Deliberate Practice as a Guide to Active Learning[1]

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Economists express considerable interest in using active learning in their classrooms and there are many ways that it can be implemented, from discussion-based courses to Team-Based Learning to Peer Instruction. Further, there is considerable evidence that it enhances student learning. However, there is little discussion on how to best implement active learning. This paper suggests that using the elements of "deliberate practice," which comes from studies of how expertise is developed, will enhance the power of active learning in economics classrooms. Specifically, it is suggested that instructors using active learning expand the types of questions they employ.

Version History

1.0: Presented at the Southern Economic Association on 11/23/2024.

2.0: Added the point that deliberate practice covers many domains and not just the performing arts (this addresses a question made by Christian Spielmann, the discussant at the SEA). Added a discussion on purposeful practice following a suggestion by Stephen L. Chew, as well as a reference to his paper "Active Learning Is an Educational Buzzword (and Not Particularly Useful)" of January 2025. Added Martella, Swisher, and Mayer (2024).

[1] I would like to thank Emily Marshall, KimMarie McGoldrick, and Tisha Emerson for detailed feedback on an earlier and much shorter expression of the ideas presented in this paper (Goffe, 2024). Christian Spielmann and Stephen L. Chew provided valuable comments on version 1.0 of this paper.

Introduction

Economists appear to be in favor of using active learning to teach their classes (Goffe and Kauper, 2014). They find in a survey of 340 principles instructors, 67% feel that students learn best in an active learning environment. In addition, the term appears frequently in economics education research as 202 papers in the Journal of Economic Education contain this term.[2] While there are many ways to implement active learning, are there fundamental principles that an instructor should incorporate? Are some implementations of active learning more effective than others? This paper explores answers to these questions with the concept of "deliberate practice," (Ericsson et al., 1993), (Ericsson and Pool, 2016) which comes from studies of how experts develop their expertise.

This paper is organized as follows. First, the literature on the effectiveness of active learning is reviewed, and then deliberate practice is introduced, along with how it has been implemented in college classrooms. Next, the related concept of engagement is discussed, and the paper concludes with a discussion of how the author implements aspects of deliberate practice in a principles of macroeconomics course.

Evidence on the Effectiveness of Active Learning

Two meta-analyses, covering hundreds of individual studies, have found that teaching with active learning benefits students. One paper widely cited for STEM disciplines is Freeman et al. (2014), which uses 225 papers in its analysis. They find that students in active learning treatments performed a statistically significant .47 standard deviations better on assessments than students in lecture-based controls. They also find decreased failure rates in active learning classes; students in a lecture-based class were 1.5 times more likely to fail. In the humanities and social sciences, (including economics), Kozanitis and Nenciovici (2023) also find that classes taught with active learning improve student outcomes; specifically, students in active learning treatments performed .489 statistically significant standard deviations higher on assessments. Their analysis uses 104 papers, but they do not study failure rates. Their separate analysis of learning in economics classes (from 16 papers with 2,080 students) also finds that active learning has a positive impact of .479 standard deviations.

The above two meta-analyses define active learning in very broad terms. Freeman et al. (2014) states that "Active learning engages students in the process of learning through activities and/or discussion in class, as opposed to passively listening to an expert. It emphasizes higher-order thinking and often involves group work." In their selection of papers, they note, "Thus, this study's intent was to evaluate the average effect of any active learning type and intensity contrasted with traditional lecturing." For the latter, they use the definition of Bligh (2000): "...continuous exposition by the teacher." Thus, Freeman et al. (2014) includes many types of active learning, "including vaguely defined 'cooperative group activities in class,' in-class worksheets, clickers, problem-based learning (PBL), and studio classrooms, with intensities ranging from 10% to 100% of class time..." In effect, most any instructional method other than the instructor talking the entire class counts as active learning. As Zakrajsek (2018) emphasizes, the active learning studied in Freeman et al. (2014) can and often does

[2] This search was conducted in the middle of November 2024.

include a substantial amount of lecture; in fact, up to 90% of class time might be taught this way. Thus, Freeman et al. (2014) and the similarly organized Kozanitis and Nenciovici (2023) are often actually comparing a lecture only class to a class with lecture plus some type of active learning. Note that Goffe and Kauper (2014) define active learning in a similar way.

Thus, while it seems that active learning "works," might there be a more precise definition? Lombardi et al. (2021) attempt to find one for STEM classes. They employ 19 authors in 7 disciplines: astronomy, biology, chemistry, engineering, geography, geoscience, and physics to describe active learning. They come to this conclusion: "However, active learning can mean many things, often different things, to many people. Therefore, as an umbrella term, active learning is not a useful concept for advancing research on effective undergraduate STEM learning." From the perspective of cognitive science, Chew (2025) points out that "it lacks a functional operational definition." He adds, "Because of the vagaries of the definition, there is no way to determine which aspects of active learning contribute to improved learning and which are superfluous." and "As long as a teacher is having students do something other than listen to lectures, they can claim to be using active learning, regardless of whether it actually works."

Despite not being well defined, there are calls for research to better understand active learning: "It is now well established that nearly any form of active learning will produce better student outcomes than traditional lecture-based instruction [27]. There is no need to conduct additional research on this point. What is needed, though, are studies to better understand how to optimize active learning." (Dancy et al., 2024) There is already some work in this area; two papers are Martella et al. (2024) and Martella, Swisher, and Mayer (2024)

In the meantime, what might a conscientious instructor, who is considering active learning for their classes, do? What type of active learning should they choose? Further, if an instructor is already using active learning, how might they optimize its use? As above, the current active learning literature does not offer a suggestion to either of these questions. However, by looking at some fundamentals of how expertise is developed, through the concept of "deliberate practice," these questions can be addressed.

Deliberate Practice

The concept of deliberate practice was introduced by Ericsson et al., (1993), which studies how elite violinists and pianists achieved their skills[3]. These crafts are particularly well suited to studying elite performance as there are standards to measure performance, there is extensive data on performer's practice history, and there are agreed-upon exercises to improve one's skills. Remarkably, the authors find no role for innate talent; instead, elite performers attain their skills through many hours of what the authors describe as "deliberate practice." It is fair to say that this has been an influential

[3] Later work on deliberate practice and expert performance used data from other types of careers and human endeavors: physicians (including surgeons), athletes, ballet, mathematicians, and salespeople. The results are largely the same. Some of this work is summarized in Ericsson et al. (2018).

work; as of October 2024 this paper has been cited nearly 16,000 times.[4] It was popularized (poorly) by Gladwell (2011) as the "10,000 hour rule" – the number of hours a practice one needs to reach elite levels of performance. However, Ericsson et al., (1993) did not settle on 10,000 hours and Gladwell did not accurately define practice. We will use Ericsson and Pool (2016, pp. 98–100) (edited here for length) for the definition of deliberate practice:

1. Deliberate practice involves skills others have and for which there are effective training methods. Training is overseen by someone familiar with the skills of elite performers.
2. It takes the student out of their comfort zone (that is, tasks are quite challenging) and likely is not enjoyable.
3. There are specific goals that can be arranged in a hierarchical fashion.
4. It requires the student's full attention and concentration on the goals at hand.
5. It involves extensive feedback and with time, the student learns to generate their own feedback. This involves "effective mental representations."
6. These effective mental representations are improved as the student's skill increases and this aids further improvements in skills.
7. It typically involves improving existing skills. Thus, fundamental skills are particularly important.[5]

Part 1 of this definition applies to a narrow range of fields. Apparently in chess and classical music, there is consensus on what constitutes effective training methods and instructors are familiar with the skills of elite performers. This is not the case for those teaching English composition, the central limit theorem, natural selection, or supply and demand. In these situations, Ericsson and Pool (2016, pp. 22, 97–98) argue for "purposeful practice." It is described by points 2 to 7 above. An interesting aspect of purposeful practice is that it does not necessarily require an instructor – an individual can use it to improve their own performance. This could even include a student.[6]

Some of the above points have been pointed out as important for learning by others. Being "taken out of their comfort zone" (part 2) is similar to "desirable difficulties" (Bjork and Bjork, 2014), which is the argument that learning is enhanced if some effort is expanded when doing so. Put another way, "learning should not be easy." These include spacing studying out over time, interleaving different types of problems (instead of continually working on the same type of problem), trying to generate an answer (versus being presented with one), and being tested on material instead of being given material (retrieval practice).

"Goals that can be arranged in a hierarchical fashion" (part 3) and "fundamental skills are particularly important" (part 7) are similar to having students work through scaffolded exercises (Wood et al., 1976). "The student learns to generate their own feedback" (part 5) is similar to metacognition (Dunlosky and Metcalfe, 2008). "Effective mental representations" (parts 5 and 6) are clearly what psychologists call "schemas," which are how humans organize knowledge, which is by connecting

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[4] Ericsson was a particularly influential psychologist as his works have garnered some 114,000 citations, comparable to economists David Card (98,000), Greg Mankiw (122,000), and Paul Romer (130,000). However, Ericsson's mentor, Herbert Simon, garnered significantly more (463,000). Simon was an early (1978) Nobel Laurate in economics.

[5] While the term is not used here, in part they are describing "subskills" that makeup larger skill sets.

[6] This was pointed out by Stephen Chew in a private correspondence.

ideas and concepts to each other. Humans are poor at remembering isolated facts but excel in recalling connections between ideas. The understanding of schemas in human memory expanded with Anderson et al. (1977). Indeed, Ericsson and Pool (2016, p. 75) state "The main purpose of deliberate practice is to develop effective mental representations, and, as we will discuss shortly, mental representations in turn play a key role in deliberate practice." Note that schemas played a significant role in Goffe and Wolla (2024).

Deliberate Practice Research Conducted in the College Classroom

A leading proponent of deliberate practice in the college classroom is the physicist (and Nobel Laureate) Carl Wieman. He and two coauthors (Deslauriers et al., 2011) employ it in a teaching experiment. Two novice instructors (Deslauriers, assisted by Schelew), using deliberate practice as a guide, taught for a week in a second semester physics course. Learning for that week in this experimental section was compared to learning by students in a section taught by a seasoned instructor (the control). Both the control and the experimental sections had about 270 comparable students. The novice instructors took this approach: "In our case, the deliberate practice takes the form of a series of challenging questions and tasks that require the students to practice physicist-like reasoning and problem solving during class time while provided with frequent feedback." The tasks that these students were asked to do in class were trialed with a few students before class; this can be seen as the instructors tailoring the tasks to students' existing schemas. Students in the control section were largely lectured to, though there were some clicker questions. Student knowledge was measured the following week with a 12-item assessment that did not contribute to the course grade, so students had no reason to study for this assessment. Students in the section taught with deliberate practice scored about 2.5 standard deviations higher on this assessment than did students in the control section. As the control section taught by the seasoned instructor used clickers, it might be classified as an active learning classroom. These results suggest that deliberate practice is a promising approach to college teaching.[7] In addition, they suggest that the implementation of active learning matters significantly.

An interesting follow-on study to Deslauriers et al. (2011) is Miller et al. (2021). The starting point is a class taught with a deliberate practice framework, but with regular homeworks. They note that "Homework is implicitly a form of active learning, but traditional homework does not incorporate the principles of deliberate practice such as subskill practice with targeted feedback. Instead, most homework involves complex problems similar to the questions that will be asked on exams." This addresses the 7th part of the definition of deliberate practice given above. In two experiments they evaluate the impact of homeworks that first target subskills and they find such homeworks across the semester improve learning (as measured by a comprehensive final exam) about as much as does moving a class from lecture to one based on deliberate practice. Their examples of subskills for their Harvard students are unlikely to be appreciated by economists, but they note that others who advocate a subskill approach to homework mention vector addition. The authors note that ideally, subskill homework questions have limited scope, and the homework author can easily write explanations for all possible student answers.

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[7] Ericsson and Pool (2016, pp. 243–254) offer a positive review of this paper.

Another approach to teaching with deliberate practice is described in Jones et al. (2015). Here, an entire senior-level physics course is reimplemented with deliberate practice and then taught by a different instructor. Again, the deliberate practice framework leads to learning gains. It also suggests that instructor effects are not the dominant factor in these experiments. Looking at STEM teaching in general, Theobald et al. (2020)[8] explores approaches to minimizing achievement gaps between advantaged and traditionally disadvantaged students. Classes taught with a deliberate practice framework are found to minimize these gaps. Some 44,000 students were involved in the studies they analyzed.

The above papers aside, deliberate practice seems little studied by physics education researchers (it does not appear in an extensive literature review (Docktor and Mestre, 2014)) but still its principles are used. For example, Knight (2002, pp. 28–40) describes in detail students' existing preconceptions on force, motion, and electric circuits, as well as how they organize knowledge and how they solve problems. In terms of deliberate practice, their existing schemas are catalogued so that instructors can better teach them. As Knight (2002, p. 25) points out, "Students' prior concepts are remarkably resistant to change. Conventional instruction – lecture classes, homework, and exams that are predominately or exclusively quantitative – makes almost no change in student's conceptual beliefs [part of schemas]."

Other STEM research is consistent with the principles of deliberate practice even though that term is not used. For example, Smith et al. (2011) and Zingaro and Porter (2014) both study Peer Instruction, popularized by Eric Mazur (Crouch and Mazur, 2001). In it, students first vote individually on a clicker question, then confer with their peers, and then vote again. Both Smith et al. (2011) and Zingaro and Porter (2014) find that Peer Instruction plus instructor feedback leads to more learning than Peer Instruction by itself or a single student clicker vote followed by instructor feedback. The reason might be that students' schemas are enriched by multiple views of an answer to a problem, consistent with deliberate practice definitions 5 and 6. These results suggest why student groups are a valuable part of active learning – they help provide useful feedback to students.

One tenant of Peer Instruction, as well as deliberate practice (definition part 2), is asking students challenging questions. Specifically, Crouch and Mazur (2001) argue that that in the initial round of questions, between 25% and 70% of students should be answering correctly, and the largest gains from the first to the second round of voting occurs when about 50% answer the first question correctly. Zingaro and Porter (2014) find support for this view as more challenging questions do indeed lead to more learning.

[8] This paper can be seen as a sequel to Freeman et al. (2014) as it involves some of the same authors and explores a related topic via a meta-analysis. It likely has not received the attention it should have given its publication in March of 2020.

Engagement And Relevant Topics

Engagement is frequently suggested as a goal for those who teach economics – 673 papers published in the Journal of Economic Education contain that word, and 61 papers have that word in their abstract.[9]

Surprisingly, cognitive scientists do not appear to agree that engagement by itself is that desirable. The view of Chew (2022) is apparent from just the title: "Student Engagement Is Not Student Learning." He notes "We should think about what our assignments are making students think about. The assignments that are best for learning go beyond engagement. They make students elaborate on concepts by making meaningful associations, they emphasize key distinctions among different concepts, and they require students to apply concepts in new ways." This is consistent with deliberate practice definitions part 2 and 5. Along these lines Willingham (2021, p. 58) summarizes a large body of research on memory with the aphorism "Memory is the residue of thought." What we think about is what we remember, and an engaging exercise does not necessarily have students thinking deeply about the concept at hand. He gives the example (Willingham, 2021, p. 57) of a 4th grade class that baked biscuits to understand the challenges of escaping slavery on the Underground Railroad as biscuits were a common food for escapees. Willingham argues that while they were engaged, students likely remembered far more about making biscuits than they did about the Underground Railroad. To summarize this point about engagement, Chew (2022) notes "Engagement is typically necessary, but it isn't sufficient for learning."

Often faculty are told to make topics relevant to students' lives and concerns.[10] Willingham notes:

> I've always been bothered by the advice 'make it relevant to the students' for two reasons. First, it often feels to me that it doesn't apply. Is the Epic of Gilgamesh relevant to students in a way they can immediately understand? Is trigonometry? Making these topics relevant to students' daily lives will be a strain, and students will probably think it's phony. Second, if I can't convince students that something is relevant to them, does that mean I shouldn't teach it? If I'm continually trying to build bridges between students' daily lives and their school subjects, that students may get the message that school is always about them, whereas I think there is value, interest, and beauty in learning about things that don't have much to do with me. (Willingham, 2021, p. 90)

This suggests that instead of trying to make topics relevant to students, instructors might follow Chew's advice and have their students elaborate on meaningful associations, to emphasize key distinctions between topics, and to have students apply concepts in new ways. In our earlier terminology, faculty should design exercises to enrich students' schemas.

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[9] This search was conducted in early November 2024.

[10] The word "relevant" occurs in 892 times in an online search of the Journal of Economic Education conducted in early November 2024. This word occurs in 42 abstracts.

Implementations of Active Learning in Economics

To the extent that active learning is used in economics classrooms (Asarta et al., 2021), it is difficult to know exactly how active learning is currently implemented. While Goffe and Kauper (2014) find that most sampled economists believe that active learning is desirable, exactly how they implement active learning was not explored. Specifically, are their implementations consistent with deliberate practice? As best this author knows, it has not been explored in any economics education paper, nor even in the STEM literature.

Active learning can be implemented in classrooms in many different formats and these formats might well be orthogonal to deliberate practice. That is, the attributes of different formats of active learning are often distinct from the principles of deliberate practice. Active learning formats include case-based classes (Conway, 2012), discussion (Hansen and Salemi, 2012), experiential learning (McGoldrick and Ziegert, 2012), cooperative learning (McGoldrick, 2012), classroom experiments (Emerson and Hazlett, 2012), and methods for teaching large classes (including with clickers) (Buckles et al., 2012).[11] Other formats for active learning include team-based learning (Ruder et al., 2021) and problem-based learning (Forsythe, n.d.).

Despite the wide range of active learning formats, a common thread across them is that students are asked questions. Some active learning formats have suggested question types; for example, cases focus on questions that, "poses [a] problem or decision that has no obvious answer" and "challenges [the] reader to think and to analyze in reaching a solution to the problem." (Conway, 2012), while discussions incorporate different question types (interpretive, factual, evaluative) in different roles (basic, support, follow up, concluding). Meanwhile, "Experiential education is a pedagogic practice that supports learning through experiences." (which implicitly involves answering questions). This often involves projects outside the classroom (McGoldrick and Ziegert, 2012). In addition, team-based learning focuses on complex "application exercises" (Ruder et al., 2021). However, none of these formats address all the aspects of deliberate practice. None appear to mention developing students' schemas, nor are subskills, that are parts of a larger skill set, emphasized. The next section explores how these elements of deliberate practice have been implemented in an economics course taught by the author, with an emphasis on questions that target subskills and connections between facts, concepts and procedures to enrich students' schemas.

[11] All these chapters are from Hoyt and McGoldrick (2012), which is quite applicable as they are written as introductions to their respective topics and thus, describe to the neophyte their key aspects.

Examples of Deliberate Practice in an Economics Classroom

The author primarily teaches principles of macroeconomics with about 330 students per section. Given the class size, active learning is implemented via Peer Instruction (Crouch and Mazur, 2001) with students voting with iClicker software. Details of the course are described in Boyle and Goffe (2018), which includes a brief description of deliberate practice. All the examples here are clicker questions, in line with the part of deliberate practice that instruction should require considerable student thought (definition parts 2 and 4).

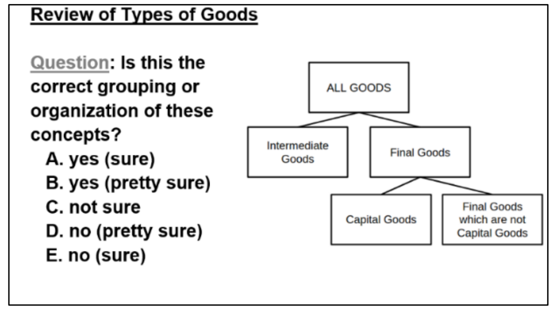

Figure 1

Figure 1 is a slide with a clicker question[12]. Note that instead of students being lectured about this topic, they need to think about the relationships between the types of goods to answer the question when they vote with their clicker software. This question is designed to enrich students' schemas (deliberate practice definition part 6). This is consistent with Chew's point (2022) that "We should think about what our assignments are making students think about. … make students elaborate on concepts by making meaningful associations, they emphasize key distinctions among different concepts, …"

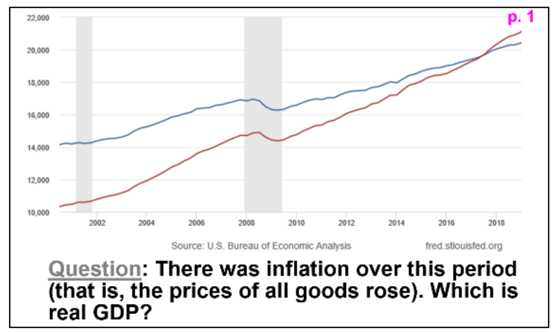

Figure 2

Figure 2 is designed to deepen students' understanding of the difference between real and nominal GDP. At this point in the course, students have read about real and nominal GDP in a reading assignment and have computed real and nominal GDP. This question helps them solidify their understanding of these two terms.[13]

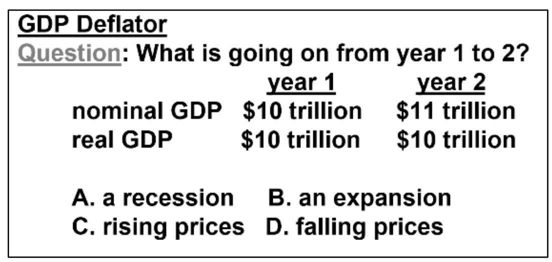

Figure 3

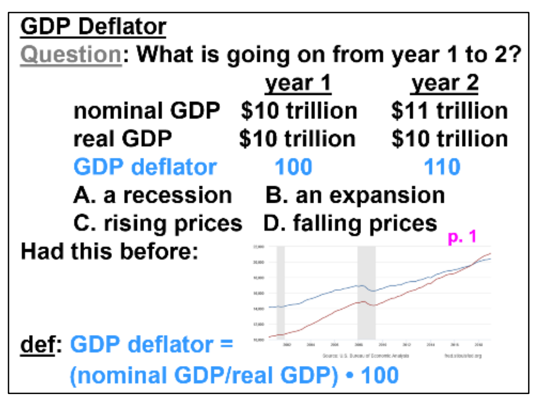

Figure 4

Figure 3 shows how the GDP deflator is introduced – first, students are presented with a question that they have the background to answer. First they must recall prior knowledge (a "desirable difficulty," (Bjork and Bjork, 2014) that should help enrich their schemas) and this is then used to introduce the GDP deflator as more of the slide is revealed after they

[12] This question was designed by a former undergraduate learning assistant, Joshua Adams.

[13] The "p. 1" in the upper left denotes that this chart is on p. 1 of a handout.

answer this question (Figure 4). Note how Figure 4 includes key aspects of Figure 2. The intent is to further enrich their connections between concepts.

Figure 5 is an example of subskill development with aggregate demand. At this point in the course, students have completed a reading assignment on this topic and seen each of these elements that shift the AD curve in class, but they still have difficulty with this question. Thus, class time is spent on this subskill.

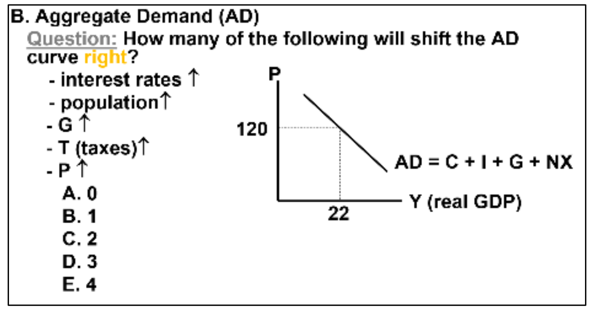

Figure 5

Figure 6 shows another question designed to strengthen schemas. At this point in the course, students have learned about real GDP and their abbreviations, as well as the terms in blue. However, they find this question challenging as they must connect concepts that seem disparate to them. The graph is used in the explanation of the answer to illustrate how much of the course is summarized in one place.

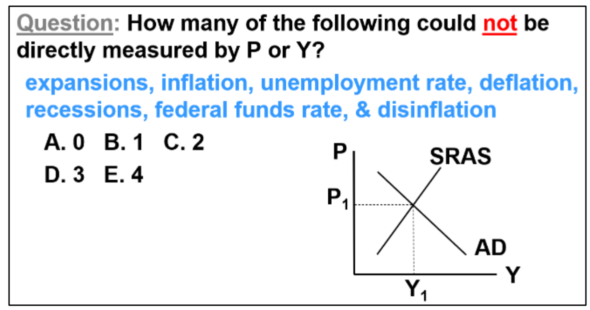

Figure 6

Conclusion

Many economists are interested in teaching with active learning and there is good evidence that it improves student outcomes. Further, there are many ways to implement it in economics classrooms. However, there is scant discussion on how to best use active learning. This paper suggests that implementing active learning with all the elements of deliberate practice, which is consistent with what cognitive scientists have found about how humans learn, is an attractive framework for refining how active learning is implemented in economics. Specifically, active learning would likely be enhanced if instructors added two types of questions: those that target subskills and those that connect concepts, facts, and procedures with each other so that students' schemas are enhanced.

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