Redefining Roles: Language Learners, Teachers and Technology

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Abstract –

This paper is adapted from *The Great Divide: Mixing Teachers and Technology* published in *The Impact of Technology on Language, Learning and Teaching: What, How and Why. (2009) ed* Ward, C. Singapore*:* SEAMEO Regional Language Centre. The paper focuses on the importance of having a learning theory to clarify the roles of teachers and technologies in a blended approach to English learning. The brain-based learning theory, Recursive Hierarchical Recognition (RHR) is introduced and briefly described.

INTRODUCTION

Technology is in the process of transforming education in fundamental ways. However, as one who has been a proponent of CALL from its earliest days, it seems that many teachers and administrators are still not prepared to deal with technology effectively, even when the decision has been made to do so. I see this from classrooms in the US, Turkey, and China, to private language academies and universities throughout the world. Technology is playing an increasing role, but the nature of that role is anything but clear. Issues of training, existing curricula, tests, and parents, for example, continue to confront teachers with difficult and often contradictory choices about how best to proceed. In fact, my greatest challenge is not technology, but teacher training and support, both technical and pedagogical.

This presentation explores this issue and suggests that both cultural and theoretical issues need to be addressed. Some of the points to be focused on are: (1) differences between the cultures of technology and education; (2) strengths and limitations technology; (3) insights from other disciplines such as cognitive neuroscience that can help us better understand the evolving interface between learners and technology, and (4) a rethinking of the roles that teachers and technology should play in the learning process. In exploring these issues, I will share some of the insights and theories I have used to build a support infrastructure for more than 15 million learners in schools, universities, and corporations.

THE ISSUE OF CUTURE AND CHANGE

First, the successful use of technology depends on a stable and reliable infrastructure. Internet connections, computers, headsets and microphones must be installed and continuously maintained. Record-keeping and security issues pose another set of challenges. Managing this infrastructure, which has a direct impact on student experience and motivation, requires a set of skills few educators have, especially teachers. As a result, expectations are often unrealistic and oversimplified.

This new infrastructure has a personality and culture of its own, very much like globalization itself. Dealing with this culture may require a challenging and new cultural identity, for teachers as teachers and students as learners.

It's not surprising that many teachers feel threatened or insecure as their territory, the classroom, is invaded. Or perhaps they seek to minimize the impact of technology by assigning to it a marginal, supplementary role that allows things to continue with as little change as possible.

Without a clear understanding of the benefits technology can bring, there is reason to be skeptical about the nature of the transformation. What problems does it address? What are the costs and benefits? How should teachers be involved? These issues need to be addressed.

CONTRASTING CULTURES

One of the chief characteristics of the technology culture is its openness to innovation and change. Anyone working in technology must be open to and adept at learning new things and ways of doing things. If we compare the technology of 20 years ago with now, the changes are clear and profound. In fact the most exciting changes are referred to as *disruptive* technologies, those that force changes in how things are done. Disruption is welcome in this culture because it creates new industries and economic rewards for those who cause the disruptions.

In contrast, in the field of language education, if we compare classrooms of 20 years ago with classrooms of today, we find very little change, except perhaps in the very best schools. In my own experience of visiting classrooms throughout the world, I still see students memorizing lists of vocabulary words and sentences, and passively listening to teacher-talk. Sometimes students are using computers, but the focus is almost always on the written skills. It's rare to see students working on their oral skills, though the role of listening as the key language skill has been known for years.

Where technology is used, it's often used as a supplement or as a means to connect learners with other learners. Teachers still teach grammar and students still memorize vocabulary in basically the same way. Textbooks are used extensively and students end up not being able to speak English well enough to use in any practical way. Language tests are basically the same, though there are now attempts to add more listening components. As a result, after hundreds of hours, students who need to use English to get a job must go to private language schools, which is where DynEd, for example, does a growing business.

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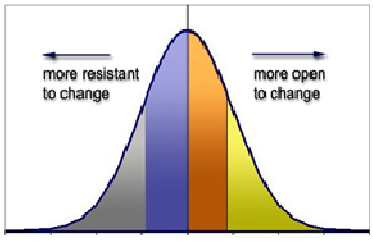
One conclusion we might draw from these observations is that the education community resists change, especially if that change means to actually change. In Korea, for example, there is lots of talk about the necessity to change how English is taught, yet upon further investigation there is an implicit expectation that change should not really disrupt how things are done. There is a need to satisfy parents, for example, who want change but who still think of language learning in the traditional way, with a reliance on textbooks and memorizing vocabulary. Though it failed for the parents, parents expect the same approach to work wonders for their children.

In other words, there is pressure to change education, but with little or no real change. This of course is not surprising. The figure below shows how people generally react to change, especially if it's a paradigm shift, which is what technology represents. Some are more open than others, and can take a leading role. Others are resistant – resistant to the point that efforts to sway them can be counter-productive. Therefore, it's important to identify those who can facilitate change. These are the people who can help build successful models. Equally important is to identify those who are against change or who remain skeptical, often for good reason. In my experience, it's best to let them continue doing what they are doing. Attempts to push them too soon are seldom successful and can be a waste of valuable resources.



I bring this up because it's important to recognize that not everyone is ready for change, especially when the benefits are unclear, or when the skills required, such as oral fluency in English, are not present. Therefore, significant change should be done in incremental steps, with the right people, and with a support plan in place to help those who are ready to develop the necessary skills.

In fact, the lack of oral fluency among teachers is a major problem and an impediment to change. It impedes change because it limits what kind of change is possible. Even in affluent countries like Japan and Korea, there are a significant number of English teachers who have so little confidence in their English that they avoid contact with native speakers. This problem is one that can be addressed with technology and is something we work on every day. In fact, we have developed a training course for English teachers!

And at the other end of the spectrum, there are large numbers of native-speaker English teachers who, though fluent, lack basic teaching skills. These teachers can also impede change, perhaps because it's more difficult for them to admit that what they are doing might not be the best way to meet the long-term needs of their students. Just because they are native speakers doesn't exclude them from the need to adapt and switch paradigms as conditions change.

For all groups, to expedite change, there first needs to be a recognition of what isn't working. It needs to be pointed out, for example, that many students with very large vocabularies cannot hold a simple conversation. And second, there needs to be leadership and a willingness to understand that change takes time. There should also be a means for assessment and accountability, including a realization that existing tests and metrics are inadequate. Old metrics, for example – tests that measure passive vocabulary or relatively obscure points of grammar – are part of the problem.

Again, this is an area where technology can play an important role. In our system, for example, we have a means of measuring how effectively students are studying. We can track how lessons are being used, minute by minute. We can also predict which programs will succeed and which will fail, and we can identify the reasons.

STRENGTHS AND LIMITATIONS OF TECHNOLOGY

From my observations over more than 25 years, it seems that the role technology should play is still not clear. Technology is here, for sure, but it hasn't been integrated into how we teach languages. Many different teachers have come up with ways to use technologies in very creative ways, but the vast majority of these are an extension of the old teaching paradigm, often using the Internet, PowerPoint presentations or vocabulary games. Instead of using a blackboard, teachers may use a LCD or a computer. But the content is the same, words and sentences, lots of text, translation, and usually an emphasis on the written skills.

I characterize many of these uses of technology as doing old things in new ways. However, with multimedia computers, learners can interact with the language in completely new ways, particularly with respect to the very skills that are lacking: listening and speaking. It was this observation that inspired me to start DynEd more than 25 years ago. What I noted at that time was a consistent lack of effective speaking and listening practice for students. It was to address that need that I went to the US and started DynEd in 1987.

What I saw then and see even more clearly now is that the introduction of such formidable capabilities as speech recognition, the ability to *coordinate* visual and audio inputs, and the ability to adjust lessons to student performance allow for new and exciting ways of learning, not possible with textbooks or in a classroom environment. Students can now practice and compare their student-generated language with a native model, at any time and any place, and their practice can be monitored and evaluated.

Fig.1, for example, summarizes the activities of a class in China. Not only can we see time on task, but we can use metrics to judge the quality of that practice time and can provide specific suggestions to students about how to improve their practice.

All Dates | New Dynamic English

Module 4 – All Units

Student N...	Time	Cmpl	MT-...	SS	Rep	ABC	Mic	Head	SR-C	SR-A	SR %
Student 1	16:19	100%	99.0	12	2467	22	1244	1230	302	416	73%
Student 2	12:08	100%	98.3	-6	58	41	75	66	451	716	63%
Student 3	08:45	100%	100.0	9	5125	27	541	542	195	220	89%
Student 4	15:18	100%	100.0	7	2369	136	1701	1642	225	468	48%
Student 5	14:36	100%	97.3	11	1822	28	1438	1494	353	516	68%
Student 6	11:58	100%	100.0	-6	201	59	93	80	461	685	67%

Fig. 1

And what about the teacher? Though technology has many strengths, I believe that the specific needs and cultures of students are best dealt with locally, in the classroom, with a teacher or tutor to guide, direct, and provide feedback – assuming of course that the teacher has the skills and is willing to play this role.

For these reasons, I have never been a proponent of e-learning, where in many cases students are expected to learn on their own. Instead, I favor a *blended* model where teachers and technology work together, and where their roles are clearly defined.

To do this effectively, we need to articulate a model that defines the roles of the teacher and the technology. In addition, we need to monitor progress and measure both successes and failures. What this requires, in my view, is an expanded learning theory, one that takes into account the new capabilities of technology. In the rest of this presentation, I will outline some of the key points of the learning theory that has guided our programs, our training, and our testing.

To begin with, I will give a brief overview of the traditional approach and set up a contrast with the blended model that we have begun to implement.

THE TRADITIONAL MODEL

The Fig. 2 below summarizes the typical language learning model we see in classrooms around the world. It shows typical ratios between classroom activities, homework, and language practice. Note that practice is minimal. This is a knowledge-based approach, where the teacher is the knowledge-giver and the students learn or memorize what is given to them.

When technology is used, it is often used to provide additional ways to get or exchange information, including activities where students interact with other students through the Internet. In this model, technology is seldom used in conjunction with the main syllabus. Note again the small percentage of time spent in actual language practice, especially the oral skills.

In this model textbooks are used extensively, and students memorize lists of words and rules of grammar. In the classroom, the teacher does much of the talking, and uses written text to set up listening and speaking drills. When students speak it is usually from rote memorization.

This is an important point. Memorization is different from language processing, where real choices are made in real time. I have seen many examples, in the traditional approach, where even students who have won speech contests cannot have a simple conversation, unless it is rehearsed. They have knowledge and memory of the language, but not the acquired skill that comes from practice. The distinction between memorization and skill acquisition is fundamental.

Fig. 2

This is where a learning theory becomes important in deciding how best to use technology. Should technology be used to facilitate the traditional memorization of vocabulary words, or should it be used to facilitate language processing automaticity? Without a learning theory, there is no framework to support the choices we have to make.

A LEARNING THEORY FOR A BLENDED MODEL

For teachers and students who use our programs, we have developed a learning theory, "Recursive Hierarchical Recognition" or "RHR". An understanding of this learning theory enables teachers to use our programs more effectively. This is one reason we stress the importance of teacher training and teacher support when working with schools.

RHR is based on research in neuroscience and cognitive psychology. It approaches language learning in a way that makes specific use of the capabilities of multimedia technologies. And it supports and defines a *blended* approach, where classroom activities and computer-based lessons play complementary roles and are linked together.

In the RHR blended approach, computer lessons provide multimodal language input and intensive practice, which is the key to language automaticity. Classroom activities provide extension and personalization of the language models previously introduced and practiced. The teacher acts as a coach and a facilitator, not a lecturer or entertainer. The Fig. 3 below shows the model, with its emphasis on practice.

Though RHR has similarities to other theories, such as Krashen's Comprehensible Input Hypothesis, it has the means to transform and *monitor* the learner experience as never before. It is this theory that guides the design and implementation, including teacher training and support. The model also requires and uses data collection and assessment, all done automatically and with metrics designed to measure what the theory says is important. Data is collected and analyzed, fed back into the design, and shared with teachers and students.

Like any good theory, RHR makes predictions that can be tested. It also provides insights into the learning process and takes advantage of research in other areas. Most importantly, it provides a degree of clarity and a framework that can support and direct teachers and students in their new roles.

What are some of the main points of this learning theory? First, it makes use of insights from the neurosciences, especially regarding memory systems. In particular, it approaches language processing as primarily a skill, not knowledge or conscious understanding. It isn't a knowledge-based approach.

From the neurosciences, we know that an important part of skill learning involves the development of procedural memory (i.e. skill memory). Skill acquisition is a process that generally occurs over many repetitions of a learning

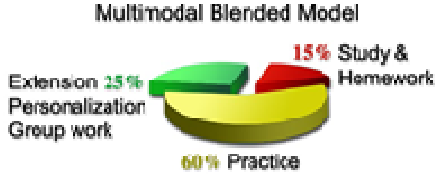


Fig. 3

activity, distributed over a suitable period of time.

Skills are acquired through practice, not study or memorization. Or rather, it's a different kind of memorization. In fact, skill memory, or procedural memory, is what allows for language automaticity, a key idea in RHR.

Language automaticity means the skill to automatically process language patterns, without conscious thinking or analysis. According to RHR, without automaticity, language fluency is not possible. If we accept this, then the development of automaticity becomes one of the primary goals of language learning.

Automaticity, as a skill, is developed through repetitive practice, and is stored as an implicit memory, an automatic sequence of language processing actions, much like playing a sequence of notes on a piano. Once a sequence is mastered, such as recognizing and grouping words into a phrase, it can be carried out automatically, without consciously attending to each step. This is important for language processing because conscious processing takes time, and the oral skills in particular require fast processing.

In fact, conscious processing interrupts the process. If you're in the jungle and you hear a lion roar, you start running and your heart starts racing even before you know you're afraid.

Second, to develop language automaticity, RHR distinguishes between the 4 skills. It notes that the oral skills are *temporal* skills, or time-based skills, and the written skills are *spatial* skills. The oral skills are time-based because they deal with a moving stream of language patterns. These sound patterns go through the brain once, without stopping. The written skills, on the other hand, deal with text, which is spatial. You can stop and look at it.

When processing oral speech, the language is held in working memory and processed very quickly. This kind of memory is limited. According to neuroscientists, it lasts between one and five seconds, and can hold from four to seven chunks of information. To hold language in working memory, the brain uses pattern recognition logic to group and process the language input into larger chunks.

Individual words, for example, are grouped into phrases, which are larger chunks. The three words, for, two, hours, can be grouped into one chunk: *for two hours*. Once it is recognized as a chunk, rather than individual pieces, it can be processed very quickly. The sentence, *She stayed at the party for two hours*, can be seen as two or three chunks rather than eight words. You can try this experiment for yourself when you repeat a long phrase or sentence, such as: "*She got wet/ because it started to rain/ and she didn't have her umbrella*."

For the oral skills, time pressure, or *temporal tension*, activates the chunking mechanism. The brain attempts to chunk language patterns so that the language input can be processed in the working memory. In fact, according to RHR, language fluency is proportional to the ability to chunk language.

Developing the ability to recognize and process larger chunks of language is the key to oral fluency. This skill is different from reading texts, yet in traditional language teaching text is used to introduce language patterns. This is one reason traditional language teaching is so inefficient. Text and textbooks are spatial, not temporal.

According to RHR, the use of text interferes with the development of oral skills. The use of text reduces temporal tension. Temporal tension activates the brain's pattern recognition logic to identify new patterns that can aid in the chunking process. Without this tension, the identification process is bypassed. You can feel this yourself when you look at subtitles or use text support. Without the right level of temporal tension, students can become bored with repetition. Temporal tension keeps the brain engaged, as long as it's at the right level

Temporal tension is a positive force. It engages the learner and helps the brain learn. In the figure below, for example, the brain instantly and naturally fills in the expected pattern. It takes incomplete information and extrapolates, or infers the rest. RHR takes advantage of this natural learning force. As illustrated the Fig. 4 below, the brain wants to complete patterns, fill in gaps, and make sense of things. It relates things to its long-term memory and to familiar contexts.

Third, in the RHR approach, the key patterns of English are carefully introduced so that the brain learns to recognize and use them. The learning sequence is: familiarization; then recognition; then comprehension; then practice and mastery; and finally, review and automaticity.

In this process, RHR takes advantage of the fact that computers can provide both language input and language practice better than textbooks or even classroom activities, where too much repetition is inefficient. Computers have an advantage because they can provide multimodal language input and practice activities far superior to anything possible with a textbook.

By multimodal, I mean the coordinated, synchronized activation of visual, auditory, conceptual, and other systems within the brain, including long-term memory.

Also from research in neuroscience, we are learning about the nature of brain plasticity, the kinds of changes in the brain that occur when learning takes place. We know that multimodal activities in particular enhance the creation of new or strengthened synaptic connections, which is the stuff of new memories. As the famous neuroscientist, Donald Hebb said: *Neurons that fire together, wire together*.

Language processing requires many neural systems to interact, with information flowing upward and downward within the brain. Fig. 5 illustrates how various processors in the brain communicate with each other and the working memory.

Fig. 4

During multimodal practice, students are coached to listen multiple times to a language model in context. This language input is supported by synchronized, visual input of an iconic nature, such as geometric figures, charts, or arrangements of pictures designed to express causal relationships. This kind of visual input helps learners to infer or guess the meaning of a language pattern, especially when animated or brought into focus so that the visual and auditory inputs are appropriately synchronized.

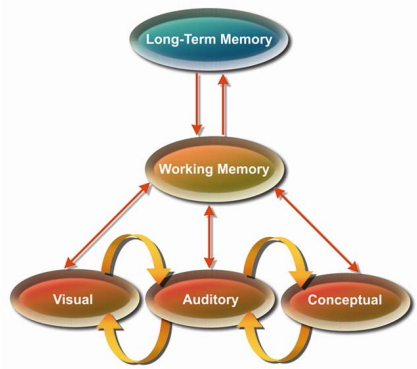


Fig. 5

With each passing sentence or question, the underlying language patterns and gaps become familiar, then recognized, and then comprehended, provided that the input has been sequenced appropriately. This learning sequence doesn't happen the first time through, of course, but with multiple cycles and repetitions.

A well-designed multimedia program can optimizes this process, both in the presentation of language models and in the interactive exercises that support them. In particular, long term (LT) memory, visual information, and conceptual processors work together to help decode and fill in comprehension gaps – a scaffolding process.

RHR takes advantage of the brain's innate ability to guess and make sense of things. It fills in gaps, and gaps create interest if the gaps are not too great. In fact, the brain enjoys learning in this way – an approach similar to how we learned our first language. Let's remember how often young children like to hear the same story told over and over again, even when they miss many of the language details.

Fourth, RHR says that language chunks are built around concepts and that these concepts are part of the structure of the brain. In fact there is evidence that there are structures in the brain – cortical columns – that may specialize in specific concepts, such as size, shape, or number. These elements of meaning structure our perceptions. They are the dimensions of our world, and as such, they are reflected in the structure of language.

In RHR, the sequencing of concepts is also important. The language presentation follows a hierarchical order. Frequent, concrete concepts, such as duration and location in time, are introduced and practiced first.

In RHR lessons, vocabulary is best taught in phrases and sentences, not as individual items. Not only does this approach help students gain a better sense of the meaning of words, which are heavily dependent on context, but it also gives students a handle on how each word is used.

Taught this way, in phrases and sentences, the chunking skill develops at the same time. As the chunking ability improves, it carries over to the written skills, reading and writing, where students are then able to process language in larger units than individual words.

In fact RHR predicts that oral fluency facilitates the development of written fluency, since language chunking is utilized in all 4 skills. Lessons should follow the *4-skills path*: listening, speaking, reading and writing. The oral skills facilitate and support the written skills, and the written skills reinforce and extend the oral skills.

And finally, RHR specifies the role of teachers and classroom activities so that they support and extend what the students have practiced during self-study with the courseware. Just as a music teacher shows students how to practice, and has the students perform what they have practiced, the role of the language teacher is to coach and facilitate rather than be a knowledge giver.

Lecture and explanation is minimized. Instead, teachers coach students in how to practice effectively. Teachers facilitate classroom interactions that extend and personalize the language models from the computer-based lessons. This complementary relationship between practice and classroom extension is the secret to a successful blend, rather than a mix of oil and water, where classroom activities are unrelated to what the students have practiced.

In this blended model, both computers and the classroom have important roles to play. The strengths and limitations of each are recognized. In the computer-based lessons, language models are presented and practiced in an interactive, multimedia format. Learners are active, not passive, and work at an optimal language level which is adjusted and monitored for each individual by the software.

Compared to a classroom-only approach, the advantages of this kind of practice are manifold, particularly in the total amount of productive time on task. If coached properly, the number of learning encounters per session is significantly higher than in a classroom-only scenario and can be monitored.

In addition to the computer-based lessons, the classroom provides the human element, accommodating the needs and lives of learners in a social context. In the classroom or tutorial sessions, students make short presentations, do role-plays, work in pairs or small groups, and do dictations that expand vocabulary and build on the language models.

In short, students use the language to communicate about their lives, their jobs, their families, and their interests. Memorization is used, but held to a minimum. The teacher sets up activities and provides directions and feedback, and allows for 'happy accidents' to occur so that the class is alive. Of course the teacher also assigns additional reading and writing support, as well as homework assignments, along with anything else mandated by the school curricula.

In this skills-based approach, multimodal practice activities form the core of the learning process. The teacher is in overall control, not only in the classroom, but in setting and monitoring learning paths for the students. For real success in this model, the teacher should be familiar with the

multimedia materials and believe in them – not blindly, but because the materials make good pedagogical sense and, more than anything else, because both the teacher and the learners can see and feel their progress.

CONCLUSION

The above is just a summary of the theory. My aim isn't to explain the theory here. My aim is to illustrate how a learning theory can guide and optimize the use of technology.

In the case of RHR, it's clear that teachers play an important role – though it is a different role. Some teachers may resist this change. But hopefully they will resist only because they disagree with the theory or because they have a better learning theory that can deliver better results.

Whatever, no teacher should be teaching who doesn't have a learning theory; and technology shouldn't be used without defining and justifying its role. Every decision a teacher makes is based on a theory, whether the teacher can articulate it or not. Sometimes that theory is nothing more than what they themselves experienced as a learner, or "It's what everyone else does." But is this good enough? I would suggest that the answer is in the results.

Now that English language fluency has clear and urgent economic consequences for countries, there are different expectations and consequences for language learning. There is much more pressure to help students gain productive language skills, rather than a dead understanding of the grammar rules and a huge vocabulary that students either forget or aren't able to use in a real situation, where time is important. There just isn't enough time to think and remember definitions or translate from one language into another. The brain simply can't do that task.

Conscious thought takes too much time. Language processing must be carried out automatically, by the brain's skill memory. The goal of RHR is to better develop that skill memory through a blend of computer-based lessons and coordinated classroom activities where language models are extended and personalized. The blend isn't mechanistic at all, but takes advantage of what the brain can do mechanically so that we can express our humanity and interact with confidence and fluency.

There are many other areas of importance that cannot be covered here, such as the importance of scheduling and study frequency. Cognitive neuroscience has much to say about learning, skill-acquisition, memory systems, and multiple intelligences. These are areas that directly relate to the design and implementation of technology, and these areas need to be focused on more in quality teacher preparation courses.

Buying computers and software is easy and fast. But reaching and supporting teachers, and bringing them across the divide, is far more difficult – along with changes in the infrastructure, tests, and even the culture of language learning. Without addressing these areas, technology will continue to play a minor, supplementary role, which is far less than its great potential.

In closing, though computer-assisted language learning (CALL) has great potential, not all multimedia programs are equal. Comparative studies need to differentiate much better than they have. Reviewers need to look through the eyes of a different paradigm than the text-based one that still dominates. Where some programs are extensions of a page-based, spatial paradigm, or follow a knowledge-based approach, other programs follow a completely different approach, a multimodal, skills-based approach which emphasizes the importance of the oral skills as the basis for language acquisition.

And even when the same program is used, there may be significant variations in how it is used, whether as a supplement in a language lab, in an e-learning mode where no classroom or teacher is involved, or as the core material for subsequent classroom work.

Such differences matter. Let's welcome this disruptive technology and realize its potential to help our students.

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