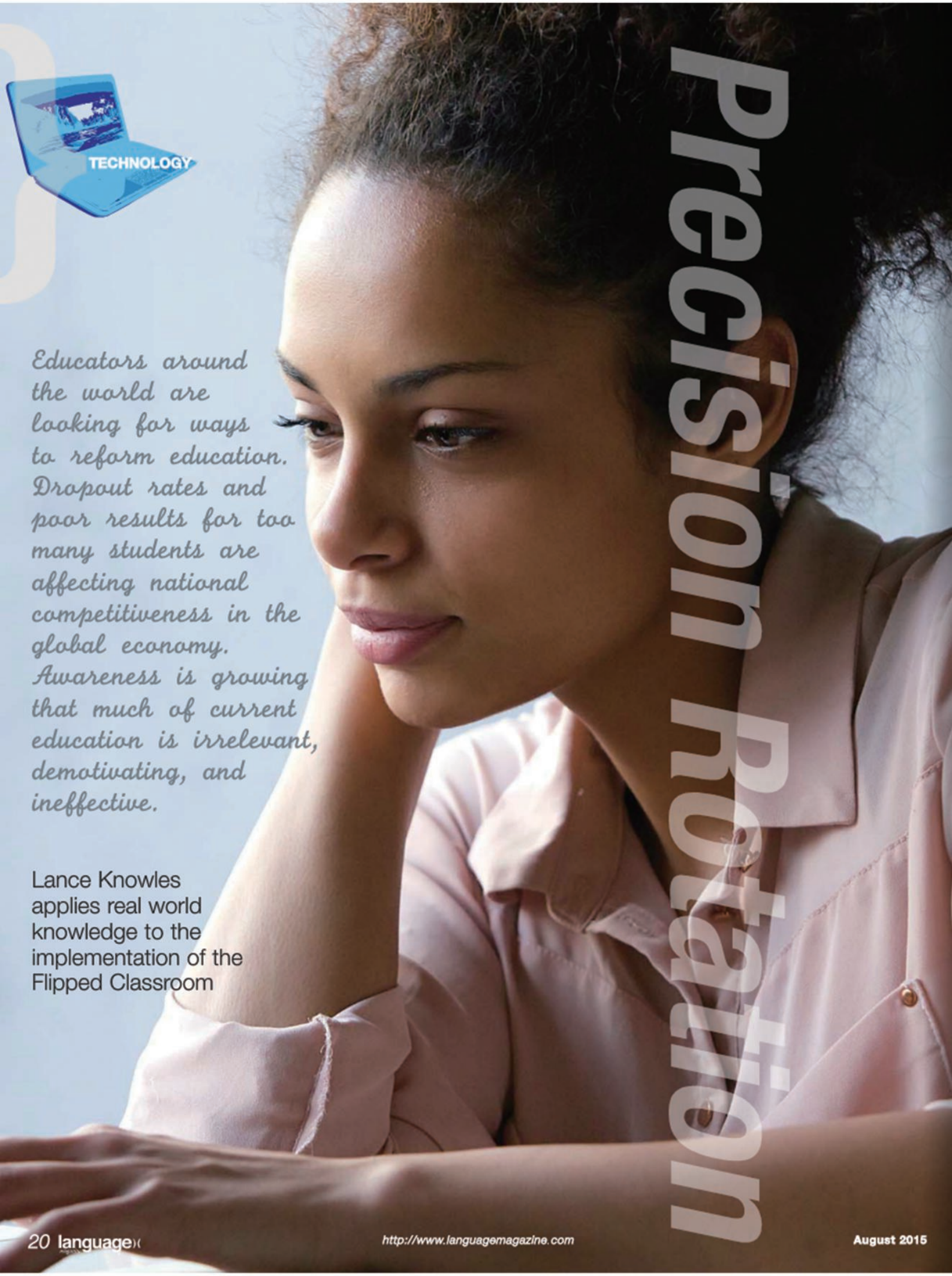


Precision Rotation

Educators around the world are looking for ways to reform education. Dropout rates and poor results for too many students are affecting national competitiveness in the global economy. Awareness is growing that much of current education is irrelevant, demotivating, and ineffective.

Lance Knowles applies real world knowledge to the implementation of the Flipped Classroom

What students need is the ability to learn new subjects and skills for the rest of their lives.

Despite this realization, many schools continue to emphasize memorization and the accumulation of irrelevant knowledge, such as the names of Egypt's pharaohs. Not only does this fail to motivate large numbers of students, but it may even impede their ability to learn or think on their own. Critical thinking may involve memory and memorized facts, but the process of thinking itself can only be developed through practice and problem solving. Critical thinking is not the regurgitation of facts or replication of problem solving techniques. It involves the subconscious recognition and manipulation of concepts and relationships.

So, the goal should be to help students develop their critical thinking and problem-solving skills — whether it be for language learning or mathematics.

From my experience as an educator for more than 35 years, I believe that to do this requires a better understanding of what motivates learners and how neural mechanisms facilitate skill acquisition. We should take full advantage of how the brain is designed to learn. In addition, we must incorporate external factors like social media into our approach.

Emphasizing Skills

Knowledge is highly compartmentalized and can quickly go out of date. Problem-solving and critical thinking are skills that never go out of date and are useful in most professions and subject areas. As skills, they can only be developed through practice, not by feeding back information or solutions that have been demonstrated and copied.

However, there is still a need for students to accumulate a core set of basic facts. Though knowledge itself is no longer the primary goal, it can and should accumulate as learning proceeds. If learners continue to use a pattern or a set of facts to communicate or solve problems, it will be committed to memory — for as long as it is useful and up-to-date.

The Flipped Classroom

The Flipped Classroom is one way to move to a more skills-based approach. In contrast to the traditional knowledge-based model where the teacher dishes out facts and example problems for students to learn and solve, the flipped approach turns everything upside down. Instead of following a teacher's presentation, students first engage with their individualized lessons through dynamic technology that facilitates pattern discovery and problem-solving. Later, students come together to extend that experience in activities that help to consolidate what they have learned and put it into a wider perspective. These classroom activities should involve active, cooperative learning rather than teacher-centered knowledge transmittal. This experiential approach develops and unleashes the power of the human brain to recognize and manipulate patterns and concepts.

In the flipped classroom, the teacher is no longer the 'sage on the stage' but is the 'guide on the side' [King: 1993]. The emphasis is on learning by pattern discovery or problem-solving - which means by having to think and solve problems. Conscious memorization plays a backseat role.

All this sounds very good in theory. However, in reality there are significant challenges to implementing a flipped approach on a wide scale.

Proficiency Levels

Students in the same grade or at the same age are not equal in their problem solving ability. In language learning, for example, there will always be a range of proficiency levels among students. Assigned tasks that are appropriate for some students will not be appropriate for others. Some students will come to class prepared to participate, and others will be unable to participate except in a passive role that can be very demotivating and frustrating.

In theory, students come to class after completing their learning activities. But what if they haven't? Should they be barred from participating in the classroom work? Should they become dependent on others? What criteria should be used to assess when students are ready to participate? What recourse is there for the teacher if a significant number of students are unprepared or unwilling to go by the new rules? Should they be relegated to a traditional lecture/demonstration approach? Should that choice be available?

Learning Styles and Preferences

You can't assume that everyone wants to learn in this new way. Some students will prefer to learn in the traditional way, even if it isn't as effective. You simply can't force students to sit down and figure things out on their own. One danger of expecting too much from the flipped approach is that it may leave out a significant number of learners who would rather sit back and follow a model, and memorize facts and solutions. We can't say that there are no benefits to this approach.

A transition to the more active approach to learning takes time and is heavily dependent on good coaching, a role that many teachers are unprepared to play. Some may even prefer to remain as the "sage on the stage."

In addition, when people speak of practice they often focus on quantity and gloss over quality. Practice by itself has many varieties, some of which are very ineffective, such as when a student is inattentive and not engaged. As I have written before [Knowles, 2014], practice has four dimensions: (1) amount of practice, (2) frequency of practice, (3) quality of learning activities, and (4) level and sequence of learning activities.

In any approach that emphasizes practice, each of these dimensions must be addressed, and to a degree that can now be done through technologies that allow us to monitor and direct student learning activities. Not only can we measure progress, but we can, for the first time, measure and score the quality and efficiency of learning activities — provided that we have a learning theory to help evaluate the efficacy of learning activities.

When using DynEd programs to develop listening comprehension, for example, inappropriate use of text can interfere with the development of language chunking skills. When learner activity includes a sequence of actions that shows an overreliance on text, the quality 'score' goes down and adaptive measures are prescribed or built in to the program.

Other factors affecting the quality of learning activities include the cognitive load in how tasks are presented and, in the case of language learning, the quality of audio input. If the model voices are unclear or have an unpleasant manner, students are turned off.

Therefore, the design of learning activities matters. Without well-designed learning activities, at the right level and in the right sequence, there may be lots of entertaining activity, but very little effective learning.

With this in mind, learning activities should be designed so that they can be monitored, scored, and be responsive. If a learner overuses text support, for example, the system should be able to provide feedback so that the negative learning style can be modified - just as a coach provides feedback and direction to an athlete. Every effort should be made to improve the quality of the practice.

Limits of Big Data

What about big data? Big data tells us how and what people do, but is limited by the data that it has collected. It can't prescribe or modify behaviors unless the data includes useful information. We can report and analyze what people do based on dumb data, or we can set up activities and collect new kinds of data that can help people learn more effectively. This involves getting information, which is not the same as data.

Collecting data is easy to do, but it can also be a waste of time and lead to erroneous conclusions. Without a learning theory and metrics designed to inform and determine what kind of data to collect, the available data may just be noise. There are patterns even within noise, but they may not be useful. For data to be useful, the data points need to reflect what is needed to make informed judgements. If the available data only includes time on task, percentage correct, difficulty level, etc. it may show correlations, but it may not show even more important factors, such as levels of student engagement or the order of learner actions within a task.

To collect user information, we may need to redesign interfaces so they can detect and collect data that was previously unavailable. Let's assume, for example, that facial expressions are an indication of learner engagement. If so, then we can design the learner interface to include that data. In other words, we can decide what data to collect and include in the big data analysis. This becomes 'smart' data because it is informed by a learning theory.

In my own experience, we have designed learner interfaces that detect and keep track of how students carry out various activities. With that information, we can coach learners and help them improve the quality of their practice routines.

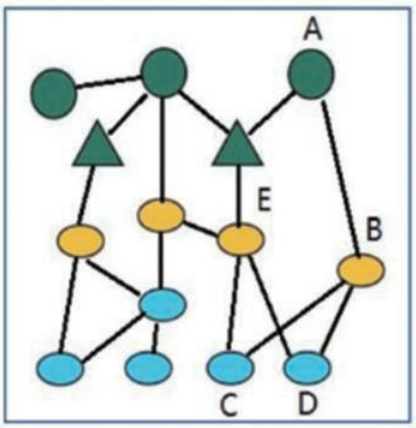
Let's now assume that a student is having difficulty solving a particular type of problem or understanding a concept or pattern in a new language. We can address the problem directly, or we can look for deeper reasons why the student is having difficulty. It could be that a prerequisite skill has not been acquired, and that the lack of that prerequisite skill is affecting other areas of learning. By treating the surface problem, the deeper problem is left behind. In contrast, we may discover that several different types of problems have a similar root cause. Addressing that root cause may end up addressing a whole set of surface problems.

This kind of analysis can be done if problem types or tasks are mapped into a hierarchical scheme (See Figure 1) that shows how problems or concepts are connected, not in a simple linear form, but in a hierarchy where several tasks (C&D) are dependent on nodes at another level (B and E). If a student cannot do B or E, then the student is not ready for C and D.

This kind of hierarchical sequence indicates the order in which subjects and tasks should be learned. It can also help to diagnose why some problems are too difficult for a student. Teaching how to solve problems of types C and D without first addressing problems of types B and E will not be effective because the prerequisite skills have not been acquired.

Effective practice requires that the sequence of activities fits the hierarchical skills of the learner. The order in which skills are developed is crucial. Using adaptive learning techniques, the level and order of activities can be adjusted based on performance. But even this approach may assume that the adjustments and learning tasks are appropriate, when in fact they may be part of the problem.

Figure 1: Task Hierarchy



An example here is to look at a traditional grammar approach to learning a language versus a conceptual, hierarchical sequence that focuses on meaning and the subconscious recognition of key patterns [Knowles, 2013]. Adaptive learning applied to these very different approaches will come to different conclusions. My point here is that adaptive learning is useful but may obscure deeper issues in design.

As I have argued in previous articles [Knowles, 2014], without a learning theory to guide the design of activities and metrics, it is difficult to reach reliable conclusions. Data is only as good as the data points collected, but is needed to help us judge whether an approach or series of activities is effective.

Why is it so important for practice to be effective? The answer to this is simple: motivation. Unless students feel progress and can see how their hard work pays off, they can lose any motivation to continue and may prefer the old-fashioned way of passive learning and memorization of facts that can and may soon be forgotten after that A-plus grade is attained.

Motivation

There is little if any evidence that self-learning is effective for most learners. Most self-learning programs have high drop-off rates, with high rates of attrition very common in language learning programs [Nielson, 2011]. One advantage of the flipped approach is that it is blended — a blend of self-learning and teacher/class support.

For practice to be effective it must be frequent, which means that learners need to be motivated enough to build it in to their daily

schedules. This motivation in large part comes from classroom activities that support and extend individual practice. Teachers are therefore important, as well as parents and the social media through which students interact. Each of these components plays a part in the flipped approach.

Having long-term goals is essential for learners to continue the learning process, especially since much individual practice has little intrinsic interest. Research shows that having an unconscious goal can be very effective in keeping learners engaged (Bargh & Morsella, 2008). It is important that teachers and others help to instill and reinforce the tremendous value of practice in terms of life goals rather than academic success. This should never be forgotten, for efficient practice requires motivation.

Summary

In this age of rapid change, it is clear that the one life skill that towers above all others is the ability to learn and acquire new skills throughout life.

The good news is that we have new tools to enrich the learning experience. The bad news is that we continue to look for solutions at a surface level, neglecting deeper issues — such as by focusing on quantity when the greater need is for quality and efficiency.

Advances in technology and cognitive neuroscience allow us to assess and modify quality. Our data shows that motivation and practice efficiency feed each other. Learners who practice effectively, and have high-quality scores remain active longer and reach their goals sooner than those who don't. Learners with low-quality scores show little if any gain and have higher dropout rates. What we can't afford is to take motivated students and demotivate them through activities that are poorly designed. For unmotivated students, a real win occurs when they suddenly find success through effective practice and become motivated for the first time, which can be a life-changing event.

Having access to information is revolutionary and can empower the flipped classroom to make a difference in education.

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