

# ACTIVE LEARNING: A QUESTION OF RISK...CALCULATION



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Increasingly encountered in college-level classes, active learning has been tested for many years in the context of higher education in the United States. The terms *active learning* and *active teaching* are defined in opposition to so-called “passive” or “traditional” teaching strategies like formal teaching. Active learning is often confused with the flipped classroom, problem-based learning, project-based learning, or discovery-based teaching methods. Active learning is actually broader in scope: it refers to a wide variety of teaching methods with the common goal of engaging students in a task and making them think about what they are doing (Eison and Bonwell, 1991).

This article will explain how active teaching methods are proving particularly effective, and will shed light on the associated challenges and calculated risks to take to successfully introduce this process into the classroom. Several suggestions for activities and techniques in line with active teaching will also be presented, both for traditional as well as socio-technological environments.

## » WHY FAVOUR ACTIVE LEARNING METHODS?

The considerable interest in active learning methods stems from the fact that they trigger deeper and longer-lasting learning among students. This was revealed in the works of Hake (1998), conducted among 6,000 students and comparing traditional teaching methods with active learning. Other researchers have also obtained similar results (Michael, 2006; Freeman *et al.*, 2014; Prince, 2004). While using peer instruction (a form of active learning) in a physics course, Lasry and Mazur observed an improvement among students in the understanding of concepts and the ability to resolve problems (Lasry, 2008). They also recorded a significant decrease in course withdrawals for courses using this teaching method.

While most of the studies that assess the different active learning methods conclude that they are particularly effective, there is some research that suggests active learning may not always have the desired effects (Andrews *et al.*, 2011; Ebert-May *et al.*, 2011). This research reveals that teachers ineffectively incorporate active learning activities, and that many claim to be active teachers when in fact they are not. Certain parameters need to be considered in order to truly harness the full potential of active learning.

## » THE KEY TO ACTIVE LEARNING: THE PROCESSING LEVEL

The effects of active learning methods on long-term memory are not yet fully understood. It has long been thought that

the encoding of information in long-term memory occurred primarily through a process of repetition and training. Craik and Lockhart (1972) discovered that the effectiveness of long-term memory retention should rather be attributed to the process of semantic processing that allows the recall of information through the association of a stimulus to its significance (rather than the frequency of its reinforcement). Researchers have therefore proposed an “information processing level” model describing how familiar and meaningful stimuli are processed more deeply by the brain than less significant stimuli (Craik and Lockhart, 1972). For example, when subjects are invited to memorize a series of words, those who are asked to memorize them without any particular task (repetition being the most commonly and spontaneously used strategy) memorize significantly fewer words than subjects who are asked to associate a pleasant or unpleasant feeling to each word.

In this vein, Meyers and Jones (1993) identified four main activities that students accomplish in an active learning context to encode information in long-term memory: speaking and listening, reading, writing and reflecting. By referring to the theory expounded by Craik and Lockhart, we can intuitively grasp the scope of the impact these activities have on the learning process. For example, when a student speaks, they must organize and structure their thoughts in order to be understood by a listener. By using various strategies, including emphasizing, summarizing, annotations, questions, etc., active reading requires the student to arrange their thoughts differently, because the objective is to understand an author’s message. Writing enables them to clarify their thoughts, to the extent that the writing task requires more than transcribing what they have learned. According to Meyers and Jones (1993), through writing, students explore their own thought process in relation to the concepts and problems they face. In other words, they develop their mental structure. Lastly, reflection involves one’s ability to clarify and criticize one’s preconceptions, as well as to assimilate metacognition about one’s own knowledge and learning.



## MODES FOR ENGAGING STUDENTS

Chi *et al.* (2014) propose another way of approaching active learning: they categorized students' activities in class according to their involvement; that is, the explicit behaviour they display during an activity that enables the teacher to adapt their activities in line with active teaching. These researchers have identified four modes of engagement: passive, active, constructive and interactive (see Table 1). In the passive mode, students passively receive information, and no explicit activity is visible. In the active mode, students receive the information and process it by selecting the important elements. This mode involves students activate their prior knowledge to ensure that they can select relevant information and encode it in their long-term memory. The constructive mode requires students to generate new knowledge. To do this, they must go beyond the information presented and make predictions, deductions, inferences, etc. Lastly, the interactive mode introduces the confrontation of a student's ideas with those of their peers, and also with those of their teacher, who can, in particular, encourage the student to analyze their errors.

To illustrate the different modes of engagement, we can look at the example of reading a text. In a passive mode, the student simply reads the text. This does not mean that they do not process the information. However, no explicit behaviour allows the teacher to verify that information is being processed. In an active mode, the student can highlight important parts of the text, summarize or paraphrase them, etc. In a constructive

mode, the student goes further than what is written in the text. They can find application examples, make predictions, create a schema that organizes textual information, etc. Lastly, in an interactive mode, the student makes inferences, like in the constructive mode, while comparing their ideas with those of their peers or the teacher. According to Chi's research findings (2014), there is an increase in the effectiveness of engagement modes according to the processing level. The advantage of this model is to evaluate the efficiency potential of an activity by referring to the students' mode of engagement.

## CHALLENGES ASSOCIATED WITH ACTIVE LEARNING

As much the case for teachers as for their students, a change in teaching practices from traditional teaching to active learning is not without its hurdles: there are challenges to overcome and risks to take. Notably, these risks vary according to the knowledge to be learned, the complexity of the tasks required to encourage learning, the management of interactions between students, the level of the teacher's comfort level to plan, structure and lead active learning methods, and, finally, the level of students' experience with these methods.

The teacher who wants to successfully introduce active learning in their classes is faced with various challenges to overcome in order to implement methods that will be successful. Bonwell and Sutherland (1996) underline six risks associated with active learning which are highlighted in the box on the next page.

**TABLE 1** MODES OF ENGAGEMENT ACCORDING TO CHI ET AL. (2014)

	Passive Reception	ACTIVE LEARNING		
		Active Selection/Manipulation	Constructive Generation/Production	Interactive Collaboration/Dialogue
Cognitive processes	<ul style="list-style-type: none"> <li>Encoding of information</li> </ul>	<ul style="list-style-type: none"> <li>Activation of prior knowledge</li> <li>Integration of knowledge</li> </ul>	<ul style="list-style-type: none"> <li>Inference of new knowledge</li> </ul>	<ul style="list-style-type: none"> <li>Co-inference of new knowledge</li> </ul>
Activities	<ul style="list-style-type: none"> <li>No explicit activity</li> </ul>	<ul style="list-style-type: none"> <li>Highlighting</li> <li>Summarising</li> <li>Paraphrasing</li> <li>Selection</li> <li>Repetition, etc.</li> </ul>	<ul style="list-style-type: none"> <li>Organization</li> <li>Prediction</li> <li>Justification</li> <li>Reflection, Etc.</li> </ul>	<ul style="list-style-type: none"> <li>Revision Of One's Errors</li> <li>Argumentation</li> <li>Confrontation, etc.</li> </ul>
Information processing level	<p>ON THE SURFACE  IN DEPTH</p>			



- A reduction in the quantity of content discussed in class (in order to increase the quality of learning of the selected content);
- The sparse quantity of didactic and pedagogical material available to support active learning;
- The positive view the teacher has about their ability to deliver formal lectures;
- The workload required to properly prepare courses;
- A class context that is not always suitable (large classes, poorly adapted furnishings, etc.);
- Students' resistance to active learning methods (many of them prefer to remain passive in class or have little appreciation for peer interaction).

Undoubtedly, active learning requires students to take time to process information and discuss with their colleagues, which restricts the quantity of subject material that is possible to discuss in class. Reducing the use of lectures requires educational material to be developed in order to complement the presentation of the subject matter. Texts, diagrams, videos, etc. will be required to allow students access to reliable sources of information that are adequately complex.

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Creating activities that make the most of active learning also requires the careful planning of student interactions. In this sense, large groups of students or class furnishings that is unsuited to working in teams can create significant management challenges. It becomes difficult to form groups of students and manage the many interactions that could take place there. With regard to resistance on the part of students, the more gifted sometimes feel like they are wasting time in discussion or by helping slower peers who feel helpless when faced with methods where they need to be more active, especially if they are disabled.

## RISKS ASSOCIATED WITH ACTIVE LEARNING

For Bonwell and Sutherland (1996), once the challenges have been identified, teachers who opt for teaching practices where

students are more active have to manage two types of risks. First are the risks that students:

- do not actively participate;
- do not use advanced cognitive processes;
- do not learn course content in depth;
- do not like the active learning experience.

Then there is the risk that the teacher:

- does not possess the necessary skills to plan or lead a new active teaching method;
- does not feel confident;
- does not feel in control of the class
- is perceived negatively by their peers.

Considering these various elements, the variations of active learning methods can be separated into two main categories: low-risk methods and high-risk methods (Eison, 2010) (see Table 2).

TABLE 2

### THE DISTINCTION BETWEEN HIGH-RISK AND LOW-RISK TEACHING STRATEGIES, ACCORDING TO EISON (2010)

#### LOW-RISK METHODS

They involve highly structured short-term activities, controlled by the teacher. To perform the tasks, students have access to the content through resources provided by the teacher (lectures, course notes, manuals, websites, etc.). The interactions between the students in the group and between the students and the teacher are very structured.

#### HIGH-RISK METHODS

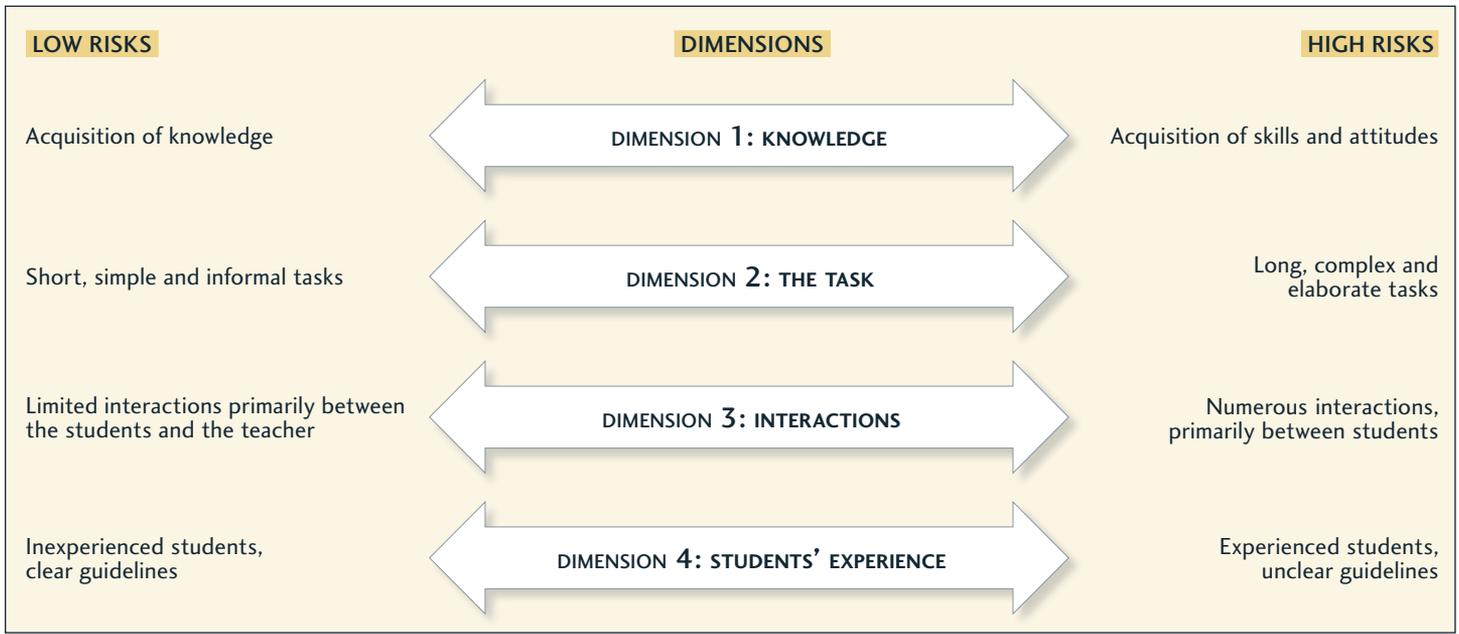
They involve activities of longer duration that are less structured, and whose control is managed more by the students. They are less familiar with the content: among other things, they must conduct research to obtain the information necessary to complete the task. The interactions between the students and between the students and the teacher are not very structured.

Again, Bonwell and Sutherland (1996) propose a more refined conceptual framework for risks, presented in the form of a four-dimensional continuum, illustrated in Figure 1, comprising elements to consider when choosing a method.

The authors mention that the outside boundaries of each of the dimensions of the continuum are not better choices or more desirable, but are the guides for selecting context-sensitive learning methods.



**FIGURE 1** CONTINUUM OF RISKS ACCORDING TO THE FOUR DIMENSIONS OF BONWELL AND SUTHERLAND (1996)



### ► SUGGESTIONS OF ACTIVE LEARNING ACTIVITIES

Focusing more on the complexity of an activity and students' involvement in active learning methods, Prince (2010) proposes a four-level continuum that groups together activity categories, illustrated in Figure 2.

#### THE INTERACTIVE PRESENTATION

At one end of the spectrum, very simple active learning is associated with informal lectures. This strategy consists of dividing up the content of a course into 15- to 20-minute

sequences that are followed by a small activity to help increase the comprehension and memorization of the content presented. The task, which is short-term and structured, targets objectives related solely to the acquisition of knowledge and involves interactions between the teacher and the students, as well as limited interaction among the students. This low-risk strategy allows the teacher to make a slight change in their teaching method, but which is significant in the normal way of presenting a course to promote learning. The activities offered between course lectures can be varied. A few examples of these are presented in the box on the next page.

**FIGURE 2** THE ACTIVE LEARNING CONTINUUM ACCORDING TO PRINCE (2010)





## EXAMPLES OF INTERACTIVE PRESENTATIONS\*

### WAIT TIME

At the end of a lecture, the teacher asks the whole group a question. After waiting 3 to 10 seconds, the teacher repeats the question and randomly chooses a student who answers orally. This can also be done in writing (One-minute paper): once the question is asked, the teacher allows the students a minute (or two, not more) to answer the question in writing. He then chooses a student at random, who verbally presents their answer.

### WORKING IN PAIRS

At the end of a lecture, the teacher asks the students separated into pairs to compare their course notes, summarize the content, paraphrase the concepts presented, etc.

### THINK-PAIR-SHARE

At the end of a lecture, the teacher asks a question and the students answer individually in writing. The students then get together in pairs, exchange their answers and discuss them. The answers are then shared with the whole group.

### IMMEDIATE FEEDBACK

Immediate feedback, also known as peer education, invites students to vote (with their cellphones, i-clickers, colour cards, etc.) in order to answer multiple-choice questions. After presenting a concept, the teacher asks students a conceptual question orally or on a screen. If the response rate is satisfactory, the teacher moves on to the next concept. Otherwise, the teacher invites the students to discuss among themselves, in a subgroup, to exchange their points of view, after which the students vote again. If necessary, the teacher re-explains the concept in a different way.<sup>1</sup>

\* For other examples of techniques to experiment with within the framework of interactive lectures, I recommend the article by Faust and Paulsen (1998).

## INFORMAL AND STRUCTURED TEAM ACTIVITIES

At a higher risk level, a teacher may select activities that involve a cooperative structure, inviting students to work in close collaboration. The use of cooperative structures requires the teacher to have a solid understanding of the teaching method, as well as co-operative skills on the part of the students. These skills must be taught; they will develop throughout the session (Lavoie *et al.*, 2012).<sup>2</sup>

One of the strategies often used is called a *Jigsaw Teaching* (Howden and Kopiec, 2000). In this cooperative structure,

the teacher gives a group of students a part of the subject (part of a lecture, part of a text, etc.) for which they become the experts. They discuss among themselves in order to learn the content. Then, new groups are formed of experts from different parts, and each student presents their part to the other experts. Lastly, the teams are invited to summarize the contents presented.

## ACTIVITIES FOCUSED ON A PROBLEM

At the other end of the continuum, activities focused on a problem pose major planning challenges for teachers. These long-term activities target high-level goals and involve many uncontrolled interactions between students. The methods found at this end of the continuum, such as *problem-based learning*, *case studies*, or the *project-based approach* rely on well-established scripts, but require the teacher to have an in-depth understanding of their underlying principles and extensive class preparation.<sup>3</sup>

Risk can be increased gradually, depending on the comfort level of the teacher and the students, as well as the complexity of the learning that students must master.

The difficulties encountered by teachers with this type of method often stem from a false diagnosis of the students' familiarity with these types of activities. Although it is common to think that it is necessary to "jump into the water to learn how to swim," then "drowning" is not far off if we do not take into account the students' level of experience. The teacher must consider the support to be given to their students during the activity, according to their experience with the chosen method. This support can be at three levels: the approach, resources and interactions (see [Table 3](#)).<sup>4</sup>

<sup>1</sup> This technique and its excellent effectiveness are presented by Lasry (2008) and Bouffard (2014).

<sup>2</sup> Howden and Kopiec (2000), and MacPherson (2010) present several examples of cooperative structures to integrate in the classroom.

<sup>3</sup> Ed. note: Articles discussing these teaching methods have been published in *Pédagogie collégiale*: for problem-based learning, see Pagé (2004); for case studies, see Baudry (2017); and for a project-based approach, see Vallières (2003). Resources were added to the bibliography.

<sup>4</sup> This summary stems from my personal thoughts following all my readings on active learning.



TABLE 3

SUPPORTING STUDENTS ACCORDING TO THEIR EXPERIENCE

	NEW STUDENTS	INTERMEDIATE STUDENTS	AUTONOMOUS STUDENTS
Procedure	The teacher models the process before setting the students into action. They give them a template and a checklist.	The teacher anticipates questions to help the students and reissues the work. They ask the students questions when deemed appropriate. Without explicitly teaching the process, they provide a template and checklist.	The students are autonomous. The teacher plans a few questions to help guide them, as required.
Ressources	Students have access to all the knowledge needed to complete the task and master the essential strategies to process the new information. The teacher only teaches knowledge or strategies that are not mastered by the students.	The teacher provides resources that students can consult. When required, the teacher can clearly explain the strategies required to process new information in the resources.	The students find the resources themselves and process them with their own strategies, which they master.
Interactions	The teacher clearly teaches the social skills that students will have to use when performing the task. The teacher uses a cooperative structure to manage interactions with students.	The teacher uses a cooperative structure to manage interactions with students.	The students manage interactions on their own. The teacher intervenes in some cases to ensure the team works well.

### ▶ ACTIVE LEARNING CLASSES (ALC's)

To encourage active learning, several higher education institutions, including several in the college network (Blogue de l'équipe de chercheurs sur les CLAAC, 2014), have chosen to introduce active learning classes. Also called *socio-technological environments*, these classes have two main characteristics:

- Class layouts that promote active teaching and collaborative or cooperative learning;
- Access to technologies that support active teaching, cooperation and collaboration (digital whiteboards, computers, tablets, projectors, etc.), which enabled the ALC's to adopt the nickname of *21<sup>st</sup> century classes*.

These two characteristics imply that students will no longer be passive players, but rather will be at the center of their learning, and that cooperation and collaboration will clearly find their place at the heart of the activities that take place in the class. Students entering a CLAAC for the first time quickly realize that things will not occur in the normal fashion! In the United States, projects for the development of active learning classes for teaching physics classes, such as Technology Enabled Active Learning (TEAL) at the Massachusetts Institute of Technology (MIT) and the SCALE-UP project at the University of North

Carolina, have obtained good results with students' motivation and learning, and student success rates (Kingsbury, 2012).

However, the combination of all these elements can be daunting for a teacher who would like to experiment with this kind of teaching, given that there are so many elements to take into consideration with regard to the teaching, technology, logistical plans, etc. A study conducted at Dawson College has shown that, regardless of whether the environment is traditional or socio-technological, the most important element for fostering learning is active teaching or active learning.

The researchers (Charles *et al.*, 2013) state that:

"[...] pedagogy is necessary for the teacher who wants to improve student learning. The adoption of new socio-technological environments must necessarily be accompanied by the adoption of an active pedagogy, if we want to benefit from the advantages they offer" (p. 7).

Consequently, the integration of active learning methods is the first step to take before exploiting the full potential of an ALC, and this type of learning can easily be introduced into any so-called "traditional" class, that is to say, that does not include special furniture or technologies.



## ► TRY ACTIVE LEARNING!

In short, active learning involves effective teaching methods that require the student to process information in-depth. The teacher who takes this into account will introduce students to activities that involve active, constructive and, even better, interactive engagement.

Given that the challenges and barriers to using active learning are numerous, the teacher who chooses to overcome them must assess the risk they are willing to take. Without turning things upside down, the teacher can experiment with activities that use low-risk methods while respecting the principles of active pedagogy. The increase in risk can then be gradual, depending on the comfort level of the teacher and the students, as well as the complexity of the learning that students must master.

The mastery of active learning methods, especially at higher risk levels, is a prerequisite for teaching effectively in an ALC. If a teacher is already using these methods, they only have one small hurdle left to jump into the technological arena! ♦

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