since the 1980s, instructional techniques have been dominated by a compelling argument: “Look at the difficulty many people have when learning in classrooms. Compare that difficulty with the ease with which people learn outside of the classroom. If we switch our classroom procedures to more closely match those of the natural world, learning will be enhanced.” This argument has swept all before it. As one example, whole-language learning was introduced when teaching children to read. Using whole-language learning, students are presented with entire words and sentences without the use of sound-letter correspondences. The “natural world” rationale is that since children do not need to be taught basic sounds when they learn to listen to their first language, they should not need sound-letter correspondences when they learn to read.

Similarly, when learning a foreign language in secondary and tertiary institutions, we have been urged to use immersion in the foreign language, with little or no emphasis on grammar and vocabulary. In line with the natural world argument, immersion is more natural and works when learning a first language, so it should work when learning a foreign language. And the argument has also been used to justify inquiry- and problem-based learning, which have become dominant in most disciplines, especially mathematics and science. Learners are presented with problems to solve without first being shown how to solve those problems and sometimes even without being presented with requisite basic knowledge.

Different kinds of knowledge
Thankfully, something else occurred during this period: we were steadily gaining knowledge of human cognitive architecture – how we learn, think and solve problems. Based on that knowledge, some of our instructional procedures, as summarised above, began to look increasingly bizarre. Cognitive load theory, which uses our knowledge of human cognition to devise instructional procedures, provides very different recommendations for teachers. Humans do learn differently inside and outside of class, but that is because of the different categories of knowledge acquired in the two environments. David Geary provided the key to understanding this difference by...
assuming a distinction between knowledge that we have evolved over countless generations to instinctively acquire and non-instinctive knowledge that we have not specifically evolved to acquire. Instinctive knowledge is acquired automatically and unconsciously. Examples include routine social interactions, recognising faces, using general problem-solving strategies such as generalising from one problem solution to another and, of course, learning to listen and to speak our native language.

Most of these tasks are immensely complex; it takes artificial intelligence years to duplicate them. But they are not complex for us. We acquire the necessary knowledge effortlessly when we were because we have evolved to acquire it. In contrast, non-instinctive skills are important for cultural reasons. We are able to acquire them but have not specifically evolved to do so. They require conscious effort from the learners and explicit tuition from teachers.

**Processing information**

Almost everything that is taught in educational institutions is non-instinctive, "artificial" and about the natural world. We invented education specifically in order to teach non-instinctive skills, such as reading and writing.

Without education, few people learn to read and write, in marked contrast to listening and speaking. For thousands of years after the invention of writing, most people could not read or write. It was only after the advent of modern mass education that literacy became widespread. The reason almost everyone could listen and speak but could not read and write was not because listening and speaking were "taught" appropriately while reading and writing were not. Rather, it was because we have specifically evolved to acquire listening and speaking skills, but not reading and writing skills. They belong to different categories of knowledge.

To function in the modern world, we need a huge store of non-instinctive knowledge, held in long-term memory. The bulk of that knowledge effortlessly without tuition. For example, we can learn content while instinctively acquiring a native language as children, it does not mean that procedure should be used as a template for secondary or tertiary students.

Learning a native language is instinctive, while learning a foreign language as an adolescent or adult is not instinctive. The working memory load of learning a new language at the same time as learning a content area is likely to overwhelm working memory.

Learning a language and learning content should be kept separate until sufficient levels of foreign language competency are attained to allow limited working memory resources to be devoted to content rather than language.

Learning a foreign language is a redundant activity when attempting to learn content and vice-versa. We should always attempt to eliminate redundant information.

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**References**

1. **Permanence vs transience**

While it is possible to obtain information in spoken form, that information is transient and immediately disappears unless it is recorded. Lengthy, complex non-instinctive information may be difficult to understand because what is presented earlier in a lesson may be needed in order to understand what is presented later. But when presented in written form, that information is transient and has disappeared.

In written form, learners can repeatedly return to required information, reducing the working memory load. It is important to present information in written form or divided into small chunks when it is presented in spoken form.

There are many other instructional procedures that flow from cognitive load theory. All procedures that flow from that theory are supported by multiple randomised-controlled trials. For those concerned with instructional issues, knowledge of human cognitive architecture and the instructional procedures that flow from that knowledge should be considered optional extras. They are essential.

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