The Family Learning Company
Research Papers

The research upon which all Family Learning Company products are based.

The 6 Components of Literacy

Promoting English Learners' Literacy Development in English

Formative vs. Summative Assessment

Student-Controlled Learning vs. Algorithms

Peer Learning vs. 1:1 Computing

Entertainment vs. Education

Accelerating Vocabulary Development

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By Jonathan A. Bower

Developing the 6 Components of Literacy

Twenty years ago, the U.S. government commissioned a project to definitively recommend the best approach to teaching literacy. Only one third of the students in American schools were learning to read proficiently, and their lack of literacy was preventing their further education. In 1998, the U.S. National Research Council released *Preventing Reading Difficulties in Young Children*[1] defining instructional solutions to the problem. In 2000, the *Report of the National Reading Panel*[2] was published describing which methods of teaching reading are proven to work by rigorous scientific studies. Both reports concluded that while reading as much as possible, students should be explicitly taught skills in six areas:

1. **Phonemic Awareness** – an understanding of the sounds in their language and how they form words,
2. **Decoding** – the ability to figure out unfamiliar words, and to learn to read them automatically,
3. **Vocabulary** – knowledge of an adequate number of words to understand text passages,
4. **Fluency** – the ability to read quickly and without conscious attention,
5. **Comprehension** – the ability to understand the direct meaning of text, and also its implications and intention, and finally the ability to perform analysis on text and
6. **Writing** – the ability to express their feelings, thoughts and understanding in various forms of written expression.

Ideally, learners should master phonemic awareness by the end of Kindergarten and decoding by the end of 3rd grade[3] while actually reading for pleasure and for knowledge. Then, learners read material of interest to them[4] while being taught to improve their vocabulary, fluency and comprehension abilities until they can easily read, understand and analyze any text. From the time they can hold a pencil, students also learn to share their perspectives, understanding and ideas in writing.

This approach stands in contrast with "whole language" approaches to reading instruction which exclusively emphasize the reading of important content and focus on using context clues to discern the meaning of text. This approach has been thoroughly debunked by data showing that explicit instruction in phonics combined with text-based language activities (reading) generates significantly faster progress in reading than the whole language approach[5].

Unfortunately today, it is still true that only 36% of students in American schools ever become proficient readers by the time they enter high school[6]. The vast majority lack adequate phonemic awareness and decoding skills, which prevents them from mastering higher level reading skills[7]. Few continue to build their reading vocabularies so that they can take on more complex, interesting text. They do not become fluent readers, and they do not learn to fully comprehend text so that they can write about it.

The solution is clear: provide developing readers of all ages with explicit instruction and plenty of practice in the six components of literacy while providing access to interesting content, until they have become proficient readers and writers. High quality literacy software provides the practice to complement teacher instruction so that students learn to mastery.

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1 Snow, C.E., Burns, M.S., and Griffin, P. (Eds.). (1998). *Preventing reading difficulties in young children*. Washington, D.C.: National Academy Press.
2 National Institute of Child Health and Human Development. (2000), Washington, D.C.
3 Joseph K. Torgesen. (2005) *Preventing Early Reading Failure*.
4 Torgesen, J. K., Houston, D. D., Rissman, L. M., Decker, S. M., Roberts, G., Vaughn, S., Wexler, J. Francis, D. J, Rivera, M. O., Lesaux, N. (2007). Academic literacy instruction for adolescents: A guidance document from the Center on Instruction. Portsmouth, NH: RMC Research Corporation, Center on Instruction.
5 Camilli, G., Vargas, S., and Yurecko, M. (May 8, 2003). *Teaching Children to Read*: The fragile link between science and federal education policy. *Education Policy Analysis Archives, 11*(15).
6 National Center for Education Statistics. (2013). *2013 Reading Assessment Report Card*.
7 Joseph K. Torgesen. (2005) *Preventing Early Reading Failure*.

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By Jane Montes, PhD
& Jonathan A. Bower

Promoting English Learners' Literacy Development in English

English Learners (ELs) each bring their own, varied cultural and linguistic literacy development experiences to literacy acquisition in English. As explained in the 2006 report *Developing Literacy in Second-Language Learners*[1], ELs take a more unique route than their English speaking peers to developing literacy in English, even though their reading instruction comprises the same research-based components: phonemic awareness, phonics/decoding, fluency, vocabulary, and text comprehension along with writing skills development. Successful literacy instruction for ELs results when ELs build upon their prior knowledge, capitalize on opportunities for cross-linguistic transfer, and receive academic language and literacy instruction that is comprehensible.

Building on ELs' existing phonological awareness to develop phonemic awareness is equally important to their literacy development as it is for native English-speaking students. It is essential, however, to recognize that the ELs' development of phonemic awareness is largely influenced by their native language proficiency and their phonemic awareness of the sounds in their native language.[2] Given the interactive nature of the components of literacy, ELs benefit most when all six skills are taken into consideration simultaneously, rather than learning them in isolation. For example, Helman discussed the importance of phonics in learning to read and also recommended eight instructional guidelines to support ELs' acquisition of the written code: 1) Work with students at their developmental level; 2) Build on students' home language and literacy skills; 3) Follow a systematic sequence of literacy instruction; 4) Make phonics instruction clear and explicit; 5) Use active learning strategies to teach and practice skills; 6) Integrate vocabulary study into phonics instruction; 7) Connect phonics instruction to meaningful texts; 8) Check for understanding and use frequent informal assessments.[3]

Flink Bilingual Literacy implements these recommendations to offer ELs appropriate second language literacy learning opportunities in English with meaningful practice in all six skill areas. Specifically, *Flink Bilingual Literacy* provides:

- Explicit phonics practice in Spanish and English using a language-specific scope and sequence for each language to ensure complete mastery of phonemic awareness and decoding skills,
- Explicit vocabulary development built on a curated list of over 1,200 high frequency vocabulary words essential for developing social and academic literacy,
- Over 120 grade-leveled eBooks in both Spanish and English with audio support for guided reading practice, tools to measure fluency, and activities supporting the development of reading comprehension via the framework *Strategies That Work*[4]: making connections, visualizing, inferring, determining importance, and synthesizing, and
- Structured opportunities to write that provide a scaffold from mechanics activities to free writing.

Daniel and Cowan[5] discussed the many language learning benefits of technology as an instructional tool for ELs. Among those benefits, the *Flink Bilingual Literacy* supplemental program offers ELs software-based practice that includes: the opportunity for ELs to interact with their second language numerous times while developing control over a text through the processing of auditory and visual input; and, regular opportunities for oral language development in the form of collaboration with peers on interactive tasks that are meaningful and result in language learning. In these many ways, *Flink Bilingual Literacy* promotes both reading comprehension and writing skills for ELs.

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[1] August, D., & Shanahan, T. (Eds.). (2006). *Developing literacy in second-language learners: Report of the national literacy panel on language-minority children and youth*. Mahwah, NJ: Lawrence Erlbaum.

[2] Herrera, S.G., Perez, D.R., & Escamilla, K. (2010). *Teaching reading to English language learners: Differentiated literacies.* Boston: Allyn & Bacon.

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[4] Harvey, S., & Goudvis, A. (2000). *Strategies that work: Teaching comprehension to enhance understanding.* York, ME: Stenhouse.

[5] Daniel, M. C., & Cowan, J. E. (2012). Exploring teachers' use of technology in classrooms of bilingual students. *GIST Education and Learning Research Journal, 6, 97-110.*

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By Jonathan A. Bower

Formative vs. Summative Assessment

When most people think about assessment, they think about tests: medium stakes tests that measure learning at the end of a course module or the end of a course, or high stakes tests at the end of a schooling experience. While these tests provide valuable information about whether learning has taken place, they do not provide much information to students or teachers about why, and none about how to achieve mastery of the target skill or content.

Formative assessment provides the data that learners and teachers need. Formative assessment is a not a test; rather, it is a conversation between learners and teachers (including peers) about learning goals and what it will take to achieve them. It comes in the form of formative feedback from learners to each other, from teachers to learners and from learners to their teachers as they go through the learning process together. According to John Hattie, “the most powerful single moderator that enhances achievement is feedback.”[1] In their review of 196 studies describing nearly 7,000 effects on learning, Hattie and Timperley reported that formative feedback had an average effect size of 0.79 – an effect greater than student prior cognitive ability, socioeconomic background, and reduced class size[2].

Note that learners and teachers are grouped together when we discuss formative assessment. Rather than having teachers test students, in formative assessment they work together to achieve an understanding of where they are in the learning process, where they need to go to achieve their mutual goal, and what needs to be done next to move forward. For larger goals, students present evidence of their mastery to their teachers, accumulating small points of data into a complete story.

While it is possible to use test results as the basis of formative feedback, there are plenty of other forms of data that can be used such as: written feedback on papers, audience feedback about presentations and performances, and, the feedback provided by software to learners. In fact, instructional support software is the ultimate source of formative feedback because it provides endless real-time feedback at exactly the moment of learning. As Hattie says, “The simplest prescription for improving education must be ‘dollops of feedback’ -- providing information how and why the child understands and misunderstands, and what directions the student must take to improve.”[3] “Feedback designed to improve learning is more effective when it is focused on the task, and provides the learner with suggestions, hints, or cues, rather than offered in the form of praise or comments about performance.”[4] Well-designed educational software provides just such hints and cues, while leaving it up to the learner to complete every task.

As we have discussed in the paper, *Entertainment vs. Education*, frequently viewing formal reports about their progress toward learning goals is also highly motivating to students. They receive acknowledgement of their achievements of mastery, feedback on their progress toward their goals, and an understanding of the scope of the task they are engaged in. So long as they can measure their progress, and experience control over the learning process, students will continue to make the effort to learn.

In summary, the direct feedback provided by well-designed software learning activities, and the reports it provides to students, provide valuable formative feedback; enhancing summative test results.

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[1] John Hattie, *Influences on student learning*, 1999
[2] Hattie & Timperley, 2007, p. 83
[3] Op.Cit. Hattie, 1999
[4] Bangert-Drowns, Kulik, Kulik, & Morgan, 1991; Kluger & DeNisi, 1996

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By Jonathan A. Bower

Personalizing Learning with Student Control vs. Algorithms

In general, the large amount of research on the subject of student agency shows that "the degree to which students learn how to control their own learning … is highly related to outcomes.[1]" Furthermore, for computer-aided instruction, "when the student is in 'control' over his or her learning … then the effects were greater than when the teacher was in 'control' over these dimensions of learning.[2]" Students who feel that they are in control of their learning are more highly motivated to do the often difficult work of acquiring a new skill like reading. Studies by Kanevsky & Keighley on student engagement show that, "Five interdependent features … distinguished boring from learning experiences: control, choice, challenge, complexity and caring teachers. The extent to which these five C's were present determined the extent of students' engagement and productivity.[3]"

Student-controlled software gives students control through choice. Students choose their own challenges across a range of complexity; for example in reading, evolving from simple alphabet activities to the application of complex analysis to text. The key item that software cannot provide is a caring teacher. That's where peer learning comes in[4]: students can share a screen with peers, who usually care about their co-learners, and with caring parents who certainly do. In this way, student-controlled software provides truly engaging and effective learning experiences.

And what about algorithms? Computer-assisted instruction is one of the many interventions studied by researcher John Hattie who found that:
- normal mental development and exposure to a teacher for a year generates an average learning gain of 0.37[5], while
- the use of computer-assisted instruction also shows a gain of exactly 0.37 per year.

Students who use algorithmically-controlled software see no benefit above students who don't!

We shouldn't be surprised. The algorithms used are rarely sophisticated enough to account for the different learning pathways of real students. As Richard Culatta says, "a model where a student is simply clicking through digital content at their own pace does not meet the criteria for personalized learning."[6] Even "Individualized Instruction" programs based on student-response algorithms do not provide a truly personalized learning experience, and as shown by Hattie's analysis if the research, do not contribute in a meaningful way to learning.

Flink Learning implements all of this best practice research by putting students in charge of their own learning in order to maximize learning outcomes. Flink Learning products are student-controlled. This means that students choose not only when and where they use them, but also, what learning activities they perform, or build – without limitations. They are free to choose any level, any activity, and to repeat activities as they wish/need. They use information about their performance on each activity, and about what they need to accomplish, to decide whether to repeat it, move on to a more difficult one, or to do something else entirely. The result is both long-term engagement and accelerated learning.

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[1] Hattie, John. *Visible Learning: a Synthesis of Meta-Analyses Relating to Achievement*, 2009, P. 48.
[2] Ibid. P. 225.
[3] Lannie Kanevsky & Tacey Keighley. *To produce or not to produce? Understanding boredom and the honor in underachievement*, Roeper Review, Volume 26, 2003 - Issue 1, P. 20-28
[4] *See Peer Learning is Better than 1-1 Computing* by Jonathan Bower
[5] That is, an effect size of 0.37 from the school experience over one year. Effect sizes ranged from -0.3 to 1.44.
[6] Tweet: Richard Culatta,CEO, International Society for Technology in Education

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By Jonathan A. Bower

Peer Learning is Better than 1:1 Computing

Since the advent of computer-assisted instruction on mainframe computers, educators have assumed that learners should use computers on their own. More recently, hardware vendors have certainly encouraged the notion that schools need one device for every student. Software developers have simplified their lives by assuming that their programs will be used by one person at a time. Yet, research shows that just as they do in classroom settings, learners learn faster and more easily when they work together at least some of the time. For this reason, Flink Learning offers its **Team** programs which encourage learners to work together, and with adults, increasing both engagement and outcomes.

Why is peer learning more effective? Because at their core, human beings are social learners. In a meta-analysis of studies investigating instructional practices that enhanced motivation for, and engagement in, reading, Guthrie and Humenick identified four instructional practices with significant effect sizes including "opportunities to collaborate with other students in discussion and assignment groups to achieve their learning goals.[1]" During its research phase from 2000 until 2010, The Writers Express found that students improved their writing faster in response to peer feedback along with teacher feedback than from teacher feedback alone[2]. The National Mathematics Advisory Panel sites 31 studies in its 2008 report indicating that various forms of peer learning accelerate the learning of mathematics, eight of which studied peer learning with computer software.[3] The computer science department of Brandeis University created a web-based computer program for skills development (mathematics, geography, and spelling) and found that when they applied a scoring algorithm that rewarded students for the improvement of their peers, the entire group learned significantly faster together.[4]

Aren't computer-based learning programs effective when used 1:1? Not really. Computer-assisted instruction is one of the interventions studied by researcher John Hattie[5] who found that:

- Normal mental development and exposure to a teacher for a year generates an average learning gain of 0.37[6], and
- The use of computer-assisted instruction also shows a gain of exactly 0.37 per year. Students who use algorithmically-controlled software 1:1 see no benefit over students who don't!

How does peer learning with software actually work? Flink's eBook activities provide an excellent example. Learners work in pairs with one reading out loud and the other listening and correcting/ assisting their peer when they make a mistake or get stuck. The reader gets a fluency score based on how quickly they finished the book. Both learners work together to answer a set of comprehension questions, some of which require an analytical conversation between the learners to answer. In this fashion, readers can take on more complex text as requested by the Common Core state standards, gain fluency without the presence of an adult to guide them, and learn from the type of analytical conversation shown to maximize engagement in reading by Guthrie and Humenick.

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[1] Motivating students to read: Evidence for classroom practices that increase reading motivation and achievement. JT Guthrie, NM Humenick, *The voice of evidence in reading research*, 2004

[2] Deborah Reck, former CEO of the Writers' Express & CAO Language Arts for Amplify Learning

[3] National Mathematics Advisory Panel. *Foundations for Success: The Final Report of the National Mathematics Advisory Panel*, U.S. Department of Education: Washington, DC, 2008

[4] Unpublished, Jordan Pollack, 2007

[5] http://visible-learning.org/2016/04/hattie-ranking-backup-of-138-effects/

[6] That is, an effect size of 0.37 from the school experience over one year. Effect sizes of various interventions ranged from -0.3 to 1.44.

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By Jonathan A. Bower

Entertainment vs. Education

Americans, and many others around the world, live in a highly stimulating entertainment environment. Television, video games, phone apps and a myriad of web sites offer highly engaging entertainment experiences at any time, in just about any place. In order to compete for attention, many educators and education software developers argue that learning experiences need to be given the style, pace and scoring systems of games, to be “gamified,” in order to engage learners and provide effective learning experiences. Yet, research contradicts their assumption.

Humans are natural learners. The brain secretes Dopamine in its reward centers in response to a successful learning experience demonstrated by performance[1]. First graders successfully reading new words and golfers who learn to hit straighter down the fairway both experience real pleasure from their achievements. They do not need animated figures to congratulate them, rapid-fire editing to keep them involved or good scores to tell them they succeeded. Performing a learned skill generated the pleasure by itself.

Even more important to learning, the gamification of learning activities actually reduces learning; reducing the value and the pleasure that learners receive from their use. Research by Michelle Donnelly in 2006[2] found that students who heard stories read out loud were 2.5 times more likely to remember their content than students who experienced them in animated interactive applications. Writing about the study, Iain Thomson noted that “pupils who use interactive software cannot remember the stories they have just experienced because they are distracted by cartoons and sound effects.”[3] Similarly, Hongpaisanwiwat and Lewis reported in 2003 that animated characters had zero or negative impact on recall depending on whether a human or animatronic voice was used[4]. Many other studies[5] have shown the same: the more multimedia effects are included in learning activities, the less learning takes place due to both time wasted and distraction from the learning task.

Effective instructional software implements this research by limiting animation to answers moving into position for selection by learners, and by limiting sound effects to direct positive and neutral (for errors) feedback. Students choose the backgrounds they prefer from complex themes or simple colors depending on their ability to concentrate and their propensity for boredom. Learners focus on the content; tracking their progress through reports. Teachers can also access these reports to provide additional feedback and direction to learners, but the primary value is in informing students directly[6]. That is probably the only area where gamification is appropriate for learning: more learning takes place when students receive direct feedback on their performance than if they receive it from a third party.

In sum, well designed educational software activities provide engagement through learning rather than through entertainment, effectively motivating students to succeed.

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[1] *The Compass of Pleasure: How Our Brains Make Fatty Foods, Orgasm, Exercise, Marijuana, Generosity, Vodka, Learning, and Gambling Feel So Good.* David J. Linden Penguin, Apr 14, 2011

[2] Education 3 to 13

[3] Iain Thomson, vnunet.com 10 Jan 2006

[4] *Attentional Effect of Animated Character. Human-computer Interaction*, INTERACT ’03: IFIP TC13 International Conference. Cholyeun Hongpaisanwiwat & Michael Lewis (2003)

[5] Christensen & Gerber (1990), Boyce & Assad (1990), Tversky, Morrison & Betrancourt (2002), Rieber, Baylor, Ryu & Shen (2003), Large, Beheshti, Breuleux & Renaud (2003), De Jong & Bus (2004), Lowe, R.K. (2004), Sung-il Kim (2007)

[6] Hattie, John. *Visible Learning: a Synthesis of Meta-Analyses Relating to Achievement*, 2009, Pgs. 48 & 225

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By Jonathan A. Bower

Accelerating Vocabulary Development with Software

According to Baumann, Kame‘enui, & Ash, students' vocabulary knowledge correlates strongly to their reading comprehension and overall academic success[1]. Robert Marzano’s research has shown that direct vocabulary instruction on words related to content that will be on a test increases performance on that test from the 50th percentile to the 83rd.[2] However, Horst, Cobb & Meara found that a minimum of 8-12 exposures must occur for retention with normal students of any new concept or word[3]. Although teaching can make a real difference in vocabulary learning, the explicit teaching of vocabulary is not enough: a dedicated teacher can only teach perhaps 300-400 words per year[4]. The solution to providing enough exposures to new words to master a complete academic vocabulary is comprehensive, well-designed software.

Comprehensive Content

The vocabulary content for Flink software for Grades K-2 is based on high frequency words for those grade levels. The vocabulary list includes all of the words in three standard lists of high frequency words: Dolch, Fry 1,000 and EDL. Grade 3 and above words are drawn from a number of standard spelling and vocabulary approaches, plus any books included in the program.

Pedagogy

The Vocabulary words are organized into wordlists, containing from six words (for Kindergarten students) to twenty words (for third grade students). Since high frequency words do not follow any content-related pattern, we organize them randomly and do the same with Grade 3 words for the sake of consistency.

For each wordlist, students are provided with 5-12 different educational activities starting with simple flash cards and image matching at the Kindergarten level, and increasing in sophistication and difficulty as the levels rise. Each activity provides students with different practice with the words in the lists. The last activity is named “Show Words You Have Learned.” This activity functions as an assessment.

Flink software therefore delivers all of Robert Marzano’s six steps for vocabulary development[5]:

1. On the computer students see and hear words in context and with definitions,
2. Students define words and give examples of their use on computer-generated worksheets,
3. Students draw a picture of words when that is possible,
4. Students extend their knowledge of the word through various activities,
5. Students are constantly encouraged to discuss word meaning during the activities, and
6. Students play multiple games using the words they are learning for additional exposures.

Flink software products help students learn a complete academic vocabulary to support proficient reading and writing.

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[1] Baumann, J., Kame’enui, E., & Ash, G. (2003). Research on vocabulary instruction: Voltaire redux. J. Flood, D. Lapp, J. Squire, & J. Jensen (Eds.), *Handbook of research on teaching the English language arts* (2nd ed., pp. 752-785). Mahwah, NJ: Erlbaum.

[2] Marzano, Robert J. (2004). *Building background knowledge for academic achievement: Research on what works in schools*. Alexandria, VA: Association for Supervision and Curriculum Development.

[3] Horst, M., Cobb, T., & Meara, P. (1998). Beyond A Clockwork Orange: Acquiring second language vocabulary through reading. *Reading in a Foreign Language*, *11*, 207–223.

[4] Beck, I. L., & McKeown, M. G. (2007). Different ways for different goals, but keep your eye on the higher verbal goals. In R. K. Wagner, A. E. Muse, & K. R. Tannenbaum (Eds.), *Vocabulary acquisition: Implications for reading comprehension* (pp. 182–204). New York: Guilford.

[5] Op. Cit. Marzano (2004)

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