approach works: there are currently ~2500 trained teachers of Grade 4 (age 8) through High School remediation (ages 19-20), across 15 US states and the Commonwealth of the Bahamas, including 700+ users in New York City. These teachers represent a wide diversity of standards, curricula, textbooks, student demographics, technology integration, standardized tests and teacher accountability structures. All of these educators and students are using the same subject sets with facility and success.

Current Subject Sets (225 Cards):

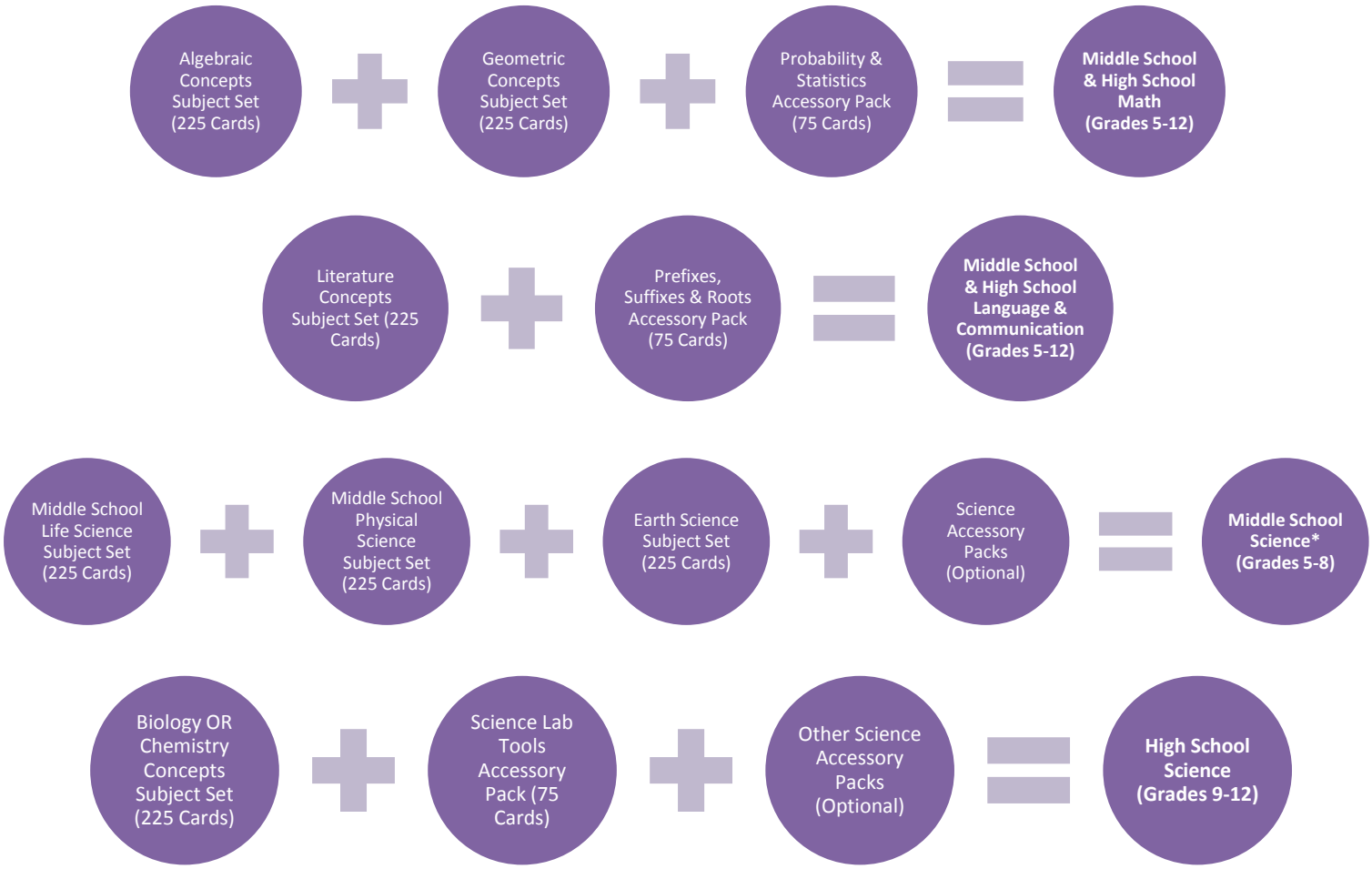
- Algebraic Concepts
- Geometric Concepts
- Literature Concepts (Language Arts)
- Chemistry Concepts
- Biology Concepts
- Earth Science Concepts
- Life Science Concepts
- Physical Science Concepts

Current Accessory Packs (75 Cards):

- Probability & Statistics
- Prefixes, Suffixes and Roots
- Science Lab Tools
- The Human Body
- Weather Instruments & Symbols
- Blanks (no topic)

The figure on the next page shows that many grade levels currently benefit from CCX in the United States, as the design does not feel "too old" or "too young" for learners. Teachers who present the system to honors-level high school students have remarked on how receptive their students are to using CCX as a learning tool. The smart, interactive, flexible design of the tool is appreciated, and the color-shape system is not dismissed by older students. Rather, as intended, it helps them situate concepts by category and usage. Sometimes students may have special learning needs and may not "fit" the school level or course indicated for their age. In this case, teachers have flexibility to choose or share subject sets accordingly, even beyond the recommended grade ranges.

We recommend the following combination of Subject Sets and Accessory Packs for the domains and levels indicated, for most US schools. New domains and Accessory Packs are being designed at this time. Due to the modular nature of the system, teachers may wish to add Accessory Packs, extra panels, magnets, etc. to customize for their particular situation.




*These Subject Sets also are appropriate for integrated science courses at the high school level. Physical Science Concepts are appropriate for Conceptual Physics/"Physics First" courses at the high school level.

By focusing the entire system on concepts instead of discrete learning goals, CCX is poised to provide a long-term solution. Standards may change, but key ideas and concepts remain the same. The share-ready system of shapes and colors may mean swapping with the teacher next to you, but it will not mean throwing out the set. The investment is lasting, even as the educational landscape changes. This positions CCX as a robust and elegant system for critical thinking, student engagement, and academic vocabulary acquisition that provides long-term stability, curricular coherence, instructional flexibility and operational expandability for any school network or national ministry.

**Concept Cards create a vertical and horizontal articulation, or "instructional infrastructure"—** Unlike regular vocabulary programs, CCX is a powerful cross-curricular, multi-level system. It is designed to honor the language and accompanying discourse of each discipline or domain (i.e., math, science, etc.), while simultaneously creating coherence for students and teachers. This is accomplished by a color-shape system that offers students a pattern recognition tool. In this way, we give students access to academic domains by removing the mystery. We are inviting students to engage in academic discourse at much earlier ages. Students can talk "the way scientists talk" or "the way mathematicians talk" and gain college and career readiness in the process.

Colors represent domain-specific categories. Each color represents a category that organizes many ideas within a single domain. This is useful for students who may not have any idea what a new concept represents. The color category gives them one clue. It is not necessary for each domain to include all colors, but a single domain cannot include more than 5 colors plus one default/general category (Black). This is because more than 5 colors become too confusing for students, and because the major concepts of the discipline should not be "forced" into a category. If the concept does not readily fit one of the color categories, it is put into the General category. Please see below for the three domains that have been built to date:

**English/Language Arts**


**Mathematics**


**Science**

Notice that in a domain such as science, there are different strands or disciplines that name different subject sets: Earth Science, Biology, Physical Science, etc. However, all science subject sets follow the same color scheme. This is critical for schools, districts and regions that want to coordinate implementation. The color categories encourage students to make connections vertically within a single domain--from course to course and year to year.

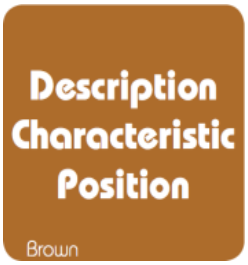
Also note that the color categories represent common entry points—not the only category useful for a given concept or idea. The color categories are intended as a guide for students who are initially learning these concepts. As learning becomes more sophisticated, students may view a single concept as a member of more than one category. This is excellent! At this moment, it is possible for the student and teacher to use a colored dry-erase marker and outline a border in an additional color to show both categories. Or, a blank card may be used to create a new Concept Card altogether.

Color categories correlate across domains. While color categories are domain-specific, they loosely correlate from domain to domain. This correlation creates a powerful, compounded, visual effect as more classrooms in a single school use the system. Thus, the colors do support curricular coherence. For example:

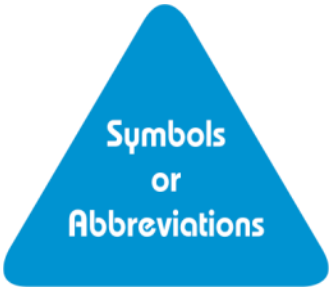
**English/Language Arts**

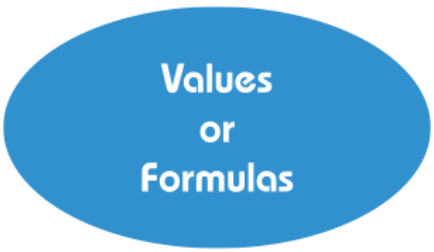

**Mathematics**

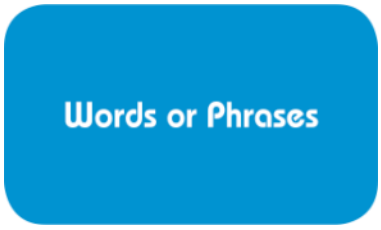

**Science**




Shape categories are identical across domains. Further coherence is created through the use of three shapes: triangle, oval and rectangle. Each shape represents different types of concepts, adding another layer of visual cues for students. The interplay between prose and symbols/notation in each domain can be confusing for students who are trying to build schema and learn language. Triangles distinguish this symbology. Students also have difficulty with numeric or quantitative concepts, regardless of domain. Ovals help emphasize those ideas that represent values, formulas, numbers, years, stages/phases, etc. Rectangles serve as a catch-all or default category for everything else.

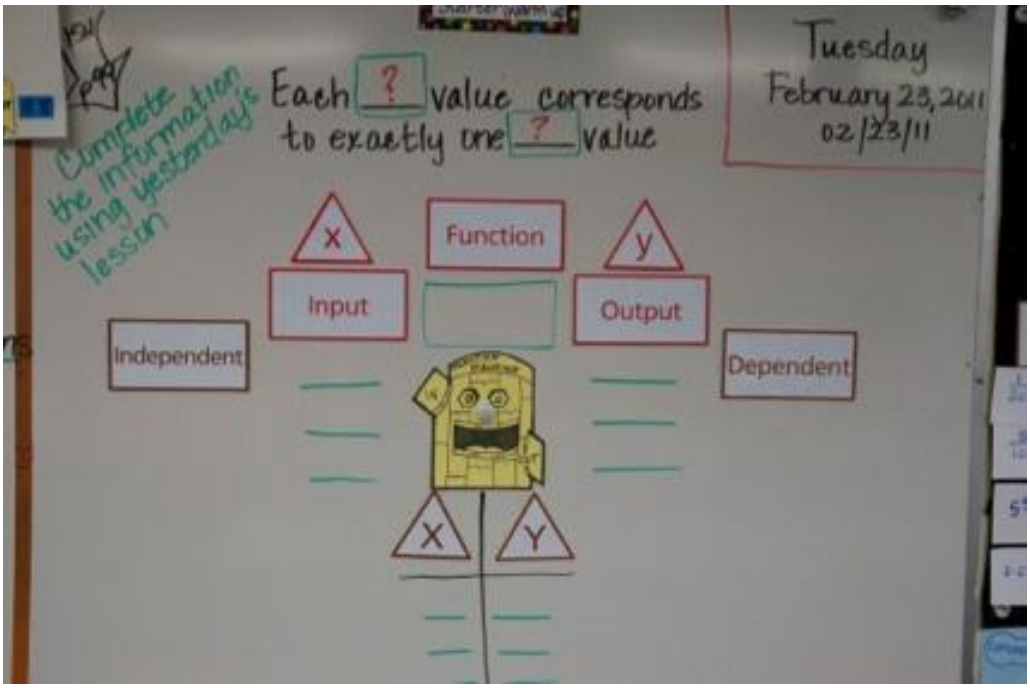



Each Concept Card, then, is defined by one shape and one color. It is the case that some Subject Sets include some combinations but not others. For example, there are no triangles in the *Literature Concepts* set for the United States. This is because the sentence notations and punctuation concepts are part of the *Grammar Accessory Pack*, soon to be released for sale.

The photo below displays two different colors for the same symbol, indicating that in a simple function, the “x” value is both an input as well as an independent variable. These math students were ready to make that conceptual connection, and the teacher seized the moment!




**Leveraging the Literature**— In fact, students are far more likely to use new words and concepts correctly in their writing after they have had the opportunity to communicate their understanding verbally and through gesture, with opportunities to be corrected and to find clarification in their understanding (Roth, 2004). Costa and Marzano (1991) explain, “As children hear these terms daily and develop the cognitive processes that these labels signify, they will internalize the words and use them as part of their own vocabulary.”

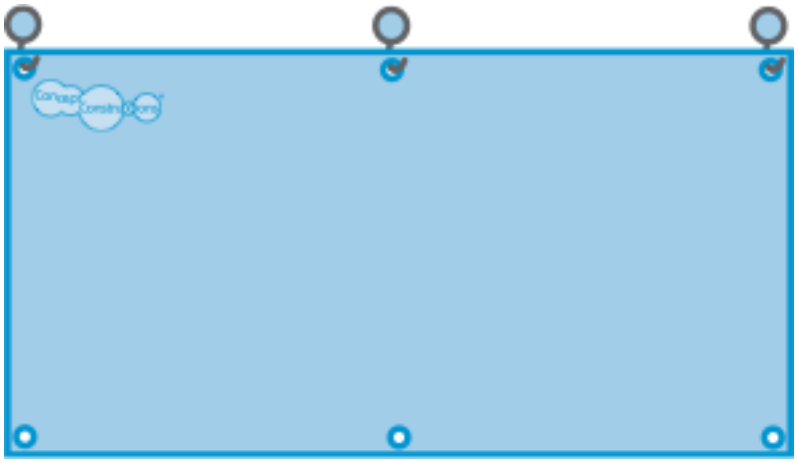
Many researchers in the field of reading believe that vocabulary acquisition must occur in the context of analysis in order for the words to really stick (Juel & Deffes, 2004; Marzano, 2004). CCX allows students to engage in the process of creating conceptual relationships among words, symbols and numbers, and to demonstrate how a single concept can be used in a variety of contexts with distinctly different meanings. CCX provides for conceptual category entry points, as the system visually cues students to attach larger concepts to the individual labels we call academic vocabulary (Marzano, 2004).

When teachers engage Concept Construxions activities that include methods such as anchored word instruction, a process by which the teacher sounds out the word, creates a visual representation of the word, and explains its meaning in context in which it is introduced, students with poor oral language skills are able to create a deeper understanding of new words than they would otherwise (Juel & Deffes, 2004). Concept Construxions facilitates teacher modeling of appropriate word use in speaking and writing, which is particularly useful for students with a low level of literacy.

Anchored word instruction, however, is only as useful as the timeliness of its use. This is why CCX was designed as an “always-on” thinking tool. In other words, it is essential to first utilize the Construxion Site either immediately before a word or concept is introduced or immediately after.

Vocabulary acquisition is particularly important in the pre-reading stage. When students are introduced in advance to key words that they may not have seen before, and which they will not necessarily guess from the context in which it is located, they are better able to understand the concepts essential to comprehending the reading selection (Blachowicz & Fisher, 2004).

**The Construxion Site® names a variety of flexible physical spaces where the system is utilized**. The second component of the CCX system relates to the physical space where students use the Concept Cards. The tangible manipulatives require a place for students to construct meaning. Our market research demonstrated that many teachers felt that their classroom wall or board space was limited. In order to help overcome that obstacle, we provide 100 cm x 150 cm black fabric panels to act as additional, portable physical space in classrooms that require it. Teachers can put the panel up for an activity, perhaps temporarily covering something on the board, and then remove it once the activity has concluded. The Construxion Site also has a carry strap, allowing teachers to move it from space to space with ease.

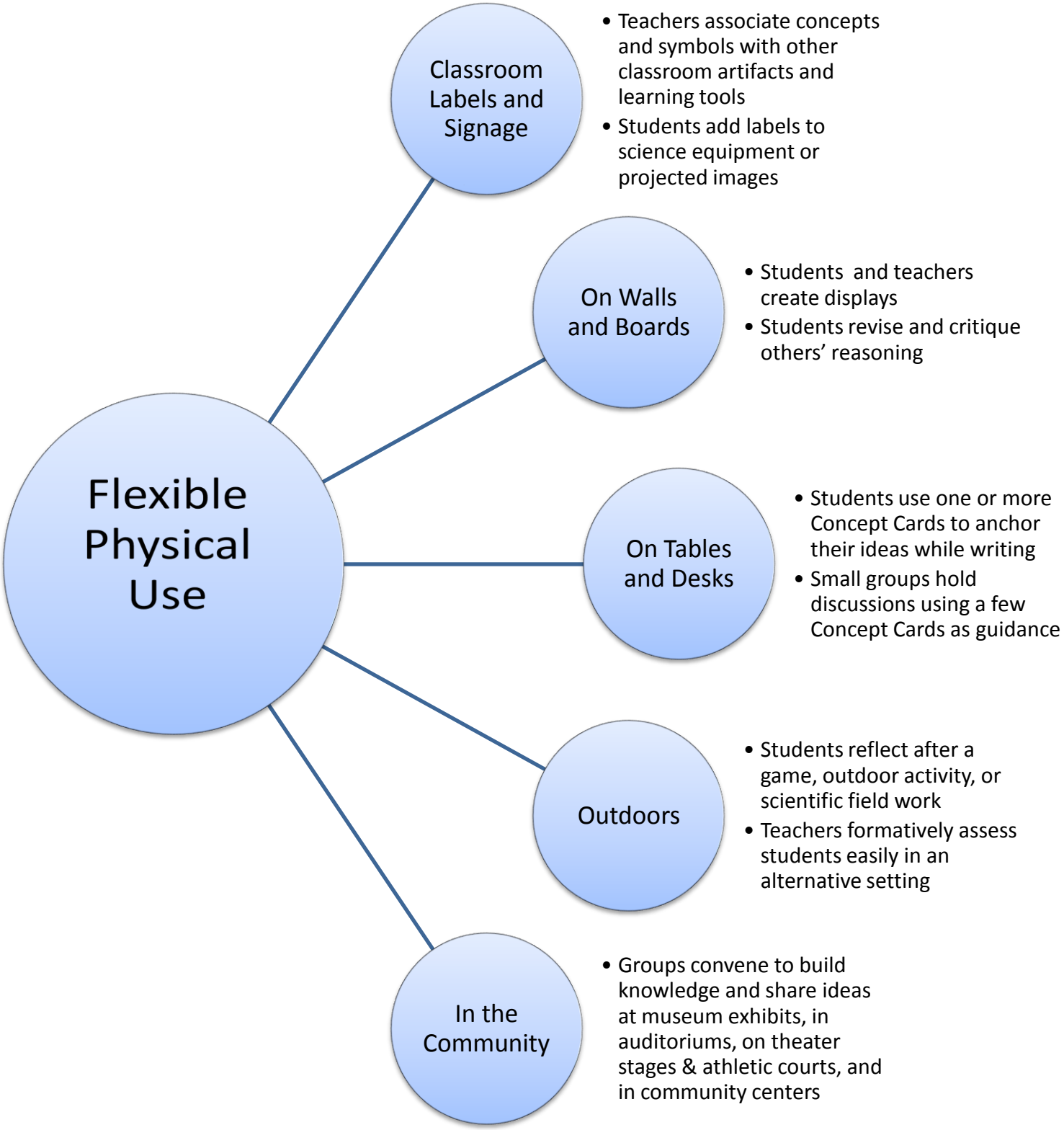


Concept Cards affix to the panel using Velcro™ fabric adhesive dots In addition, magnet adhesives affix Concept Cards to magnetic white boards (i.e., not all white boards are magnetic). The system is designed to use both types of adhesives and on the same Concept Card. For use on tables, the floor or the ground, no adhesive is required.

**The Construxion Site® invites active student engagement and multi-modal learning** The name of this component, and the name of the entire system, was based on John Dewey's social construction of knowledge (1933, 1938). Many administrators want teachers to create student-centered learning environments that are interactive and engaging for a diverse set of learners. However, teachers (and even students) may have trouble understanding what that sounds like, looks like, and feels like. Traditional teacher training and pedagogy courses often do not concretize interactivity for teachers who need to shift their practice. Through the use of CCX, teachers can take steps to make their classrooms more interactive, by engaging all modes of learning as well as learner readiness levels.

Short or extended learning experiences that combine visual, auditory, oral and kinesthetic modes make it easy for different kinds of students to participate in the same activity. Real academic discourse combines these modes with collaborative critical thinking; academics push each other to revise and consider alternative models and perspectives. With CCX, students tangibly "give" and "get" concepts from others, and this exchange helps them understand why idea-sharing is essential for learning and progress. Further, teachers can monitor the dynamic to note which exchanges are moving the class forward, which are not, and where confusions lie. English Language Learners and Special Needs students also use the system to help articulate their understanding to teachers and peers. Some of these students do not even need to speak; the physical movement of the Concept Cards in relation to one another gives the teacher insight into their thinking. Further, students do not feel as though they are being quizzed when using the system. They are more relaxed and find it easier to take risks, ask questions, and revise other students' work.


**These design features support a fluid use of *the same physical materials in multiple settings and situations*[1]:**




[1] Please see page 36 for the complementary digital use case, which is currently under development.

**Leveraging the Literature—** Through a variety of activities (e.g., races, card games, openers, mini-presentations, etc.), CCX can engage students with a range of learning styles. "Instruction that focuses on the multiple dimensions of a word will provide students with more secure knowledge than will instructional approaches that focus on only one of the word's dimensions" (Juel & Deffes, 2004). On the back of each Concept Card™ is a space for teachers and students to log all of the Classroom Contexts in which a given concept is used. In this way, the same Concept Card may return to the Construxion Site® and its reappearance may be documented. Students who tend to process new information through visual, auditory or tactile means potentially are able to learn concepts and words through this comprehensive system.

Recent research in the field of neuro-cognition has shown that a portion of the brain that is primarily used for kinesthetic operations, the cerebellum, is also activated in "response to phonologic and semantic tasks" (Fulbright et al., 1999). Some educational researchers believe that physical activity and gesture, incorporated into vocabulary and reading activities, reinforce substantive comprehension of key concepts regardless of which learning style a student tends towards (Armstrong, 2004; Jenson, 2005). Dr. Patricia Kuhl (2008), Co-Director of the Institute for Learning and Brain Sciences at the University of Washington, believes that social interaction bolsters language acquisition, which generally adds to the body of educational literature supporting the 'social construction of knowledge.' Further analysis of words, as they are added to or manipulated within the Construxion Site, allows students to use words and concepts when they speak, making it more likely that students will use these words in their writing.

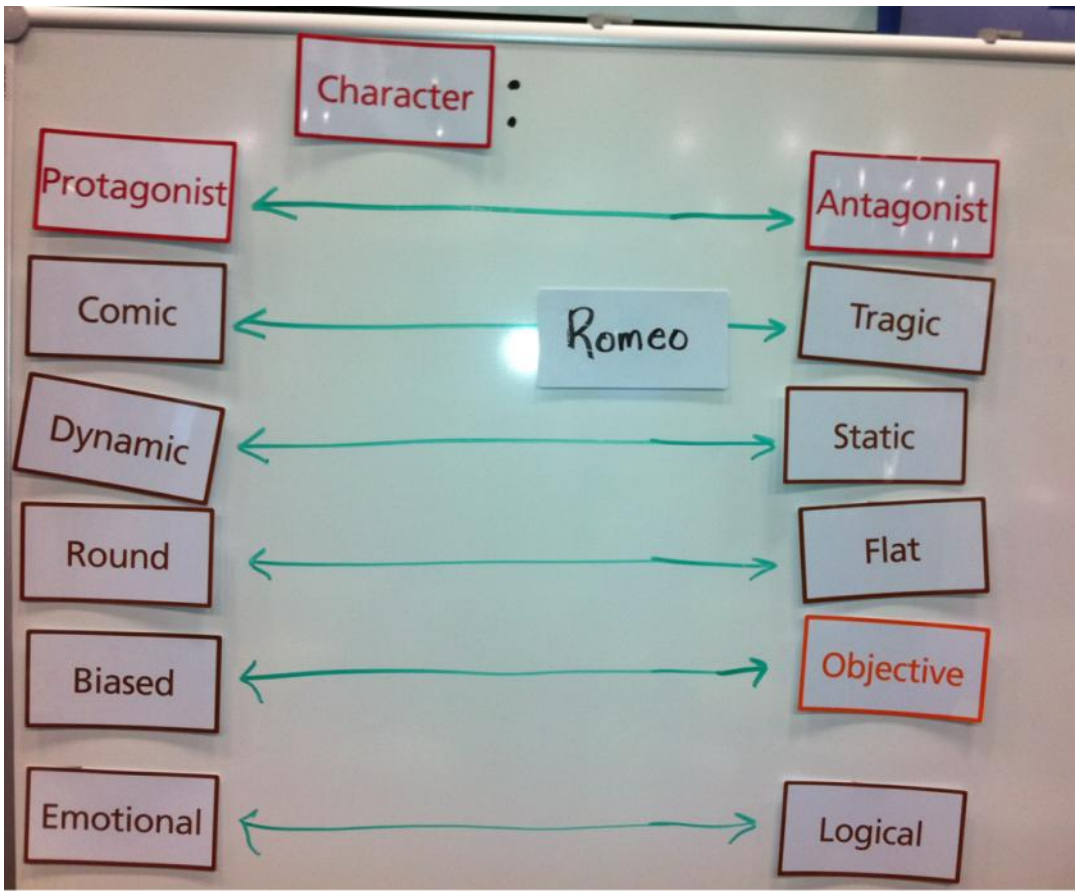
*"Teachers know what they have to do…they don't need another book…they need an actual resource to actively engage students in the classroom," notes one administrator.*

*"It's like you plugged them in!" a teacher observes of her students' engagement levels.*

**The Converse and Convey Panel® provides a dynamic archival space**. This third and final component of the CCX system is critical for promoting retention and supporting conceptual connections from topic to topic. Many teachers display student work, hang posters and post notices on classroom boards and walls. While a few of these artifacts may act as student references, more likely than not they are decorations or mandated policies that are rarely reviewed during class time. More skilled teachers understand that these spaces should serve as archives and ready references that are built continuously and used frequently by students. However, the task of updating such references is too great for most teachers; they have neither the time nor the materials to do so.

The design features of CCX provide classrooms with the materials needed for maintaining a truly dynamic archive of evolving student understanding. A unit or project may begin with only a few Concept Cards, but over the course of weeks and months the displays and arrangements become more sophisticated--either by virtue of the selected concepts and ideas or by the number of concepts combined in association. One point is clear: Concept Cards never should be posted in disarray. This common teacher mistake greatly hinders post-activity retention and growth. It is important for students to enter the classroom later in the same week and see an organized reminder of their learning that they can use to support continued thinking. Concept Cards are easily added to the Converse and Convey Panel, arrangements are revised to accommodate new learning, and students who missed the main message during the initial activity are invited to continuously revisit the ideas with support from peers and the teacher in order to build understanding. Used alongside a Smart Board™ or other

classroom projection device, the Converse and Convey Panel™ provides an instructional anchor linking ever-changing images, animations, videos and teacher notes.




**Leveraging the Literature**—When students learn vocabulary and concepts over an extended period of time, rather than in a short burst followed by a one-time short review, they are more likely to incorporate comprehension into their long-term memories (Schenck, 2003). Students are able to learn words and to retain them over longer periods of time when they are able to reference the words repeatedly and to use them in a variety of contexts; they should not, and cannot, be expected to learn words adequately in a single contextual exposure (Baldwin & Schatz, 1985). Teachers want students to "pass the test," but we also want them to build background knowledge in ways that actually close the achievement gap (Marzano, 2004).

For those students without much experience with certain academic subjects, such as math and science literacy, Concept Construxions allows students to create a visual memory of the written word as long as it remains a part of a Construxion Site or a Converse & Convey Panel®. Research in the field of language acquisition tells us that when a spoken word is associated with its written form, or "orthographic representation", learners are able to distinguish the new word/concept from those previously learned, thus placing it within a schema of other familiar concepts (Ehri, 2000).

Concept Construxions engages students in analytical thinking processes that facilitate long-term comprehension of new words and concepts. Many researchers in the field of reading believe that vocabulary acquisition must occur in the context of analysis in order for the words to really stick (Juel & Deffes, 2004; Marzano, 2004). Similar studies found that even students with low levels of literacy, those who did not engage in frequent dialogue about language, improved their vocabulary base

significantly through good vocabulary instruction (Blachowicz & Fisher, 2004). We know that good vocabulary instruction involves frequent dialogue about words and concepts, opportunities for word play, and the ability to continually refer back to learned words and concepts, both visually and orally. We know, from both research and experience, that students who are able to reinforce previously learned words and concepts are more likely to build long-term memories and lasting comprehension (Jenson, 2004).

Teachers who use Concept Construxions on a regular basis will quickly realize that words may be added or removed from the Converse and Convey Panel as deemed necessary, particularly if words and concepts become integrated into the common discourse of the classroom and are no longer a central part of discussions. And, Concept Cards may return to the Construxion Site after a temporary hiatus, particularly when students are reviewing older material before tests and exams. Archived organizational schema on the Converse & Convey Panel allow for more opportunities to mentally reconstruct the gestures and conversations associated with previously learned vocabulary.

### *Teacher Testimonial*

*I have been teaching middle school science for 9 years, and Concept Construxions is one of the most powerful tools I have ever used in the classroom. It allows you to tell in a moment just how well students have understood the concepts you have taught. You can quickly identify areas of strength and weakness, including any misconceptions that your pupils may have.*

*As I work through a topic I add key words to the Construxion Site. Sometimes I ask my students which words they would like to see up on the wall. This allows them to take ownership of the activity, as well as allowing me to see if they are recognizing the important ideas. The words remain in a random order whilst students process them. Once we have completed the topic (or part of it) I give the students sets of words and ask them to make concept maps. I ask them to explain their arrangement, and this is where the magic begins. Students have to really think about the words, and what they mean, in order to form and explain their word arrangement.*

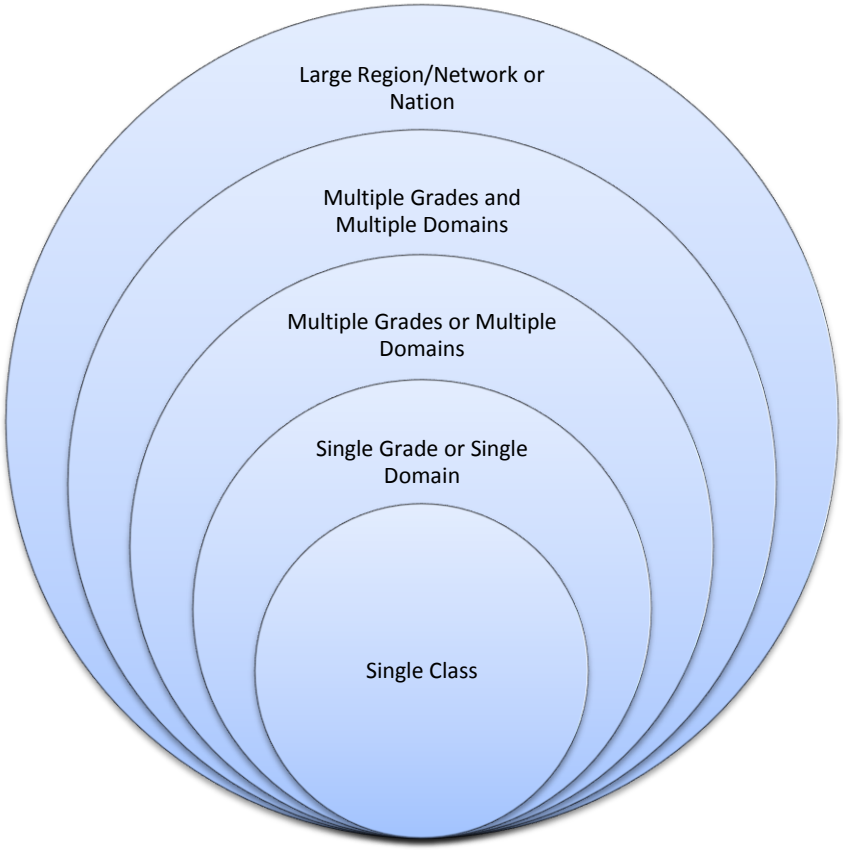
*As you work with them you can quickly identify major misconceptions. For example, I recently used this activity to review Newton's 1st and 2nd Laws. It quickly became clear to me that the students were confusing the link between friction and inertia. I was then able to return to these concepts, and clarify the relationship between them for my class.*

*If we remember that words are simply labels for concepts, then the value of Concept Construxions is made very clear. By giving our students a deep clear understanding of how to use these words correctly we are arming them with a very valuable skill.*

*— 8th Grade Science Teacher, New York City*

## Implementation, Customization, and Purchasing Models

The modular design of the system also supports implementation, and it is designed for compounded positive impact as utilization expands. Most school programs are only as stable as long as the trained teachers remain stable. It is becoming increasingly difficult to achieve this stability, and we have witnessed the "death" of entire programs once a critical mass of users leaves the district or region. With CCX, expanded implementation adds strategic layers of infrastructure that survive teacher and administrator attrition and replacement, thereby creating a truly robust solution for students who remain in the district.




**Effective in a Single Classroom**—It is possible for a single teacher to be successful, even if others in the school are not utilizing the tool. In general, teachers can easily see the effort that went into designing a product that truly respects teacher autonomy and classroom wear and tear. Students using CCX are actively engaged in dialogue, games, collaborative problem-solving and constructivist learning. They are physically moving in the classroom or at their seats to manipulate cards and demonstrate what they know, without feeling the pressure of a quiz or test. Students appreciate the professionally-made cards that "look nice" and display age-appropriate concepts. They ask to "use the cards" on a regular basis. Although students may not be familiar with the term "differentiated instruction," they observe that each student can easily participate at his or her own level and see that the entire classroom is more actively engaged when CCX is part of the lesson. This allows for true collaboration among students, and establishes a positive learning environment for all. For one year in one domain, students are engaged and supported in the presence of CCX.

**Increased Effectiveness Across a Single Grade Level or Through a Single Domain Department**—As explained previously, the color-shape system allows for interdisciplinary coordination. Students benefit most by expansion to this level: CCX acts as a silent teacher that moves from room to room helping students make explicit connections between disciplines when their real teachers do not. It is almost impossible for teachers to coordinate their language usage on a daily or weekly basis, yet teachers observe that students cannot perform similar tasks from class to class. This is because students who are still building schema within a particular domain do not already possess a mental model of how certain tasks and ideas fit together. CCX makes this schema clear and, when teachers across domains utilize the tool—even if their use varies—students have an easier time seeing how the world of academia is organized.

Implementation within a single domain, such as all math courses/levels in a single school, promotes this same kind of student support. However, the support carries students from level to level rather than across subject areas. This type of implementation works well for districts and regions that wish to deploy domain-specific reform or interventions. Fairfax County, VA adopted CCX in this fashion, as a way of connecting their existing academic vocabulary initiative through middle and high school science. The color-shape system allows for students to move from life science to physical science to biology to Advanced Placement (college-level) Chemistry using the same concept-based color-shape system. In this fashion, CCX acts as an incredibly cost-effective and instantaneous articulation manager.

**Compounded Effects With Multiple Grades and/or Domains**—When students are supported by the "silent teacher" from year to year and across domains, they see more than achievement gains. As students internalize this academic superstructure, they become more confident and more participatory students over time. They feel more able to enroll in advanced courses, envision college enrollment or pursue their post-secondary career of choice. For teachers, the share-ready system of shapes and colors encourages occasional, strategic "swaps" with the teacher next door. And CCX provides a common entry point for collaborative teacher discussions about curriculum, assessment and instruction.

*CCX is truly unique in its ability to offer an expandable and coherent system that simultaneously supports mainstream, differentiated, remedial, tutorial, gifted & talented, bilingual, alternative, adjudicated youth, community-based, and multi-age learning programs.*

*In this way, learners enjoy a seamless experience as they move from setting to setting in the same year, or from year to year.*

Regional administrators appreciate the way that CCX supports major initiatives without being prescriptive for every user. Administrators work with certified professional developers to craft training sessions that use CCX to scale their initiatives. CCX creates coherence for students, for teacher teams, and for districts and regions in low-cost, easily-achievable timeframes. This is why several of our districts started with only one school but increased implementation to several schools or districts within only one year.

**Complete Customization With Large Regions/Districts or Nations—**Robust flexibility is attained when multiple learning facilities under the same jurisdiction (i.e., to include schools, after-school programs, community centers, alternative learning settings, government-run institutions, etc.) implement the CCX system. High-volume purchases of Subject Sets & Accessory Packs create an opportunity for completely customized Concept Card lists. EduChange instructional specialists work in collaboration with designated personnel to build custom materials and accompanying training. Due to the flexible implementation model and patented color-shape system, a variety of different learning settings are appropriate for CCX. Strategic roll-out or phase-in plans may be developed to facilitate large-scale use. Teachers for Learners and EduChange contract and work directly with executive teams and ministries as needed.

## *Teacher Testimonial*

*I was lucky enough to discover Concept Construxions during my second year of teaching. The school I worked for was an alternative school that was largely self-paced. What made it so challenging was the wide range of abilities my students possessed. In one class, I had an 11th grader reading on a 3rd-grade level. Sitting next to him was a senior that was accepted to Cal-Tech later that year. I had to think of something that would support basic vocabulary acquisition, yet also challenge my higher-level thinkers.*

*Concept Construxions helped solve this problem in many ways. During group work, a student that could only remember definitions would write these definitions on the back of each card with a dry-erase marker, while another student might begin grouping them by concept. Though there were many ways to group these words, the shape and color-coding allowed these students to participate with confidence. Then, students that were up to the challenge could place these concept groups on a magnetic white board and build a concept map with arrows and notes.*

*There was a specific role for each member of the group because the Concept Cards offer built-in scaffolding through the coding system. However, the Concept Cards also lend themselves to quick warm-up activities that require minimal prep. Using the suggested lesson plans that accompany the card sets, I arranged 9 word cards on the magnetic white board, in 3 rows of 3. Then, students were required to construct sentences using any 3 words that were in a straight line. This encouraged them to think about the connections between words in a specific unit.*

*In addition, by placing words from past units on the Construxion Site, students are continually reminded how to integrate all the words they used throughout the year. In the past, students would ask questions like, "Remember that thing that is causing that thing to happen on earth?"*

*Now they have a visual reminder and can use the words Greenhouse Effect, and Global Warming. In that sense, Concept Construxions has also aided our classroom discussions, and help students ask for clarification in a constructive way.*

*— High School Special Educator, Virginia*

## Custom Professional Development Aligned to Local Initiatives

**EduChange Experts Lead the Way**—Teachers for Learners works exclusively with sister company EduChange to provide custom professional development to schools and districts. The EduChange staff is comprised of university professors, researchers, instructional leaders, former district officers and administrators, *all of whom have significant K-12 classroom teaching experience*. EduChange is dedicated to providing practical solutions to real-world educators, and since 2000 has bridged research to practice in the areas of professional development, curriculum/content development and program evaluation.

All professional development for Concept Construxions is designed collaboratively with districts and schools to align to local initiatives. Since CCX is a flexible tool, it can be used by instructional leaders to leverage the professional development that already has taken place, and to invite more teachers to get on board. EduChange understands that "another new thing" is not what teachers want. EduChange takes time to develop Concept Builder activities that model an already-named and desired instructional practice using the CCX system. **Not only are Concept Builders aligned to state and national standards, they also align to the instruction that schools and districts are trying to implement**. In this way, EduChange is an ally providing real support, rather than another cadre of consultants with advice bulleted on PowerPoints but little in the way of practical tools.

For example, past professional development and Concept Builders have linked standards to the following instructional models:

- Common Core State Standards transitions
- Universal Design for Learning
- Principles of Learning
- ELL (SDAIE, SIOP)
- TEKS Standards Adoption
- Online textbook and curriculum adoption
- STEM Initiatives
- Marzano's "High-yield Strategies"
- Differentiated Instruction
- Critical Thinking (New Bloom, Depth of Knowledge, Hess' Rigor Matrix)
- Non-fiction reading and writing strategies
- Academic Language Notebooks

**Table 1: Levels of Professional Development for CCX**

| Level | Description |
|---|---|
| **Level I** | • half-day orientation on-site<br>• train-the-trainers or direct-to-teacher<br>• short, easy-to-implement *Concept Builders* aligned directly to district curriculum instructional strategies aligned to local initiatives<br>• website provides additional resources post-orientation |
| **Level II** | • blended training delivery possible<br>• Concept Builders extend to longer periods of time (1-3 days)<br>• The instructional strategies at this level model more sophisticated pedagogy<br>• Concept Builders elicit more student ownership of the classroom discourse |
| **Level III** | • collaboratively designed with districts to support advanced educators<br>• build capacity for instructional leadership at the site or district level |

# Ongoing Data-Driven Development:
# Primary, Market and Case Study Research

**Identified From Within a Comprehensive Curriculum**—Most supplemental instructional tools are developed as "add-ons" to large textbook packages, and sometimes the publisher does not explain to teachers exactly how to integrate the use of the extra resources within a larger curriculum. Thus, teachers may use these resources arbitrarily and without guidance. On the contrary, the precursor teaching strategies that informed the development of our patented system were embedded in a larger curriculum, and tested with a diverse demographic of teachers and students. The promise of *Concept Construxions*® was discovered while gathering a variety of data about a two-year fully comprehensive secondary science curriculum developed by EduChange, Inc. in the United States. This curriculum was provided at no cost to ten (10) high schools, approximately thirty (30) teachers, as part of a 5-year professional development initiative.

Teachers experienced an intensive immersion in the curriculum implementation process in order to identify strengths and weaknesses in their instructional practice. They were supported one full day each weekly or every two weeks by a professional development provider who was trained in best-practice instruction. Teachers and coaches worked together to determine areas of focus on an individualized basis. These ten schools were supported from 1-5 years in this fashion, as well as through an annual professional development institute each summer hosted by The Rockefeller University, who served as advisors to the materials development process.

Teachers represented professionals at a variety of different stages and proficiency levels. In addition to certified science teachers, Special Educators also utilized the strategies that would evolve into *Concept Construxions*®.

**Table 3: Teacher Demographics Across 10 Implementing Secondary Schools, 2002-2008**

Approximately 30 teachers represented

| Indicator | Data |
|---|---|
| **Gender** | 33% male, 67% female |
| **American Indian or Alaska Native** | 3% |
| **Black or African American** | 18% |
| **Hispanic or Latino** | 11% |
| **Asian or Pacific Islander** | 11% |
| **White** | 57% |
| **Teaching Experience** | First Year →15 years |
| **Science certifications** | 71% |
| **Special Education/ELL certification** | 29% |

Most schools were located in urban environments, but there was one site in a semi-urban/suburban environment and one in a rural environment. Please see Table 3 below for a summary of student demographics that were observed during 2002-2008.

**Table 3: Student Demographics Across 10 Implementing Secondary Schools, 2002-2008**[2]

~Approximately 2000 students were observed across schools~

| School → Indicator | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **American Indian or Alaska Native** | 1% | 0% | 1% | 1% | 0% | 0% | 2% | 1% | 0% | 99% |
| **Black or African American** | 9% | 10% | 73% | 83% | 0% | 32% | 15% | 23% | 36% | >1% |
| **Hispanic or Latino** | 14% | 25% | 22% | 15% | 100% | 62% | 16% | 35% | 53% | >1% |
| **Asian or Pacific Islander** | 28% | 30% | 1% | 0% | 0% | 3% | 14% | 28% | 4% | >1% |
| **White** | 47% | 36% | 2% | 0% | 0% | 2% | 53% | 13% | 7% | >1% |
| **English Language Learners** | 0% | 0% | 1% | 1% | 100% | 12% | 0% | 3% | 18% | 45% |
| **Special Needs** | 16% | 8% | 17% | 21% | 1% | 20% | 12% | 4% | 90% | N/A |
| **Economically Disadvantaged** | 36% | 45% | 80% | 84% | 97% | 87% | 23% | 66% | 80% | 82% |
| **Average School Attendance Rate** | 95% | 96% | 85% | 84% | 86% | 84% | 95% | 95% | 80% | N/A |
| **Average High School Graduation Rate** | 100% | 97% | 95% | N/A | 81% | N/A | N/A | 96% | 47% | 68% |

[2] These figures represent approximations based on official school report card data from relevant State Education Departments. Some information on each school for a given year may be unavailable, in which case school stability indicators were considered along with recent years' data. Best estimates were made.

This extraordinary undertaking in professional development allowed us to observe over 2000 students across a wide array of demographics. An external evaluator, Nicolle Gottfried of Consonance Consulting, collaborated with us during this period in order to help coordinate the primary data collection activities outlined in Table 4 below.

**Table 4: Data Types And Frequency of Collection Informing CCX Product Development, 2002-2008**

| Data Collected | Frequency of Collection |
|---|---|
| **Documented classroom observations & meetings** | Weekly |
| **Student work and formative assessments** | Monthly |
| **Written student reflections** | Every 6 weeks |
| **Written teacher reflections** | Every 6 weeks |
| **Teacher, Student, Scientist Inquiry Group Meetings** | Quarterly |
| **Administrator Interviews** | Annually |
| **Publicly accessible school profiling data** | Annually |
| **Standardized test scores, each exam** | Annually |
| **Student attitudinal profiling questionnaires** | Biannually |
| **Teacher action plan portfolios** | Biannually |
| **Teacher one-on-one interviews** | Biennially |
| **Parent surveys** | Biennially |

Weekly classroom observations of each teacher's practice and student participation by five (5) professional developers, as well as teacher observations of changing student behaviors, were the main data sources that identified the strategy of the "Interactive Word Wall" as a powerful tool that moved class discussions beyond basic vocabulary work and into the realms of critical thinking, collaborative reasoning, visual text interpretation, formative assessment, and Accountable Talk®, as described by the University of Pittsburgh's Institute for Learning (Michaels et. al., 2010). At that time, EduChange was exploring questions about shifts in teacher practice and student engagement. It was during this period that interesting information crystallized about certain practices and their common power across this broad range of teachers and students.[3]

*In 2004, EduChange presented a paper reporting two years of findings at the Annual Meeting of the National Association for Research in Science Teaching (NARST) in Vancouver, BC. This paper was nominated for an Outstanding Paper Award.*

[3] Gottfried, N. & Saldutti, C. Changes in Student and Teacher Attitudes and Behaviors in an Integrated High School Science Curriculum. Paper presented at the Annual Meeting of the National Association for Research in Science Teaching, Vancouver, British Columbia, (April 1-4, 2004).

Between 2004-2006 the data were studied more deeply, and the cross-curricular design of the system began. The observations of the strategy "in action" that seemed to surface again and again across schools, teachers and students, were as follows:

- **Increased participation across students who normally did not verbally engage**
- **More students were making more connections to previously learned content**
- **More attempted use, and accurate use, of academic vocabulary in student written assignments**
- **More teacher and student accountability to consistent language use in discussions and explanations**
- **Students reported having more confidence when completing writing tasks**
- **ELL, Special Ed, GATE students reported higher levels of engagement than during other class activities**

It was clear that this instructional routine was more than just a way to teach science vocabulary. There was more to describe and to learn. Starting in 2004, we began to gather evidence in the literature to support the expanded design of the strategy that would become Concept Construxions. In addition to the alignment of Concept Construxions to instructional models and best practices (described in the next section), the team embarked on a market research effort to inform the final features and components described in earlier sections of this report.

**Getting it Right: Listening to hundreds of potential users prior to production**

In addition to the 6 years of alpha-test user data in 30+ science classrooms with over 2000 students from 2002-2008, additional market data from a multi-faceted research effort targeting the US market was collected from 2005-2007. We knew the strategies worked, but we needed more input from potential users in order to design *features that teachers actually wanted, and were still in line with what the literature describes as best-practice*. What a concept, right? Engaging in this process is nearly unheard of for supplemental tools provided by large-scale publishers. But we took it seriously.

Before the feature set for the product was designed and the actual products manufactured, Teachers for Learners and EduChange

- exhibited at 2 national trade shows where we interviewed 400 educators and leaders;
- held in-person meetings with over 50 school and district-level prospective purchasers;
- ran 6 professional development seminars for 350 educators;
- held 2 in-person focus groups with teacher testers; and
- conducted an online pricing study with approximately 150 respondents

For this series of activities, we partnered with a senior market researcher at Consonance Consulting, Inc. in San Francisco. Our partner had extensive background in both online and offline market research methodologies, market psychology, and quantitative analysis techniques. Further, our researcher served in a senior sales position for EduSoft, Inc. prior to its acquisition by Houghton-Mifflin publishers, served as a middle school math teacher and department chair, and received Ed.M. and LISCW Master's degrees. This combination of skills sets proved invaluable in researching the potential of the market. We learned a great deal, and we continue to utilize many of those strategies and approaches today.

One source of valuable information was the identification of barriers to implementation. From our classroom work, the development team understood some of these barriers, but wanted to build a broader picture across additional learning settings. **Table 5 on the next page names the major barriers to use identified by potential users, and the corresponding design solution that removed the barrier.**

By eliminating barriers to implementation as much as possible, the professional development providers are able to convey to teachers how best to set up the system and get started. **Feedback based on these sessions indicates that many educators initiate use within two weeks of training, and some begin to implement in just one or two days.** The smart and classroom-friendly design of the system assures classroom teachers that their needs and constraints were kept in the forefront of development.

Administrators appreciate that Teachers for Learners has addressed their concerns as well. Administrators are interested in bringing their initiatives to scale, and the elimination of barriers and excuses goes a long way in helping initiatives succeed.

**Table 5: Market Research Informing Product Design**

| Barrier to Implementation | Design Solution |
|---|---|
| **Resistance to "something new"** | Dovetail PD with current initiatives—not canned, but custom |
| **Fear of losing content time** | 225 high-frequency domain-specific Concept Cards; focus on conceptual comprehension |
| **Resistance to learning a new "method"** | Flexible use case with ability for teacher customization, using blanks & own strategies |
| **Different levels of teacher awareness** | Multiple entry points and purposes for initial use |
| **Materials: Room constraints** | • Portable, semi-permanent panels with Velcro® adhesives<br>• Magnetic adhesives for white boards<br>• Simultaneous Velcro® and magnetic use, where possible<br>• Needs to be fire-retardant so displays can safely hang |
| **Materials: Teacher attrition** | • Easily shared, transferred without losing durability<br>• Critical mass of master users in a school permits turn-key training<br>• Instructional leaders can provide training after initial orientation |
| **Materials: Changes to standards, assessments, textbooks** | • Concept-focused<br>• Driven by key ideas in the domain<br>• Designed to survive policy changes |

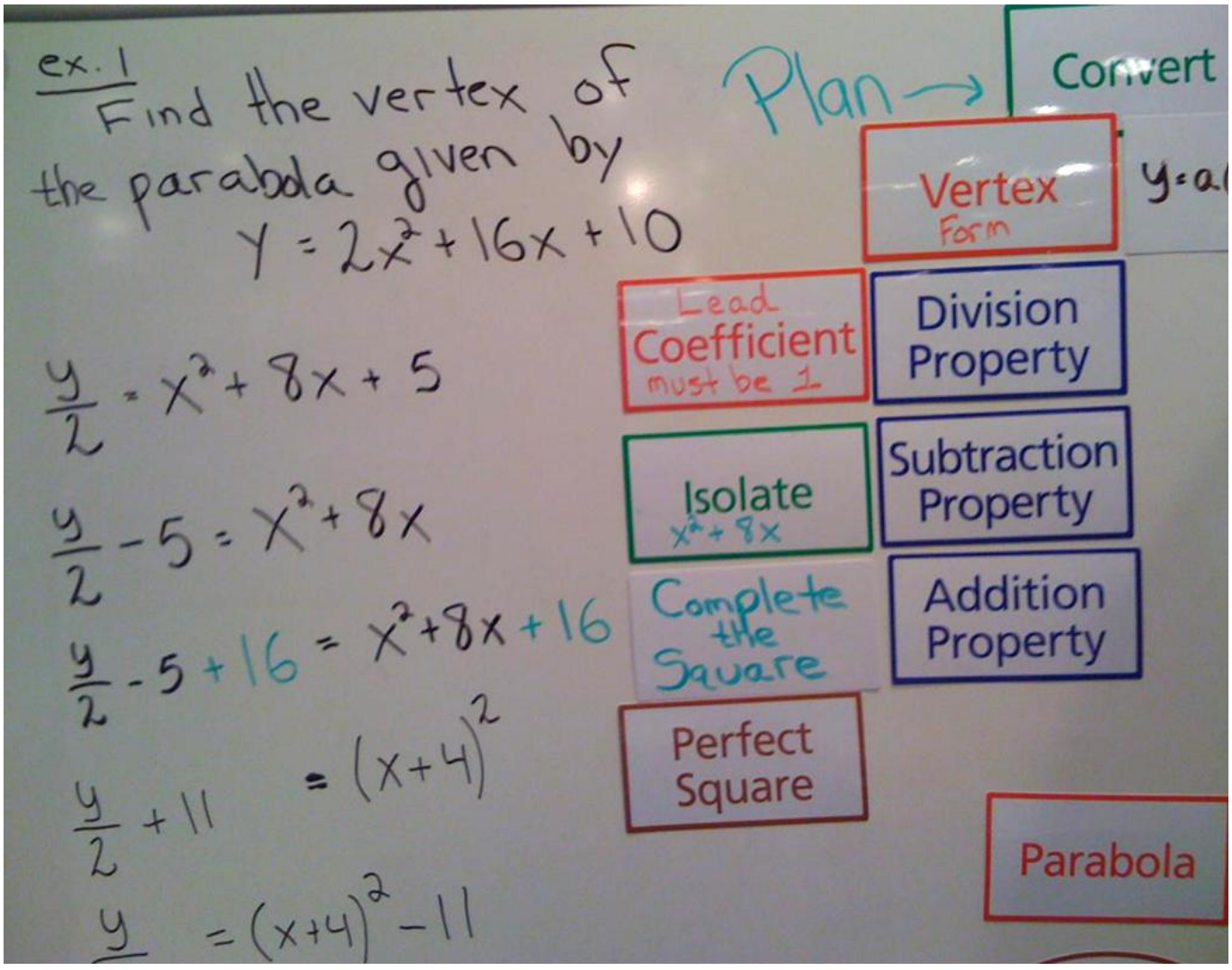
*Teachers also tested a Concept Construxions prototype with interactive white boards (e.g., SMART® and Promethean®). Bottom line: it's NOT the right technology for the job!*

**Here's why**:

- The screens are too small, relative to the kinds of displays that teachers and students wanted to create, while keeping the visibility of the cards high;
- Most schools in the USA have purchased single-touch screens, making it nearly impossible to have multiple students working together simultaneously;
- In 2008, when tested, there was a lag time as the cards were moved on screen, thus delaying the activity;
- These boards are best and most often-used by teachers, not students; Concept Construxions is designed to shift classrooms towards student-centered learning;
- Some boards have been awkwardly installed in classrooms, making it difficult or impossible for students to kinesthetically engage with the screen;
- Teachers turn off the screens, thus making any archive or ready-reference disappear.
- Teachers don't return to past displays that often. They said they wanted a screen capture, but in reality they never used them again anyhow (and of course you can snap a digital photo of a hands-on display with any smart phone);
- There are *so many more uses* for Concept Construxions than on-screen displays--none of them could be accomplished using these boards;
- Teachers who were not facile with the technology were less likely to use the Concept Construxions application at all, or used it less frequently;
- Teachers wanted students to use the Concept Cards to describe or discuss something else they projected on-screen (e.g., video, animation, photo, diagram, etc.). However, they could not effectively see both at once on the same screen; and
- Teachers and students sometimes move the Concept Cards and panels out of the room, for example to use outside, in a learning lab, for professional development, or for after-school remediation sessions. (We did not have students and teachers try to physically move their interactive white board from their classroom to these other locations ☺, but we think you get the picture.)

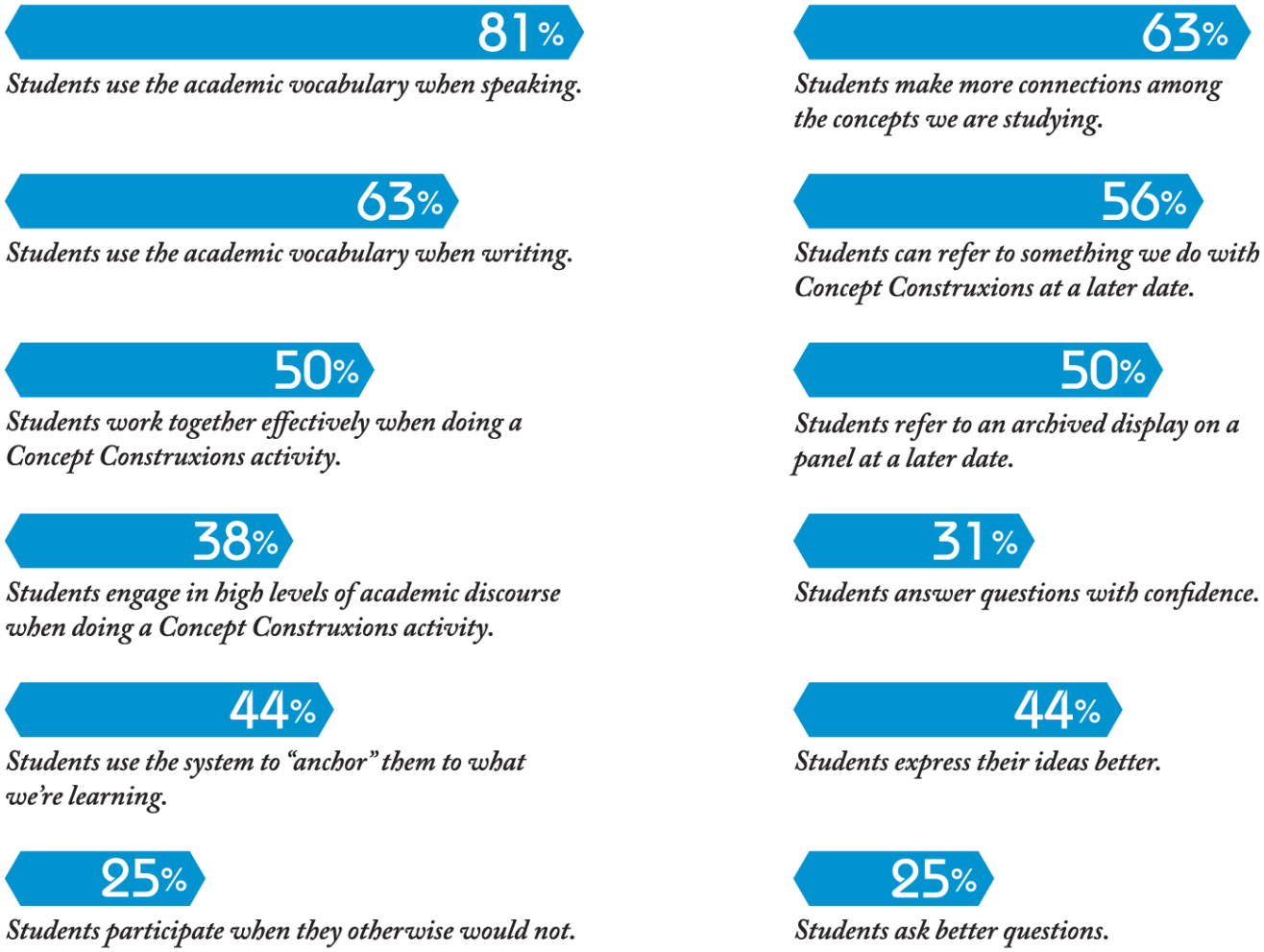
Technology changes quickly, and we are encouraged by the more recent software and device capability available today. We are currently busy collecting data to drive the development of a design for newer, more student-centered electronic technologies that preserve the robust, cost-effective, flexible, hands-on technology that we originally created. To see some of our thinking, please see *Digital Concept Construxions: A Demonstration of Ed. Tech. 2.0* near the end of this report.

**User Data: 2010-2012—**We continue to work with schools implementing the system, and we applaud their creativity and energy. The next two pages of this report highlight some key feedback we have gathered regarding impacts on classroom learning and multiple modes of teacher implementation. These data speak to the robust and multi-faceted utility of the tool. Teachers are using it to help students tackle content from several angles, not only connecting concepts but connecting modes of learning as well.



Teachers from New York City, Southern California, and Texas in the USA provided the following data. These teachers represent upper elementary, middle and high schools. They teach class sizes that range from fewer than 5 students (i.e., a pull-out setting) to greater than 35 students. They teach math, science and English Language Arts. Their students include: Special Needs students, English Language Learners, Gifted & Talent/Honors/AP students, students from migrant families, adjudicated learners, hospitalized learners, learners who are socioeconomically disadvantaged, and GED candidates. Data were collected from 2010-2012.

## In what ways has the use of Concept Construxions in your course(s) affected student learning? (select all that apply)



How have you implemented Concept Construxions? (select all that apply)

50% *To connect previously learned concepts with new concepts*

57% *To actively engage students*

64% *To introduce new concepts or strategies*

39% *While lecturing*

64% *As a classroom reference tool or archive*

39% *To assess student understanding or progress*

61% *To review content/concepts*

64% *To prompt students to use vocabulary asking questions/explaining*

32% *Alongside a computer projection system or other technology*

39% *To prompt students to use vocabulary when writing*

46% *To create concept maps, flow charts, concept graphs, hierarchies, tables or other organizers*

18% *During extra help or tutorial sessions*

46% *In preparation for standardized tests*

14% *As an instructional routine*

**User Data: The EduExChange Program™—**Supplemental tools are best studied on a case-by-case basis. To determine whether a tool is making an impact, myriad local factors must be considered. The EduExChange Program is a free, two-way information exchange with partnering schools and districts and consists of these steps:

1. Users provide Teachers for Learners and EduChange with information about implementation.

2. EduChange specialists analyze the data and create a report for the organization.

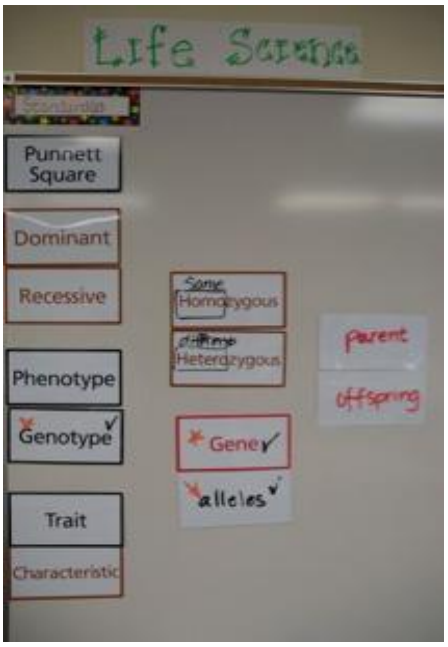
3. After reviewing the report, the administrators invite team members and implementing teachers to attend an EduChange-facilitated webinar to discuss the results.

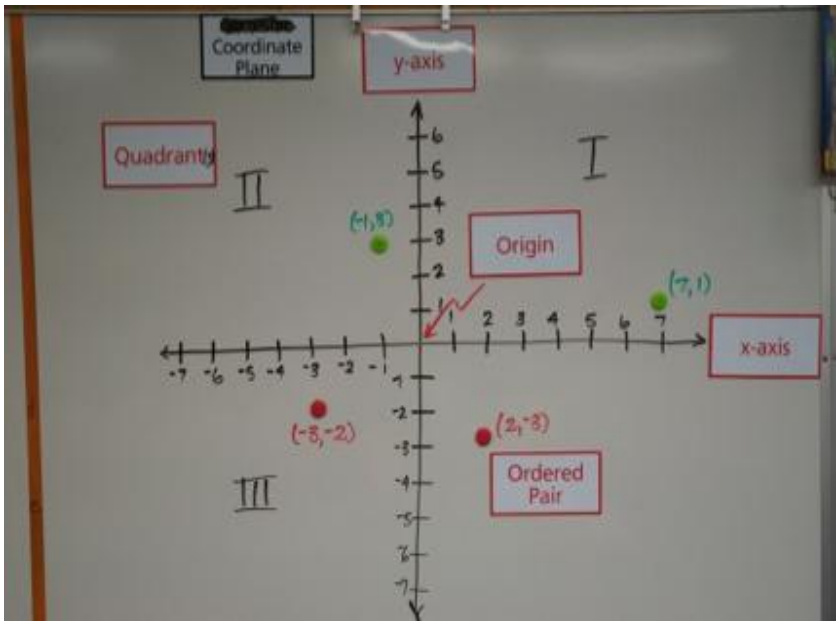
4. An anonymous digest of the report with public student demographic data is shared with the larger user community so that other schools and districts may benefit from the learning.

5. Teams may repeat the process at a later date when the next steps have been taken and new data is required.

*Case Study Summary: Large ELL population in a Rural Setting*

After an initial half-day orientation session, middle and high school science, ELA and math teachers and their ELL and Reading counterparts began to implement with Concept Construxions. Implementation was not mandatory, and teachers had been invited to attend the training on a voluntary basis. The student population and implementing teachers remained stable between the year prior to implementation and the first year of implementation. There were no changes to standards, textbooks, assessments or other major drivers of practice or achievement during this time period. Implementing teachers also attended ELD trainings and completed coursework. Teachers explored practices that created language-rich classrooms for their largely long-term ELL students.



In one math and science middle school classroom, students were using Concept Construxions two or three times per week. At the end of the first year of implementation, with no other notable changes in instruction or curricular materials, students demonstrated statistically significant achievement gains:

- **Pre-Concept Construxions Implementation**
  8th grade science **2009**: Standardized state test, class average = **317**
  - 89 English Learners (combining ELL and RFEP students)
    More Honors/GATE students in 2009 than 2010

- **Post-Concept Construxions Implementation**
  8th grade science **2010**: Standardized state test, class average = **356**
  - 101 English Learners (combining ELL and RFEP students).

Other observations made by classroom teachers and administrators included:

- Students like the manipulatives; they like to interact with the Concept Cards
- More active engagement was observed when using CCX
- CCX provides opportunities for cooperative grouping
- CCX is a predictable instructional routine
- CCX offers structure in the classroom

As other teachers in the district took note, some sharing sessions and classroom visits occurred. The district decided to learn more about other sites of implementation. One key finding for this district was the number of different ways that teachers were implementing in their classrooms, and the variety of impacts CCX implementation was having on student learning. The pie chart on the previous page shows results.

It was evident that they needed to create time and space for teachers to come together to share their practice and, after a change in supervisors at the district level, a renewed district commitment was made. Successful teachers were invited to become teacher leaders at professional development sessions, and new or newly interested teachers were given the opportunity to receive kits and join the discussion. Some teachers reported that they had been given materials but had not received any training. These teachers also reported that they lacked the confidence they felt they needed to implement like other teachers they had seen, or were simply not as motivated to try the tool. However, these same teachers reported a desire to receive a proper orientation and immersion in different strategies that aligned with their curriculum.

This district is just one of several who have taken the opportunity to learn more about how to optimize their investment and expand the reach of Concept Construxions. As a two-way information exchange, the EduExChange Program proves to be a valued data collection effort. Schools and districts do not have the financial or personnel resources to spearhead such efforts for supplemental tools, but they still desire to understand the impact of their investment. As more schools and districts participate in this program, cross-cutting data will be shared with the larger user community.

## Select Instructional Models That Underscore Classroom Implementation

One of the reasons why CCX appeals to so many teachers and administrators (approximately 2500 trained users to date) is that the system may be used to support a variety of best-practice instructional models. Complemented by strategies and practices from these models, CCX demonstrates its power as a robust and multi-faceted tool. There is no need for a "my way or the highway" approach that so many educators loathe. High-quality, custom professional development provided by EduChange and Teachers for Learners helps schools to internalize and scale the research-based instructional models they have adopted, using Concept Construxions as a cross-curricular tool to guide the process. The next several pages outline specific aspects of the instructional models we already have helped schools address in the United States, but the summary is not intended to be exhaustive.

### ***Tiers of Words***

New curriculum standards that focus on college and career readiness, such as the Texas TEKS (Texas Education Agency, 2012) and the Common Core State Standards (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010) have highlighted the importance of vocabulary acquisition and models that explain how to best address this process in classrooms. The "Tiers of Words" model was used to inform the development of CCX, as outlined by Isabel L. Beck, Margaret G. McKeown, and Linda Kucan (2002, 2008). In their model, there are three tiers or types of words:

- Tier One includes basic, everyday words
- Tier Two includes academic words that are found in texts that students read in school, and in verbal academic discourse that accompanies and informs these texts
- Tier Three includes academic words specific to a domain or discipline, such as math, literature, science, etc.

The work of these researchers has called our attention to Tier Two and Tier Three words in particular, as both types of words can be barriers to facility with language useful for secondary and university environments in particular. If educators are to prepare students to advance in their education, we must focus on unpacking and connecting Tier Two and Tier Three words. The Concept Construxions system was designed to bridge high-frequency Tier Two and Tier Three words that are relevant to the discourse of each domain, as well as across domains.

*The Concept Construxions system was designed to bridge high-frequency Tier Two and Tier Three words that are relevant to the discourse of each domain, as well as across domains.*

For example, Tier Two words inside Concept Construxions Subject Sets such as *analyze, estimate, illustrate, variable, rationalize, intersection, complementary, counterexample*, *sequence*, and *inverse* are not used often in everyday teen conversations, or even in normal conversations and transactions that occur outside of school. When coupled with Tier Three words such as *parallelogram*, *photosynthesis*, and *dénouement*, classroom explanations, readings, questions and discussions become very difficult very quickly. By taking time to explore the connections between these Tier Two and Tier Three words, educators can build conceptual understanding and domain-specific discourse with students.

At The Victoria University in Wellington, New Zealand, Averil Coxhead (2000) built a list of academic words and their word families according to academic domains in an effort to support university-level preparation for lectures and readings (i.e., these would be considered Tier Two and Three words according to Beck's schema). Further research shows that building a schema or framework for the

domain itself (i.e., understanding the nature of math in general, as well as how mathematicians communicate with precision across topics or contexts) can accelerate a learner's understanding of Tier Three words by up to four times (Landauer & Dumais, 1997). Building intra-domain curricular coherence as well as interdisciplinary coherence is essential to helping students acquire the academic vocabulary they need to enter more advanced coursework in high school, college and on-the-job training (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010).

## ***Adolescent Literacy Across the Content Areas (Domains)***

Several recent studies of the status of literacy in schools across the United States highlight a lack of commitment to consistent teaching of literacy strategies in every domain and in every grade level. Over half of the nation's secondary students read below grade level, only 3% of all eighth grade students read at an advanced level, and yet the workplace is demanding readers that can negotiate complex texts—and then respond to them in writing (Achieve, 2005; Alliance for Excellent Education, 2006; Barton, 2000; National Center for Education Statistics, 2004). The clarity of the need is, fortunately, met with a clarity in the research that explains what must be done in secondary schools across the country (Biancarosa & Snow, 2004). In *Reading Next*, a report to the Carnegie Corporation of New York, the authors name "Fifteen Elements of Effective Adolescent Literacy Programs" (ibid., 2004. Concept Construxions puts a tool into secondary classrooms that supports these elements directly. The authors suggest "that practitioners and program designers ***flexibly try out various combinations"*** of elements, making sure the professional development and the assessment of student progress are always incorporated (ibid., p. 5). We followed their recommendations by developing a flexible yet elegant design to bolster and complement—not counteract—the literacy initiatives already in place in schools and districts. The quoted phrases in italics below are taken directly from the report (ibid., pp. 4-5) and are followed by explanations of how CCX has been supporting these recommendations with our partner schools:

*"**Direct, explicit comprehension instruction,** which is instruction in the strategies and processes that proficient readers use to understand what they read, including summarizing, keeping track of one's own understanding, and a host of other practices"*

- CCX is often used as a pre-reading or post-reading strategy, when students are guided to determine purposes for reading, engage new vocabulary, and demonstrate comprehension.

- Teachers use CCX to model and conduct think-alouds for students, and use the tool to scaffold lessons.

***"Effective instructional principles embedded in content,** including language arts teachers using content-area texts and content-area teachers providing instruction and practice in reading and writing skills specific to their subject area"*

- CCX's domain-specific color categories that correlate loosely but meaningfully across domains support many teacher discussions of how reading and writing are the same and different in various secondary subject areas. For several of our schools, CCX provided a conversation piece that fueled, or even prompted, these kinds of conversations. On some occasions, student comments and connections based on their reference to CCX motivated teachers to take note.

- In the classroom, CCX naturally invites students to visualize and create mental models in their brains of plot arcs, character continua, and relationships among ideas in informational texts.

- CCX supports students with their questions and paraphrasing techniques by literally giving them something to hold and show to represent their thinking to others as they speak.

***"Text-based collaborative learning,** which involves students interacting with one another around a variety of texts"*

- CCX supports collaborative discussions in the classroom—about texts, about ideas, about perspectives and opinions, about visuals, and about models of human-created or natural phenomena. The visual, auditory, oral and kinesthetic nature of classroom implementation offers a wide array of learners the opportunity to collaborate in substantive ways.

***"Strategic tutoring,** which provides students with intense individualized reading, writing, and content instruction as needed"*

- Collaborative Team Teachers/Special Educators, ELL specialists, Reading Recovery/reading intervention specialists, and after-school remediation programs have used CCX to support specific learners strategically as they negotiate classroom texts and assignments. The familiar system can move physically from space to space, and can maintain mental consistency for students.

- Advanced/GATE students enjoy using CCX to present alternative explanations or reasoning to teachers or other peers after class. Sometimes teachers use the results of these informal discussions to create peer-teaching moments in class the next day.

***"Intensive writing,** including instruction connected to the kinds of writing tasks students will have to perform well in high school and beyond"*

- Many students struggle with writing. Often, this is because they are not quite sure what to say due to various factors: they are not yet facile with the content, they do not understand their purpose for writing, there is no authentic audience outside of the teacher, or their ideas are swimming in their brains in a disorganized mess. CCX is used as a valuable pre-writing and revision tool, helping students to talk through their ideas, create a visual organization pattern on the Construxion Site, or connect concepts that support their point of view. The kind of writing that students are required to do in college and in the workplace requires them to have a clear sense of message, supporting details, and textual references that explain or persuade; this kind of writing demands sufficient instructional time in the pre-writing and revision phases.

***"Ongoing formative assessment of students,** which is informal, often daily assessment of how students are progressing under current instructional practices"*

- Many CCX users employ the system for formative assessment purposes. Since students exhibit a high level of engagement when using CCX, it is easy for teachers to gain insights into their thinking and determine where misconceptions lie. Teachers can strategically use Concept Cards to assess comprehension post-reading, and also can see which Concept Cards students select to include in classroom conversations on the Construxion Site. Concepts Cards left behind signal a lack of comfort, facility or relevance in students' minds.

- Diagnostic assessment also is a helpful way for CCX users to wield the tool. Pre-reading or pre-topic, teachers can assess students' prior knowledge more effectively than cold-calling students, or asking "out of the blue" type questions that even students with sufficient background knowledge find difficult to answer. Using single or a few Concept Cards as a base, teachers can see what level of facility students have, and can immediately inform the next

steps in the lesson. Assessment using CCX affords rich, varied kinds of diagnostic data, and serves as a nice complement to more standardized written assessments. And, of course, there are no papers to grade!

## ***Special Focus: Formative Assessment***

This assessment focus deserves special mention, as the literature about formative assessment substantively influences the professional development experiences we design in collaboration with schools and districts. The landmark work of UK researchers Black and Wiliam (1998a, 1998b) and the subsequent "Black Box" series (Black, Harrison, Lee, Marshall, & Wiliam, 2002; Black and Harrison, 2002; Hodgen and Wiliam 2006; Marshall & Wiliam, 2006) remain central to the practices we encourage in classrooms. The body of work by Stiggins and his colleagues (2001, 2004, 2005, 2007) also informs the design of our professional development curriculum for CCX users.

***"Professional development** that is both long term and ongoing"*
***"Teacher teams,** which are interdisciplinary teams that meet regularly to discuss students and align instruction"*

- Many of our implementing schools work with EduChange to develop a program of facilitated discussions and sharing sessions in extant or novel professional learning communities. Using CCX as a common tool allows for productive discussions that isolate strategies that are working, identify need areas across the grade level or within departments, and share progress of individual students.

- EduChange works collaboratively with schools and districts to provide three levels of professional development to attend to evolving and/or differentiated needs.

- As standards, texts and assessments change, CCX provides a much-needed anchor that supports these transitions. CCX demonstrates that stable and coherent best instructional practices, routines and systems, what we call "instructional infrastructure," are critical to closing the achievement gap; textbooks that represent the same content in a different order or at different grade levels and affix a new cover as a solution to changing expectations have proven ineffective.

***"A comprehensive and coordinated literacy program,** which is interdisciplinary and interdepartmental and may even coordinate with out-of-school organizations and the local community*"

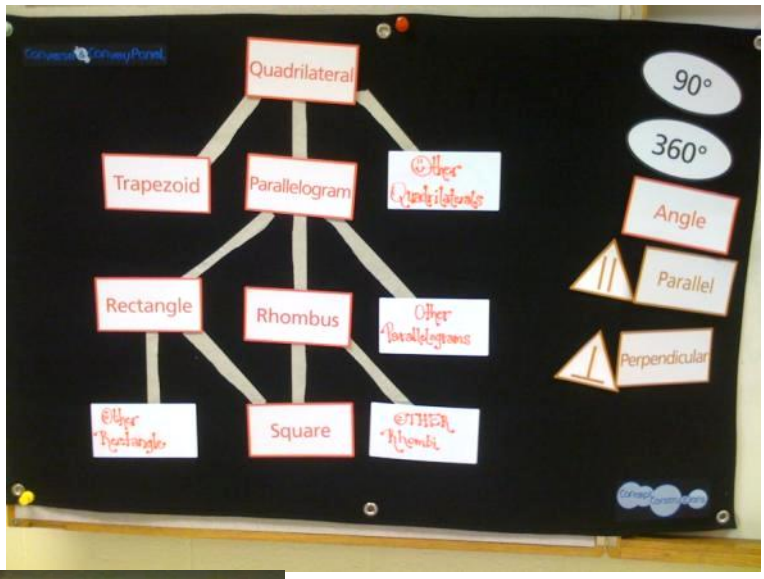
- School and district leaders seek support from EduChange in developing professional experiences for teachers in each subject area/domain that coordinate practices across disciplines. Sometimes, literacy experts are not well-versed in social studies, math and science and are not effective facilitators because they do not understand the cognitive demands of domain-specific texts and accompanying writing tasks. EduChange is a collective of subject-matter experts that convene to address domain-specific needs with an eye toward cross-curricular coordination.

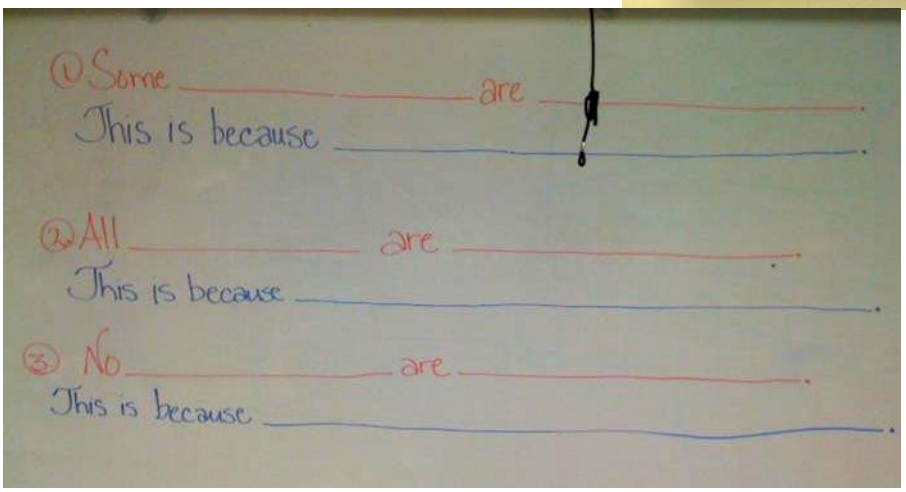
- The color-shape system concretizes the purposes for both comprehensive (vertical) and coordinated (horizontal) literacy and knowledge-based strategies across secondary courses. Teachers quickly see and appreciate CCX as an instantiation of both the need to collaborate and share practices, as well as a framework that can stabilize the implementation for teachers and students.

## ***Supporting Long-Term English Language Learners***

Unfortunately, English Language Learners (ELL) retain their status over long periods of time in our schools and 1 in 9 students is an ELL. 80% of ELL in the United States are Spanish speakers, and many of these students are also economically disadvantaged, meaning that they arrive to schools in the United States with limited educational backgrounds (Goldenberg, 2008). Thus, they tend to get "stuck" in an intermediate level of development and schools have trouble moving students into appropriate levels of academic language proficiency. Saunders and Goldenberg (2010) state that: *"*ELD instruction should continue at least until students reach level 4 (early advanced) and possibly level 5 (advanced).*"* CCX provides an instructional infrastructure that acknowledges the reality of the ELL situation and provides vertical articulation of language assistance in various classroom settings.

Linan-Thompson (2012) describes a model of building conceptual knowledge for ELL as one that combines general and domain-specific academic language with texts and discussions that illuminate content. She emphasizes "exploratory talk" where students clarify ideas, make suggestions to or challenge the ideas of peers, and use organizers such as sentence frames and other visualization tools. Zhang & Stahl (2011) emphasize similar discussion tactics. CCX professional development for teachers of ELL supports that research, and Concept Builders are designed to highlight appropriate ELL instructional models.




ELL struggle because they cannot make meaning of what they read (Fillmore, 2012). Leading researchers have described supports that help ELL, including but not limited to: front-loading vocabulary instruction, using visual aids and realia to support explanations, emphasizing speaking and listening, using established routines, engaging students in sustained and multimodal interactions with teachers and peers, and ensuring that teacher talk is comprehensible to students at these levels (Fitzgerald & Graves, 2004-2005; Kinsella, 2010; Krashen and Biber, 1988; Saunders and Goldenberg, 2010; Walqui & van Lier, 2010). Some of these recommendations have been used to construct ELL instructional models, such as the **Specially Designed Academic Instruction in English (SDAIE)** as described by Genzuk (2011) and the Sheltered Instruction Observation Protocol (SIOP) (Echevarria, Vogt & Short, 2009) whose methodologies several of our implementing schools utilize.

On the next two pages please find specific descriptions of the ways in which Concept Construxions supports these two instructional models.

# Concept Construxions® and ELL Students

a patented system

Concept Construxions is a vocabulary acquisition system that provides all students, including English language learners (ELL), with language support to facilitate content instruction (i.e., math, science, and social studies). Each component of the Concept Construxions system supports English language learners with research-based instructional practices as they progress toward meeting state standards. In fact, Concept Construxions and Specially Designed Academic Instruction in English (SDAIE) methodologies are based on the same premise: students learn best through comprehensible inputs that are grounded in the context of a given discipline. Concept Construxions provides English language learners with comprehensible delivery of content, which leads to academic language proficiency.

## For each of the Sheltered English SDAIE precepts below, see how CCX directly bolsters instructional efforts:

### SDAIE Lessons should utilize the academic language, and this repertoire should be complete for a given course and posted within the classroom

- Over 200 standards-based Concept Cards™ are provided for each academic discipline. This provides all ELL with a more equitable experience as they enter the classroom.
- The Converse & Convey Panel® serves as a posted reminder of previous vocabulary-based lessons, allowing students to see academic language and interact with learned words on a daily basis.
- Students use the back of the Concept Cards to write down Classroom Contexts™ where the word was used; they keep track of these contexts and add more as the year unfolds.

### SDAIE Teachers should make connections between student life experience and knowledge when introducing new concepts

- While using the Construxion Site, the teacher can verbally prompt students to make real-world connections and can personalize learning through examples that students can understand (comprehensible inputs)
- Students can write their own ideas, examples, cultural connections and analogies directly onto the Concept Cards

### SDAIE The ELL classroom should provide students with opportunities for active learning

- The Construxion Site® is the perfect place for students to collaboratively problem-solve, organize, arrange, assemble, express and, of course, *construct* meaning using higher-order thinking skills
- Concept Cards can be used in pairs or small groups just as easily as they can with the whole class

### SDAIE Teachers should use graphic organizers, pictures, realia and pictographs to aid in comprehension of new concepts

- These artifacts may be attached to or displayed near the Converse & Convey Panel
- The Concept Cards, with their color-shape system, are ideal manipulatives that enhance content learning
- The Converse & Convey Panel is a graphic organizer in and of itself!

### SDAIE English language learners should be provided with multiple opportunities to integrate newly-learned concepts into their reading, writing, speaking and listening

- Concept Construxions can be used several times each week, or even daily, to offer students the chance to practice using their terms as they "Converse & Convey."
- Writing and speaking prompts flow easily from the Converse & Convey Panel, acting as a formative assessment that provides teachers and students with ongoing feedback about content learning and vocabulary acquisition



Teachers for Learners® Smart Instruction Begins With Smart Tools™

# Concept Construxions® and ELL Students

a patented system

Concept Construxions® is an interdisciplinary, articulated academic language system that provides all students, including English language learners (ELL), with tools to build comprehension of major concepts within a discipline (i.e., math, science, ELA and social studies). Each component of the Concept Construxions system supports English language learners with research-based instructional practices to facilitate academic language learning as they progress toward meeting state standards. In fact, Concept Construxions and Sheltered Instruction Observation Protocol (SIOP) are based on the same premise: students learn best through clearly defined objectives, comprehensible inputs that are grounded in the context of a given discipline, and frequent practice and feedback.

## For each of the SIOP precepts below, see how CCX directly bolsters instructional efforts:

**SIOP** **Teachers should present curricular content that is aligned to state standards and should choose content concepts that are age appropriate and comprehensible.**

- Over 200 Concept Cards™ are provided in each Subject Set, and each concept was maps directly to national and state standards, widely-used curricular programs, and the major concepts of the discipline.
- Students use the back of the Concept Cards to write down Classroom Contexts™ where the word was used, and to make personal and real life connections so that concepts are meaningful and comprehensible.

**SIOP** **The ELL classroom should incorporate cooperative learning, reading comprehension strategies, and differentiated instruction to promote high quality instruction.**

- Concept Construxions supports a variety of pre-reading, during reading and post-reading strategies and allows teachers to provide multiple exposures to concepts over an extended period of time.
- Concept Cards can be used individually, in pairs, in small groups, or with the whole class, thus promoting opportunities for a variety of levels of cooperative learning and for the social construction of knowledge.
- Concept Builders provide teachers with model lessons that appeal to multiple learning styles, provide differentiated instruction prompts and structure cooperative learning tasks to optimize successful implementation.

**SIOP** **Teachers should use best-practice instructional techniques, including visuals and graphic organizers, to develop English skills in reading, writing, listening and speaking.**

- The Construxion Site is the perfect place for students to collaboratively problem-solve, organize, arrange, assemble, express, and, of course, construct meaning using higher-order thinking skills.
- The Construxion Site facilitates concept mapping, and the Converse & Convey Panel® is a visual display in and of itself!
- Teachers use the Converse & Convey Panel to prompt students to use academic language as they "Converse & Convey" when writing and speaking; this helps English language learners actively engage and interact with content of the discipline.

**SIOP** **Every content lesson should include language objectives that are geared towards developing background knowledge and content-related vocabulary and emphasizing academic literacy practice.**

- Concept Construxions can be used several times each week or daily, for a portion of a lesson or for the entire lesson, to flexibly support individual classrooms and mesh with curricular resources already in place.
- Concept Construxions promotes authentic academic language learning over the entire course of study by helping students learn language in context, then make connections to new concepts in subsequent units.
- The Concept Cards, with their interdisciplinary color-shape system, are ideal manipulatives that enhance content learning within a single content area (e.g., science), as well as bridge related concepts across the entire curriculum.

**SIOP** **English Language Learners should be provided with comprehensive review of key vocabulary and content concepts, assessed frequently for learning and comprehension, and provided with feedback about their learning.**

- A single Subject Set includes all of the key concepts and ideas that students need to assimilate over the course of an academic year. Teachers use Concept Cards again and again to reinforce past learning as new concepts are introduced.
- Writing and speaking prompts flow easily from the Converse & Convey Panel, acting as ready formative assessments that offer teachers and students with ongoing feedback about content learning and vocabulary acquisition.

## *Universal Design for Learning*

It is interesting yet not surprising that the same design principles that inspired Teachers for Learners products also laid the foundations for the Universal Design for Learning (UDL). In the 1980's, Ron Mace of North Carolina State University developed methods and guidelines for architecture and product design that consider applications to multiple users in multiple contexts (CAST, 2011, p.3). The work of CAST followed suit, with an eye toward curriculum design for the development of life-long learners. The following tables take each UDL principle and provide an explanation of how CCX offers a practical classroom tool to actualize select checkpoints. **In summary, 22 of 31 checkpoints are explicitly aligned with appropriate and tested uses of Concept Construxions in the classroom**.[4]

| | I. Provide Multiple Means of Representation (UDL) | Concept Construxions® Applications |
|---|---|---|
| Provide Options for Perception | Checkpoint 1.1 – Offer ways of customizing the display of information | CCX is designed for flexibility and customized use. Used as a reading strategy, print text becomes more accessible when students use CCX to revise and add to others' conceptualizations or previous learning. Emphases change depending on how certain students interpret the lesson at hand, as well as where the lesson falls in the overall trajectory of the unit. |
| | Checkpoint 1.2 - Offer alternatives for auditory information | CCX is designed to enhance verbally delivered information by coupling talk with tangible artifacts and a pattern-recognition system. CCX also may be used with sound recordings to help emphasize key concepts and make connections visually. Conversely, visual displays and graphic organizers with Concept Cards are almost always coupled with descriptive talk and explanations for learners who require more conversational support for graphic interpretation. |
| | Checkpoint 1.3 - Offer alternatives for visual information | |
| Provide options for language, mathematical expressions, and symbols | Checkpoint 2.1 - Clarify vocabulary and symbols | The shape system highlights the differences among symbols, notations, abbreviations & words or phrases. Pre-teaching with CCX in order to emphasize these important connections is a standard use case for the system. |
| | Checkpoint 2.2 - Clarify syntax and structure | The physical and spatial movement of Concept Cards allows teachers and students to construct, deconstruct and reconstruct visual displays such as T-charts, flow charts, concept graphs, taxonomies and timelines. This movement helps students to visualize component parts and then reorganize them in ways that aid their further comprehension. |
| | Checkpoint 2.3 - Support decoding of text, mathematical notation, and symbols | CCX provides "flexibility and easy access to multiple representations of notation where appropriate (e.g., formulas, word problems, graphs)" (CAST, 2011, p. 17). And better than a list of key terms, the color-shape system provides a stable system as the use of the same symbol or notation changes. The system provides mathematical consistency and coherence through the secondary grades. |
| | Checkpoint 2.4 - Promote understanding across languages | The CCX color-shape system is designed to work in multiple languages across multiple disciplines and through multiple levels. The ability of the system to expand is what makes CCX such a robust solution for teaching and learning across a variety of environments. |
| | Checkpoint 2.5 - Illustrate through multiple media | CCX itself provides an alternative to print text, for the reasons explained above and earlier in this paper. Students also add their own illustrations, depictions, downloads, photos and drawings to the Construxion Site or Converse and Convey Panel in order to enhance visualization. Teachers also use video and animations projected on Smart Boards alongside a CCX display for enhanced understanding. |

[4] Not all UDL checkpoints are included in these tables. Only those that align directly and explicitly are explained here.

| | | |
|---|---|---|
| **Provide options for comprehension** | Checkpoint 3.1 - Activate or supply background knowledge<br>Checkpoint 3.2 - Highlight patterns, critical features, big ideas, and relationships<br>Checkpoint 3.3 - Guide information processing, visualization, and manipulation<br>Checkpoint 3.4 - Maximize transfer and generalization | These UDL Checkpoints comprise the hallmark instructional premises of the CCX system. The implementation examples provided by CAST (2011) describe the types of instructional immersions that EduChange conducts in the professional development sessions for teachers. Below please find relevant excerpts from their *UDL Guidelines Version 2.0* (pp. 19-21):<br>• "*Anchor instruction by linking to and activating relevant prior knowledge (e.g., using visual imagery, concept anchoring, or concept mastery routines)*<br>• *Use advanced organizers (e.g., KWL methods, concept maps)*<br>• *Highlight or emphasize key elements in text, graphics, diagrams, formulas*<br>• *Use outlines, graphic organizers, unit organizer routines, concept organizer routines, and concept mastery routines to emphasize key ideas and relationships*<br>• *Provide scaffolds that connect new information to prior knowledge (e.g., word webs, half-full concept maps)*<br>• *Offer opportunities over time to revisit key ideas and linkages between ideas*" |

| | **II. Provide Multiple Means of Action and Expression (UDL)** | Concept Construxions® **Applications** |
|---|---|---|
| **Provide Options for Expression and Communication** | Checkpoint 5.1 – Use multiple media for communication | CCX provides physical manipulatives that help students engage in academic discourse. Having this tangible support provides security, and gives students more confidence when discussing text, art, visuals, video or other media. |
| | Checkpoint 5.2 – Use multiple tools for construction and composition | CCX acts as a pre-reading, post-reading, pre-writing, and modeling device for students who are engaged in project-based learning where their own compositions and products are front and center. The revisionist, iterative nature of the design process is freely supported, and encouraged, by the use of CCX. |
| | Checkpoint 5.3 – Build fluencies for graduated levels of support for practice and performance | Mathematical and literary fluency is supported by the use of the relevant Concept Cards in different contexts, with different texts, and with different problems experienced over multiple years. The vertical articulation allows teachers to continue scaffolding concepts that require it, while retiring concepts that students have internalized. |
| **Provide options for executive functions** | Checkpoint 6.2 – Guide planning and strategy development | CCX makes it easy for math teachers to guide problem-solving planning and allow students to share multiple strategies before actually solving the problem at hand. This practice emphasizes the process, and not the correct answer. In science, the design of experimental procedures also should be planned and revised, for safety purposes as well as to clarify purposes in the lab. |
| | Checkpoint 6.3 – Facilitate managing information and resources | CCX is the ultimate conceptual organization aid, providing a prominent, consistent and ready reference in the classroom. Students refer to the Concept Banks and also to completed displays in order to jog their memories and keep them grounded in the task at hand. |
| | Checkpoint 6.4 – Enhance capacity for monitoring progress | Teachers find CCX to be incredibly useful as a formative assessment tool, and students can gauge progress based on the kinds and numbers of connections they make. Concept Cards that are used with ease stand out in classroom activities and discussion, and there is a visible remnant of those concepts that were left behind during the activity. Both teachers and students can reflect on why that was the case. |

| | II. Provide Multiple Means of Engagement (UDL) | Concept Construxions® Applications |
|---|---|---|
| Provide Options for Expression and Communication | Checkpoint 7.2 – Optimize relevance, value and authenticity | CCX invites learners to bring their own perspectives to the table. When teachers "*provide tasks that allow for active participation, exploration and experimentation*," CCX elicits engagement from all learners. Other relevant and tested CCX classroom experiences are highlighted in CAST's implementation examples:<br>• "*Invite personal response, evaluation and self-reflection to content and activities*<br>• *Include activities that foster the use of imagination to solve novel and relevant problems, or make sense of complex ideas in creative ways*" (2011, p. 29) |
| | Checkpoint 7.3 – Minimize threats and distractions | Teachers observe that students feel safe and unthreatened when using CCX, and they are more inclined to share confusions, take risks, or challenge another's point. Since it is designed to breed social constructivism, there is a natural kind of differentiation that invites each learner to participate in his/her own way. This may include non-verbal participation, as from a pre-production ELL. |
| Provide options for sustaining efforts and persistence | Checkpoint 8.3 – Foster collaboration and community | CCX supports the development of communities of practice in the classroom. Once again, it provides a predictable system when groups and roles change. This supports teachers in managing more complex configurations in the classroom, encouraging them to provide opportunities for peer collaboration that increase in sophistication over time. |
| | Checkpoint 8.4 – Increase mastery-oriented feedback | Physical, visual and verbal cues from students allow teachers to provide immediate, corrective feedback when needed. And, teachers can walk up and rearrange or model a different solution or strategy if necessary. Since the goal is exposure to multiple applications of the same concepts, students understand that they will have the opportunity to try again at another moment or on their own time. Students often find CCX useful during after-school sessions when they are in need of extra support for advancement or remediation. |

## *Principles of Learning*
## *(from The Institute of Learning at The University of Pittsburgh)*

The work of Lauren Resnick and other Institute for Learning researchers (2000, 2006; Michaels et. al., 2010) have anchored many schools and districts in principles that help shape the culture, vision and operations of the learning organization. Concept Construxions specifically targets the following principles: *Academic Rigor in a Thinking Curriculum*, *Accountable Talk*, *Socializing Intelligence, and Self-Management of Learning*.

***Academic Rigor in a Thinking Curriculum*—**The Institute of Learning reminds educators that rigor cannot be achieved without a deep understanding of content, nor can it be achieved without getting students to think deeply in order to achieve deep understanding.

- "Commitment to a Knowledge Core": Core concepts that are revisited over time is key to coherence in a rigorous curriculum, and CCX enables course development committees, grade level teams, and domain/content area departments to instate an articulation structure that supports curricular coherence in a flexible yet accountable way. The Principles also prompt schools to articulate curriculum so that it "progressively deepens understanding of core concepts" (Institute for Learning, 2000, p. 4).

- "High Thinking Demand": It is important for teachers to understand that all students should be engaged in active reasoning from the very start of a topic or unit. Teachers can use CCX to pose questions and complement activities that demand thinking *from* students rather than digesting content *for* them on PowerPoint presentations. CCX is perfect for challenging students "to construct explanations and to justify arguments in each subject" (ibid.). These premises are incorporated into the immersions and explicitly reviewed with corresponding materials that guide teachers in the replication of such learning experiences.

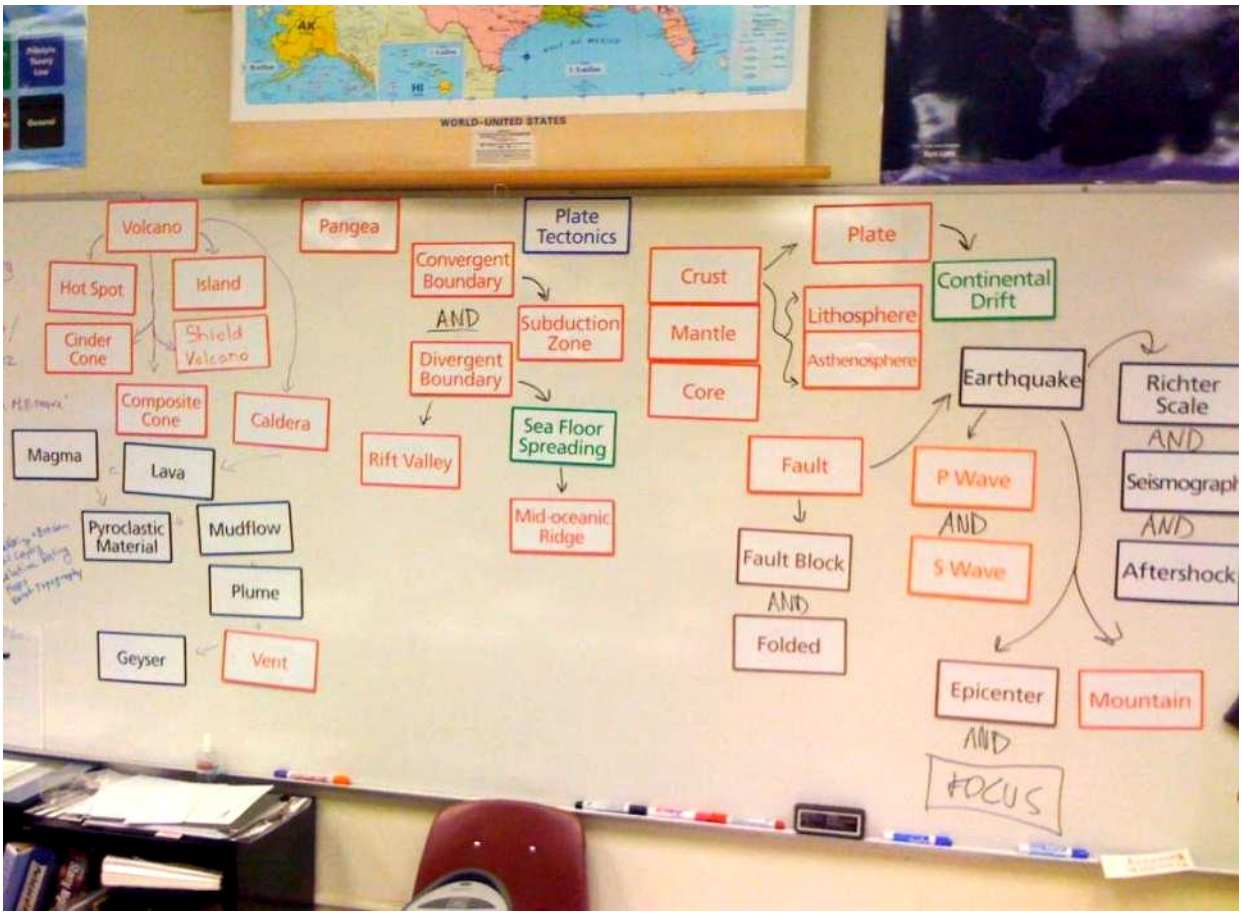
- "Active Use of Knowledge": Again, CCX is a powerful conduit for student-centered learning. The authors remind educators that: "People only acquire robust, lasting knowledge if they themselves do the mental work of making sense of it" (Institute for Learning, 2000, p. 5). The name Concept Construxions was coined based on this understanding of active engagement in one's own learning. Professional development helps teachers visualize "instructional tasks and classroom discourse" that "require students to interpret text and construct solutions" (ibid.).

***Accountable Talk®*—**New teachers sometimes confuse taking turns to speak, listening politely and praising others for participation as major goals of the Accountable Talk model. Indeed, the management skills required to achieve that level of discussion in the classroom take some teachers a bit of time to acquire and are not trivial. But The Institute of Learning intends for the talk in classrooms to enter the realm of academic discourse. EduChange models the structure and flow of true academic discourse by demonstrating: ways for teachers to be more accountable to their own talk and "air time" in proportion to that of their students; how domain-specific talk time is used to teach content; prompts that encourage collaborative problem-solving, synthesis of others' ideas, and revisionist thinking; the correct use of Tier Two and Tier Three academic language; and norms and structures that routinize this kind of talk in the classroom over time. The "Accountability to Knowledge" and the "Accountability to Rigorous Thinking" are particularly difficult to enact for some teachers, and CCX is useful for supporting a transition from classroom management to academic discourse (Michaels et. al., 2010).

***Socializing Intelligence***—Built on the early ideas of Dewey's social construction of knowledge, the Institute for Learning suggests that teachers tap the inherent social energy of secondary students to build capacity for learning in a collaborative setting. When teachers foster certain "Beliefs," "Skills" and "Dispositions" in students, they invite their students to learn about learning (Institute for Learning, 2000, p. 9). All students must believe they can: attain high expectations, build stamina for problem-solving and processing complex tasks and concepts, and persist beyond initial frustration. Teachers, too, must adopt the same habits of mind and demand that students do most or all of the thinking and interacting (Perret-Clermont et. al., 2004). CCX is helpful in creating classroom culture and community because it simultaneously offers all students access to the domains of academia and reminds them to revisit the core concepts day after day without fail.

***Self-management of Learning***—Metacognition is not a process that many people naturally initiate. In order to monitor one's own learning, it is important to see a teacher or peer model what that looks like. One of the more difficult parts of this process is keeping track of the "story line"—where the learning began, how it progressed, what was helpful or hindering, and where it culminated. CCX makes these progressions more tangible and visual to learners, including how certain people's participation moved the work forward. Fishbowls and other whole-class experiences can help students name the kinds of learning and participation their classmates demonstrate, and the process of reflection can become internalized. Over time, students can use CCX without the help of the teacher, and can comment on what worked and what did not in terms of their own learning progress. In this way, students use CCX to "become agents of their own learning" (Institute for Learning, 2006).

The photo below shows the result of a verbal, visual and kinesthetic collaboration among 3 Special Needs students in an Alternative school—without the help of the teacher.



## ***Differentiated Instruction***

The large body of work by Carol Ann Tomlinson (2000, 2001, 2004, 2005, 2006) and the work of Rick Wormeli (2006, 2007) have greatly impacted the approach to curriculum delivery. Unlike individualized instruction where outcomes are different for each student, differentiated instruction guides teachers to convene their classrooms around common curriculum, but allows for different students to pursue different pathways toward the same end. This approach is more responsive to the needs of learners than more traditional instruction, where students "sink or swim" based on whether a teacher's approach or pace works for them. While most educators concede that a differentiated approach is desirable, it represents a level of sophistication in the pedagogy that not all teachers have reached. Further, there is confusion in schools about what differentiated instruction looks like.

One reason for this confusion lies in the misunderstanding of the site of differentiation. Teachers sometimes try to differentiate very discrete and specific understandings or strategies and feel disappointed when it does not work. Tomlinson (2001) asks educators to "zoom out" and consider a wider scope as a starting point for differentiation:

*"Differentiated instruction is so powerful because it focuses on concepts and principles instead of predominantly on facts...[this focus helps students]*

- *Understand rather than memorize*
- *Retain ideas longer because they are more meaningful*
- *Make connections between subjects and across facets of a single subject*
- *Relate ideas to their own lives*
- *Build networks of meaning for effectively dealing with future knowledge"*


Consistent with the Principles of Learning (Institute for Learning, 2000, 2006), the message here is that students must be invited to make meaning of core concepts and ideas rather than copy teacher notes half-heartedly or press "play" and sit passively in front of a computerized lecture in order to satisfy seat-time and coverage requirements. Teachers find CCX helpful in gaining insight into differentiation practices. Strategic selections of Concept Cards for different students help maintain a common conversation, but allow different students to participate at their own level of ability. Professional development immersions demonstrate the use of the Construxion Site as an anchor for key concepts while flexible groups of students work with different problems or texts. These groups may be orchestrated according to learner interest, learner profiles or learner readiness. CCX is used to reconvene and assess all students on their understandings of the key concepts after they experience different tasks or texts. This activity sequence has helped many teachers gain confidence in this advanced mode of instruction.

# Digital Concept Construxions:
# A Demonstration of Ed. Tech. 2.0

Educational leaders and developers are both asking, “How do we effectively integrate technology into the classroom?” Unfortunately, Ed Tech 1.0 in the USA has witnessed the introduction of a multitude of ill-conceived technology products that educators must somehow “shove” into class time because they are mapped to itemized technology dollars that must be spent and monitored. Certainly, quality technology tools that are effective for educational settings exist, but they are the exception rather than the norm. The promise of technology is great, but not if those trying to “get in the game” do not understand what the game really is in the first place. Similar observations have been made by CAST regarding their Universal Design of Learning modeil, and they have concluded: “Effective teachers should be creative and resourceful in designing flexible learning environments that address the variability of learners using a range of high-tech and low-tech solutions (2011, p. 10).

We believe that the questions about educational technology integration should be reframed for Ed Tech 2.0. “What are desirable teaching and learning practices, and what tools would best support them?” is a more appropriate question. And those who answer that question likely should be a combination of experienced and new educators, researchers and information architects. Often (though not always), technology will be part of the solution; but technology is not an educational solution in and of itself.

As described in previous sections of this report, we have designed, tested, delivered, and continue to refine the physical use case for this system. We are currently embarking on the digital use case because we feel that there are different instructional purposes that it can address. We recommend that schools use both physical and digital components for a full-scale solution, as it is easier and more effective to use the physical components for certain instructional purposes, and the digital components for others.

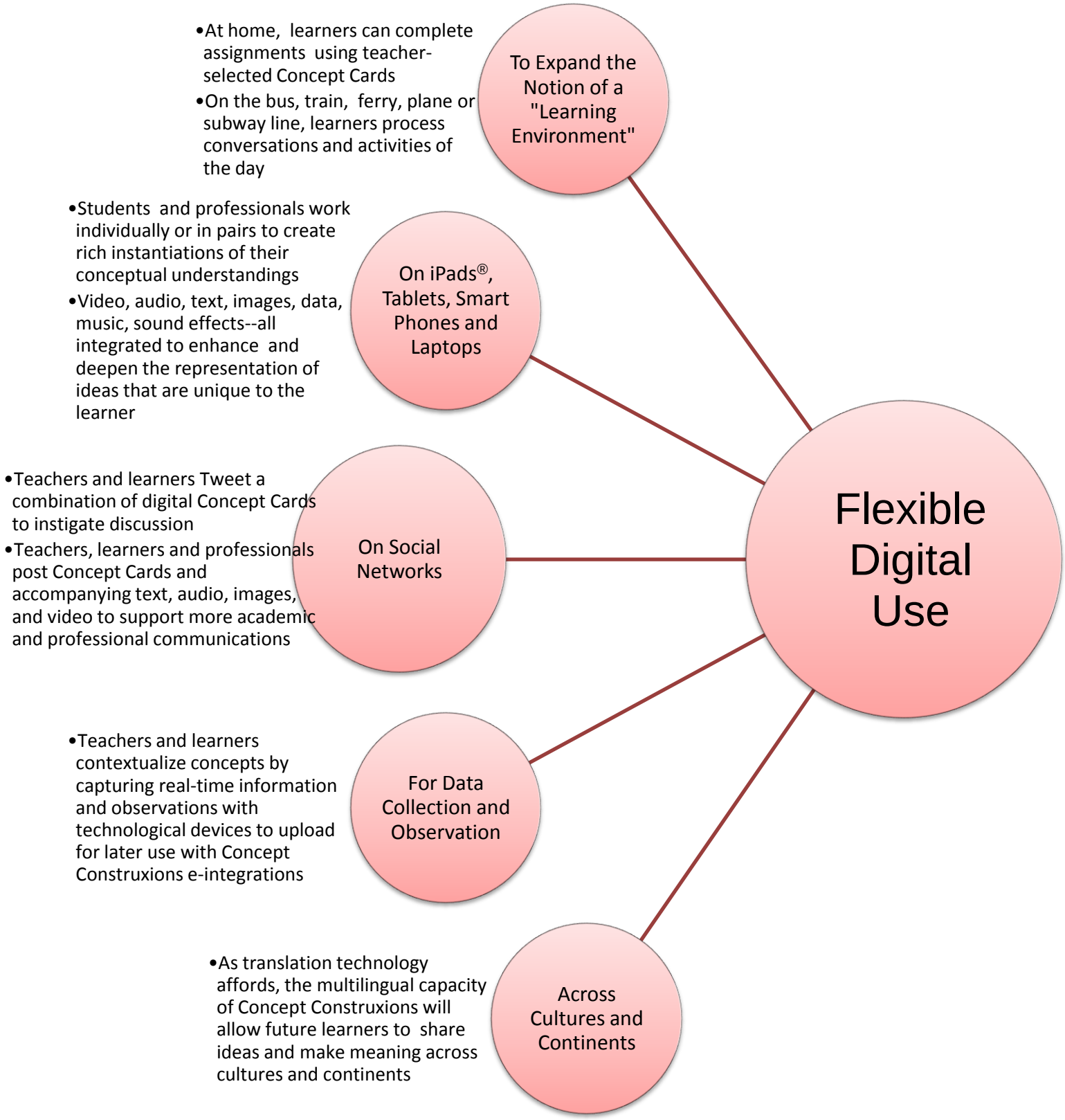
The physical Concept Cards work well because they help concretize substantive interactivity in synchronous learning environments. There is nothing more gratifying than to witness learners “giving” and “getting” concepts from their peers to support their understanding--CCX physical makes this process tangible, and even visceral. Digital integrations must take this physical and synchronous interaction and allow the conversations to continue and build asynchronously. Eventually, users may initiate the conversations digitally. But for the rich, high-level, high-quality conversations to take place, most learners require some kind of initial or even ongoing facilitation. Much of the educational literature cited earlier in this report, as well as other research, describes high-quality interactions for academic and professional purposes as those that involve:

- critical thinking and problem-solving
- constructivist and revisionist work (the work of modeling)
- conversations where discussants’ verbal contributions show evidence of active listening
- probing and pressing questions where the goal is a desire for the work to progress

It is the movement between asynchronous, short-form, follow-up, instigative types of communications and synchronous, long-form, detail-rich, complex types of discourse that Concept Construxions seeks to support. In addition, e-integrations with various video, audio, text, image, data, music and sound effects applications offer users an opportunity to reflect on and process these rich interactions. These multimedia & multimodal representations of understandings and idea configurations will serve to fuel next steps for learners and collaborators. In this way, Concept Construxions provides a stable yet flexible framework for both physical and digital use.

Please refer to the diagram on the next page for a visualization of the digital use case.

**Just as the physical components do, the digital use case will provide multiple entry points and opportunities to enhance the *Concept Construxions*® experience:**



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