

# Do lazy professors teach better?

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## ABSTRACT

Professors traditionally spend more time preparing lectures, grading, catching cheating, and so forth, than teaching.<sup>1</sup> Though necessary, these tasks do not engage student learning, nor improve chances for promotion and tenure. Thus, professors should minimize time spent on them. This paper surveys alternative tactics for tasks traditionally ancillary to teaching. We argue that alternative tactics aid professors and improve student learning outcomes.

## Categories and Subject Descriptors

K.3.2 [Computer and Information Science Education]:  
Self-assessment

## General Terms

Management, Measurement

## Keywords

Alternative tactics, roles

## 1. INTRODUCTION

Students demand teaching, yet professors spend far more of their time on course preparation and management instead. Let us assume professors teach for the entire 30 hours scheduled for lecture. A full-time professor can expect to spend the week before class starts, or 40 hours, preparing or revising syllabi, learning outcomes, lectures, rubrics, questions, assessments, etc. Once the term starts, the professor manages the course. Grading can easily consume 50 hours over a course. Dealing with plagiarism also takes time: in one case, it took 45 hours in a semester [6]. These tasks are essential, as an unprepared professor who delays grading or tolerates plagiarism will not teach effectively. Yet, these tasks are secondary to teaching, and traditional tactics take time.

<sup>1</sup>In this paper, teaching refers to tasks that engage student learning, i.e., practice or correcting mistakes.

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The traditional tactics to manage and prepare for a course are inefficient with respect to time and labor. For example, professors who prepare their own syllabi, lectures, assessments, etc., gain little benefit from the experience of other faculty. Furthermore, multiple professors who prepare for the same course individually waste time and end up teaching inconsistently. Likewise, taking attendance by calling names wastes time: until the professor is done, students are idle and not learning. Professors who collect student signatures on paper still need to transcribe attendance into a spreadsheet. This benefits neither students nor professors.

The time and labor intensity of traditional tactics for ancillary non-teaching tasks suggests room for improvement. Indeed, subtle changes in tactics and roles may save time and effort better devoted to teaching. For example, professors who prepare a course as a team may save effort, benefit from each other's experience, and teach consistently. Likewise, requiring students to complete an online questionnaire at the start and end of each class meeting simultaneously automates attendance-taking and measures overall student comprehension. Changes in tactics and roles may benefit everyone in ways beyond freeing up time.

In this paper, we distinguish among related words in specific ways. Course prep and management are unavoidable *tasks*, but the available procedures (*tactics*) or who is responsible (*role*) can change. Thus, unavailable procedures are not tactics. All tactics in this paper are readily available to professors. Indeed, none of the tactics mentioned in this paper are novel. *Lecturing* refers to disseminating information, whereas *teaching* implies correcting student mistakes or engaging them in practice exercises. *Assessment* refers to measurement, whereas *evaluation* ties assessment to a consequence, reward or punishment.

Traditional tactics are familiar, requiring little (if any) technology. They have been passed down over generations out of habit, and nobody "owns" them. They are the standard by which any other method is judged. Yet tradition does not imply quality, and traditional tactics do not necessarily lead to desirable outcomes.

Alternative tactics and roles must maintain or improve student learning outcomes and aid the professor. Achieving only one is useless. Professors will not readily adopt tactics that they perceive will burden them. Likewise, professors cannot justify tactics that impair student learning.

Alternative tactics structure interactions among students and the professor to achieve desired outcomes by default. On-line records and delegation are the underlying mechanism behind alternative tactics. *On-line record-keeping* prevents paperwork. *Delegation* distributes work to students

and the peers of a professor.

This paper contributes a survey of alternative tactics and roles for traditionally ancillary non-teaching tasks. Section 2 outlines work related to the conditions necessary for learning. Sections 3 through 5 analyze each tactic separately with respect to professor productivity and student learning. Section 6 proposes how to integrate alternative tactics into the classroom. Section 7 discusses tactics in a broader sense before the conclusion.

## 2. BACKGROUND

This paper focuses on tactics and roles for tasks traditionally ancillary to teaching to simplify discussion of pedagogical merits. Pedagogy, by definition, refers to teaching methods. If teaching is the product, then non-teaching tasks are overhead. If alternative tactics improve learning outcomes, they do so by transforming traditional non-teaching tactics into teaching tactics.

Teaching cannot be effective unless professors provide the conditions in which students can learn, as outlined below.

### 2.1 Laws of Learning

Thorndike postulated several laws of learning [13]:

**Readiness** Learning requires readiness, motivation, and time.

**Exercise** Learning requires practice and repetition.

**Effect** Students learn with rewards, not punishment.

**Primacy, recency** Students remember the first & last things.

**Intensity** Students remember exciting things.

**Freedom** Students learn best with choice, not coercion.

### 2.2 Bloom's Taxonomy: Cognitive Domain

Learning objectives fit into the following categories [2]:

**Knowledge** Recalling facts, definitions, concepts.

**Comprehension** Demonstrate understanding of ideas.

**Application** Solve problems by applying knowledge.

**Analysis** Break information into parts.

**Synthesis** Combine elements together in a novel way.

**Evaluation** Judge quality using evidence or criteria.

### 2.3 Flow

People learn best when they are so engrossed in an interesting challenge that they ignore distractions, also known as *flow* [3]. With golf as an example, achieving flow requires:

**Clear goals** Place the ball into the hole.

**Limited choices (rules)** Players cannot walk with the ball and drop it in the hole.

**Immediate, actionable feedback** Is the ball in the hole?

**Skills matched to challenge** (Figure 1) Players must be able to wield golf clubs.

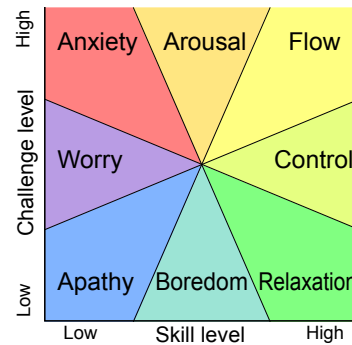


Figure 1: Flow: skills match challenges.

## 3. STRUCTURED INTERACTION TACTICS

Table 1 outlines traditional and alternative tactics for structuring interactions among the professor and students. Traditionally, the professor communicates expectations in terms of perfection and percentages, does not enforce reading assignments, asks students to work at home, and reacts to plagiarism. Traditional tactics require minimal preparation, but more management time.

Alternative tactics structure student-professor interactions to achieve desirable outcomes. The professor communicates expectations with rubrics and total points necessary to pass, enforces reading assignments, asks students to work in class, and prevents plagiarism. Alternative tactics require more up-front preparation, but less management time.

Table 1: Structured interaction tactics

Task	Tradition	Alternative
Expectations	Perfection, percentages	Rubric, points
Reading	Unenforced	Enforced
Student Work	Homework	Classwork
Plagiarism	Reaction	Prevention

### 3.1 Communicating expectations

Traditionally, professors communicate and set expectations in terms of perfection and percentages. For example, assessments explain what students must achieve for full credit, without describing how student mistakes translate into deductions. Because anticipating student mistakes is difficult, professors retain flexibility by delaying decisions about deducting points until after examining all work. Expressing the grade for a course in terms of percentages (e.g., a final is 20% of the total) also communicates expectations. Calculating grades as a weighted average is not difficult, and it enables the professor to adjust how many assessments are necessary to pass a course.

While describing expectations in terms of perfection or percentages allows the professor to remain flexible, this obfuscates goals for students. Delaying decisions about how to penalize mistakes leads students to nag the professor about whether they worked hard enough. Such students rightly feel that their grades are subject to the whim of the professor, rather than a standard of achievement. When a professor can adjust how many assessments are necessary to pass, it frustrates students eager to assess their progress. A downward adjustment makes prior mistakes more costly, and an

upward adjustment surprises students with more work.

The alternative of rubrics and points communicates and sets expectations clearly, thereby facilitating student learning. Rubrics are a well-known tool for setting a standard for achievement, not effort. Rubrics require criteria for performance, as well as levels and descriptors for each criteria. By describing imperfect work, rubrics enable students to self-assess. Rubrics should be generic for different types of assignments to enable practice with them; e.g., separate rubrics for programming, writing, presentations, and grading. Rubrics take time to prepare, but once made, they save time in grading and prevent nagging. Expectations expressed in absolute, not relative terms (i.e., total points toward the course, not percentages), simplifies grade estimation, and forces professors to decide up-front what constitutes passing the course. Instead of a weighted average, students can determine their progress by adding all points received, and divide by points necessary to pass the course.

### 3.2 Reading assignments

Traditionally, professors post required reading assignments by page or section numbers in the syllabus, but students ignore them. Students should read before class, to ensure they learn the material. Yet, when lectures largely rehash the reading assignment, attending to both is redundant. Students rationally choose between lecture or reading, without penalty. This is problematic, because students who do not read are unprepared for the class meeting.

The alternative, known as the Gutenberg method [11], requires reading by including a topic outline and having students complete a pretest at the beginning of the class meeting. The outline motivates students to focus attention on important topics in the reading, avoiding wasted time. A short pretest at the beginning of class motivates and enforces reading. The pretest should ask questions about whether students read, not their comprehension [9]. The pretest should also ask for questions students have about the material. Pretests establish a baseline measurement, thereby enabling assessment of learning outcomes. Pretests also determine whether the students are ready for the lesson.

### 3.3 Student Work

Traditionally, most work for the student (and professor) happens outside of class meetings. By requiring students to complete work outside of class, the professor retains full control over class meeting time. Although students can, in principle, contact the professor for help on their homework assignments outside of class, most chose not to for a very good reason. Face-to-face interactions are far more productive than waiting for email from a professor.

The alternative, known as the Thayer method [12], moves student work into the classroom. This enables face-to-face interactions between the professor and students when they are most useful. Students can also help each other out when they are seated nearby each other.

### 3.4 Handling plagiarism

Traditionally, professors react to plagiarism because all students work on the exact same assignment by a single deadline. Making one assignment with one due date for everyone is easy for the professor. Furthermore, it allows the professor to retain full authority and responsibility for enforcing academic honesty. Students must share work only with the professor, but because copying is so easy, practicing on the same assignment tempts them to plagiarize. Likewise,

students who cannot perfect their work by the deadline feel pressured to cheat. They realize that either way, their grade will suffer, but if the professor overlooks cheating, the grade may benefit. Plagiarism is a problem because students who copy and misrepresent themselves as the original author also deny themselves of practice necessary for learning. Unfortunately, the reaction to plagiarism can undermine any rapport a professor hopes to build with students. While plagiarism detection has been automated, this does not address the underlying temptations, which is why the problem persists. So, rather than automate plagiarism detection, instead it is worthwhile to consider prevention of plagiarism.

The alternative to reacting to plagiarism is prevention [6]. First, make all student submissions public to all other students. Realistically, they are public to other students, anyway. This could be a shared folder (with back ups) available to the entire class. Each student writes to their own subfolder, but all work is readable to everyone else. Second, offer a wide variety of choices for assignments, or allow students to propose new assignments. Students bid on which assignment they can complete, provided no pairs in any section of the class work on the same thing. Third, require students to submit revisions showing progress over time, and grade every revision. Feedback on each revision motivates students to learn when they can correct work to attain full credit. Note that plagiarism is still possible, but by addressing the temptations to do so, it is far less likely.

Incidentally, when students can bid on work, this opens the question: which form of bidding is preferable? Two obvious possibilities include: first-come, first-served (FCFS) and prioritizing bids by student grade. Whereas FCFS rewards punctuality, prioritizing bids by current grade penalizes struggling students. Alternatively, students could submit bids for each assignment via a Vickrey-Clarke-Groves auction, thereby ensuring each bidder receives at most one in a socially optimal manner [4]. At the start of bidding, each assignment is worth the same number of points, and students bid what fraction of credit they are willing to accept to work on it. Such a scheme ensures that all students work on assignments that they are motivated to complete.

## 4. ON-LINE RECORD TACTICS

Many traditional tactics are offline, as shown in Table 2. Traditionally, the professor calls names or collects signatures for attendance, and lectures in person during class meeting time, asking and answering questions verbally. The professor also grades everything manually.

The alternative of on-line records offers productivity and learning benefits. Record-keeping is essential for managing improvement. You cannot manage what you do not measure, and you cannot measure what you do not record. The convenience of on-line record-keeping services, such as Google spreadsheets, motivated us to keep more records. Taking attendance, questioning and answering on-line saves time in class. Recording presentations saves preparation time in subsequent years: professors can improve them in response to student questions. Automating grading saves manual effort and enables rapid feedback essential for learning.

### 4.1 Lecture & demo presentation

In-person lectures and demonstrations have several benefits and drawbacks. By presenting in person, the professor can build rapport with the students. Because presenting in person is ephemeral, it forces students to take notes to at-

**Table 2: On-line tactics**

Task	Tradition	Alternative
Presentation	In person	Recorded on-line video
Attendance	Call, collect	Picture, questionnaire
Q&A	Verbal	On-line clicker, journal
Grading	Manual	Automatic

tend to the material. Prior to the invention of the printing press, presentations were the most efficient means of delivering information. Scribes, who copied books, gained practice at transcribing from lectures. Unfortunately, because in-person presentations are ephemeral, they do not engage students much beyond taking notes. Students without recording equipment cannot replay lectures. Students who lose focus or do not catch what the professor said cannot go back and review. Presenting in person during class time has perverse incentives: reviewing the reading assignment rewards only students who did not read and wastes the time of those who did.

The alternative of on-line recorded lectures and demonstrations has benefits that outweigh those of in-class lectures. OpenCourseWare and Khan Academy pioneered the concept of recorded presentations. Recorded presentations enable and motivate students to review material at their leisure outside of class. On-line recorded presentations ensure that students of all levels do not waste time. Weak students can replay until it makes sense. Strong students can skip ahead of any material with which they are already familiar. Recorded presentations allow professors to cover themselves when they cannot make it to the class meeting. Unfortunately, recorded presentations require slightly more preparation: professors cannot as easily “wing it.”

Regardless of tactic or who presents, the professor should ask all students to evaluate the presentation. Students can use an online questionnaire to assess the presentation quality. When the professor makes presentations editable, students can revise and solicit feedback.

## 4.2 Taking attendance

Traditional tactics for taking attendance have their own benefits and drawbacks. Calling names gives professors practice with student names. Later on in the course, professors save time by collecting signatures. Taking attendance by calling names or collecting signatures, as mentioned in the introduction, wastes time better spent teaching.

The alternative tactic makes more clever use of time. To practice names, on the first day, require students to make name placards, then photograph the classroom. Alternatively, ask students to upload a self-portrait next to their name in a shared online document. Incidentally, photographs or name placards help students practice each other’s names. To automate attendance, the professor asks in an online questionnaire for the student’s user name, and a few blank, numbered short-answer questions. A pivot table of student and date stamp produces the attendance spreadsheet. The professor posts numbered comprehension questions in a Powerpoint slide at the beginning and end of class with the (shortened) URL to the on-line form. By asking questions at the beginning and end of the meeting, professors can distinguish absences from late arrivals. Answers to questions provide feedback beyond who arrived to class.

## 4.3 Q&A

Traditionally, questioning and answering is verbal, presenting several benefits and drawbacks. Regardless of tactic, questions should be prepared in advance [7]. By asking questions verbally, professors can engage students or check who is paying attention. By answering questions verbally, professors can provide answers quickly. However, verbal questioning and answering is ephemeral. Ideally, questioning and answering is bidirectional among professors and students. Yet, without a record of student participation, students rightly perceive that their questions and answers are not valued.

One alternative tactic, known as peer instruction [10], makes records. In class, the professor asks students simple questions using clickers or online questionnaires.<sup>2</sup> The professor asks a multiple choice question in class, waits one minute, and provides live feedback of student responses. The professor asks students to discuss their answers amongst their peers, then they resubmit their answers.

Professors welcome questions from students. To reward in-class student questions, designate a student to record them in a shared on-line document. Out of class, when students review material, students submit questions on-line using a form. Students should be encouraged to ask questions and point out errors. The professor can answer questions on-line to ensure all students benefit from the professor’s answers. In our experience, some student questions were so good that they ended up on exams.

## 4.4 Grading

Traditionally, grading is a manual process. Grading manually allows the professor to learn what kinds of mistakes students make. However, a professor grading student submissions can easily fall behind, thereby impairing learning and frustrating students eager for prompt feedback.

Automating grading still allows professors to learn from student mistakes, and ensures instant feedback. Automation is appropriate only for true/false, multiple choice, and short answer questions. The upside is that the structure of the answer is obvious to the student. The downside is that such question styles can easily lend themselves to mere recognition of the answer. Also, additional preparation may be required to make it work.

## 5. DELEGATION TACTICS

Traditionally, professors are solely responsible for course prep and management, as shown in Table 3. Before the course starts, professors work alone to set the pace with a syllabus for their respective course sections. Before and during the semester, professors prepare lessons, present, and grade on their own. The all-encompassing role of professors ensure that they retain full control over the course. With this control, each professor can distinguish himself or herself among peers in a department.

From an engineering perspective, the professor is only one person, a single point of failure. The professor may load balance with teaching assistants. Nevertheless, the traditional roles of student and professor are analogous to a client/server architecture. Highly reliable systems do not depend on any single component. Illness, travel, or other issues

<sup>2</sup>Online clicker questionnaires should ask for the student’s user name, question number, and a single multiple choice question with standard options. E.g., yes, no, it depends; more, equal, less; many, once never; all, some, one, none. Pivot tables and charts show the same feedback as clickers.

imply disruptions to the course pace, unprepared lessons, class meeting cancellation, delayed lecturing and grading.

Delegating to students transforms traditional non-teaching tasks into teaching tasks by engaging practice in time management, preparation, presenting, and evaluating work. Delegating to students and peers is analogous to a peer-to-peer architecture. It distributes work, thereby removing the single point of failure, increasing reliability.

**Table 3: Role delegation**

Task	Traditional role	Alternative role(s)
Pace-setting	Professor	Student
Preparation	Professor	Student, peers
Presentation	Professor	Student, guest
Grading	Professor	Student, peers

## 5.1 Pace-setting

Professors traditionally include a topic schedule in the syllabus to ensure students achieve the learning objectives by the end of the course. Crafting the topic schedule ahead of time is not easy, which is why they are so frequently subject to change. Nevertheless, a topic schedule sets the pace for the course, and assumes that students will all learn at the same rate. By setting the pace with the topic schedule, the professor can readily distinguish among strong, weak, and average students. Yet, despite such schedules, students vary widely and learn at their own pace.

Professors who set the pace ensure few, if any, students will learn effectively. As mentioned in Section 2.3, students learn best when they are engaged in interesting challenges. Yet, each student varies in what they regard as an interesting challenge. When professors set the pace, they must target “average” students, thus, the standard is mediocrity. Professors reward average students with an interesting challenge. Professors penalize and frustrate weak students who cannot keep up with the schedule. Professors also penalize strong students with boredom. Who is a strong, weak or average student varies with the topic at hand. Thus, professors who set the pace never engage all students at all times in interesting challenges necessary for effective learning.

The alternative of enabling students to set their own pace requires preparation. All assessments and course material must be ready by the first day of class. Instead of a topic schedule, the syllabus should have a topic sequence or graph. Offering a choice of activities ensures that each student can work on what is interesting to him or her. Sections 3.4 and 5.4 describe how to enable choice in activities.

Allowing students to set their own pace does not imply that lateness becomes irrelevant. Indeed, students should be required to show work during each class meeting, as detailed in Sections 3.3 and 3.4. Rewards or punishments should relate to whether students achieved the learning objectives, not to whether they could maintain the professor’s pace.

## 5.2 Lesson preparation

In this paper, a *lesson* consists of: a learning objective, reading material, a pretest, a presentation, questions, exercises, rubrics, assessment, and evaluation.

Traditionally, professors are individually responsible for entire lessons, but borrow or adapt lesson components from the textbook or peers. Each professor preparing their own lessons leads to duplicated work and inconsistent teaching,

and that is problematic for students and professors. We suspect inconsistent teaching contributes to student variation.

The alternative to traditional lesson prep is collaboration with students or the professor’s peers. Delegation does not imply abdication or micromanagement. Professors are responsible for learning outcomes, therefore they cannot delegate lesson preparation completely. Professors can and should supervise lesson development in collaboration with their students or peers. For example, the professor may supply a learning objective and a reading assignment for the lesson, while allowing collaborators to develop the pretest, presentation, rubrics, questions and exercises. When professors collaborate on lesson preparation, this is known as lesson study [8]. Lesson study implies that professors never prepare lessons alone, thereby enabling professional development. When students collaborate on lesson preparation and presentation, this is known as learning by teaching (*Lernen durch Lehren*) [5]. As Seneca wrote, “we learn by teaching.” Students gain practice at setting expectations, presentations, questioning, assessing learning and so forth.

## 5.3 Presentation

Traditionally, the professor lectures or demonstrates, and students engage by asking and answering questions or pointing out errors. Unfortunately, when students do not engage, the experience is depressing.

Asking students to present provides the ultimate role reversal. Presentation becomes just another assignment for students. Students experience what the professor otherwise would at the podium. For student presentations to be effective, the professor should model expectations of students. The professor can and should challenge the student lecturer by critiquing with pointed questions asking for clarification, or pointing out errors. The form used for evaluating and critiquing presentations, as discussed in Section 4.1, should be the same regardless of who presents.

Guest presentations offer some of the same benefits as student presentations. But unless students are asked to evaluate and critique guest lectures, they gain no additional practice, thus they do not necessarily improve learning outcomes.

## 5.4 Grading

Traditionally, professors working alone or with teaching assistants decide how student work translates to a standard of achievement. Professors typically receive work without any indication of quality. Yet, when grading is fair, it does not tell students anything that they do not already know. This wastes time better devoted to teaching.

Alternatively, the professor can ask students to grade themselves (self-grading) or each other (peer-grading). The online form for self-grading can be identical to the form for peer-grading. Students can assess work online with a detailed, relevant rubric or indicate incorrect (or unsure) answers. Since they gain practice at evaluating work, student grading is a teaching tactic. Professors can use student-reported grades as estimates to streamline grading and avoid squabbles. Immediate feedback is essential for learning, and students grading their own work save substantial turnaround time. Grading is embarrassingly parallel: a class of 24 students may accomplish in 10 minutes what would otherwise take a professor 4 hours to do. To motivate accurate grading, allow graders to grade grades, in a process analogous to meta reviewing or moderation.

When students record a private copy of each self-grade

(*estimate*), professors can enhance the privacy of public grade postings by revealing only the difference between the actual grade and the estimate, rather than the grade itself:

$$post = grade - estimate$$

Students can compute grades from public posts as follows:

$$grade = post + estimate$$

## 6. INTEGRATING ALTERNATIVES

Alternative tactics change prep and the first class meeting. Before the course starts, professors collaborate to prepare or revise core lessons and recorded presentations so students can review (and grade) them at their own pace. During the first class meeting, the professor supplies students with a secret key to post grades publicly. Students make (and use) double-sided name placards before the professor takes a picture of the classroom.

Alternative tactics also structure class meetings. Students prepare by reading the textbook, asking and answering questions online. At the start of class, students complete a short online reading pretest and bid on work, with one volunteering to record all verbal questions and answers online. Then the professor asks a multiple choice question that students answer. The professor shows a histogram of responses, asks small groups to discuss their answers, and repeats before moving to subsequent questions. Once discussion is over, the professor shows the assignment of work to each student. Students work on similar, but unique exercises, asking the professor and each other for help. Some students work in teams to craft upcoming lessons. Students then submit their work as-is to the shared folder. Since all work is public to the class, students grade themselves and two to three randomly-selected peers. Class ends with an online assessment. Outside of class or in subsequent class meetings, students revise work to address deficiencies in response to peer feedback. Many students revise their own work, while some students improve on others. Improvements to work receive credit for the difference in grade between the original and revision.

## 7. DISCUSSION

Alternative tactics enable professors to adopt the three virtues of a programmer: laziness, impatience, and hubris [14]. Laziness means going to great effort to reduce overall energy expenditure [14]. With a bit of additional prep, lazy professors can expend less energy overall on management tasks and improve chances for promotion or tenure by focusing on teaching, research, or service. Furthermore, lazy professors can be proud of how they structure interactions with students, and be impatient with grading.

The alternative tactics improve professor productivity, challenging the assumption that education is subject to Baumol's cost disease [1]. Baumol noted that in other sectors of the economy, productivity gains have improved quality and reduced cost. Yet in education, as in the performing arts, costs have risen without productivity gains. Without improvements in professor productivity, either tuition must continue to rise or enrollments must hold steady or decrease, else quality will suffer. If it is possible to improve professor productivity, then Baumol's cost disease does not apply. The alternative tactics in this paper improve productivity and reduce time away from teaching.

## 8. CONCLUSION

This paper surveyed tactics traditionally ancillary to teaching. You can choose not to adopt the alternative tactics. But, we hope that you do so now with an awareness of the benefits and drawbacks of tactics that do exist. Course prep and management are unavoidable tasks, but the alternative tactics transform them, thereby aiding the professor and supplying students with what they demand: teaching.

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