

2-1-2022

## Why Online Teaching Amplifies the Differences Between Instructors' Success

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Technical Report: UTEP-CS-22-16

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### Recommended Citation

Kosheleva, Olga; Kreinovich, Vladik; and Servin, Christian, "Why Online Teaching Amplifies the Differences Between Instructors' Success" (2022). *Departmental Technical Reports (CS)*. 1655.

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УДК

## **WHY ONLINE TEACHING AMPLIFIES THE DIFFERENCES BETWEEN INSTRUCTORS' SUCCESS**

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### ***Abstract***

Empirical studies show that online teaching amplifies the differences between instructors: more successful instructors become even more successful, while the results of the instructors who were not very successful becomes even worse. There is a simple explanation for why the performance of not-perfect instructors decreases: in online teaching, there is less feedback, so these instructors get an indication that their teaching strategies do not work well even later than usual and thus, have fewer time to correct their teaching. However, the fact that the efficiency of good instructors rises is a mystery. In this paper, we provide a possible explanation for this mystery.

***Keywords:*** *Online teaching, Differences between instructors, Successful instructors, Struggling instructors.*

### **FORMULATION OF THE PROBLEM**

*A sudden switch to online teaching.* The Covid-19 pandemic forced most teaching to switch to the online mode. This provided an unexpected natural experiment, with thousands of instructors and millions of students suddenly switching to the online mode.

Many researchers have analyzed the results of this natural experiment. Some of these results are expected, but some are unexpected and therefore mysterious.

*What we learned from the experience<sup>1</sup> of this switch: an example.* For example, one of the consequence of switching to online teaching is that the differences between

instructor success have been drastically amplified: the efficiency of more successful instructors have unexpectedly increased even more with this switch, while the efficiency of struggling, not-yet-successful instructors further decreased; see, e.g., [1].

*The decrease is easy to explain.* The decrease is expected and easy to explain. First, these instructors have been still struggling with the teaching tasks, they have been still adjusting their teaching strategies to in-person teaching, to changing environments, and a sudden switch to a completely new environment of purely online teaching made their job even more challenging. Second, in the in-person classroom, there is much more feedback from students: an instructor can see, from their reactions, from their facial expressions, from their answers, whether a given teaching strategy is working or not, and adjust his/her strategy if this feedback indicates that this strategy is not working well. As a result, even when an inexperienced instructor selects a teaching strategy which is not appropriate for the current class – e.g., starts going too fast – he/she will soon notice that this strategy does not work, and change to a more appropriate teaching strategy.

In contrast, in the online mode, it is much more difficult to read facial impressions and other signals. As a result, the feedback is delayed, the wrong strategy continues for a much longer time, and the resulting overall efficiency decreases.

*How to explain an increase in efficiency is a challenge.* However, the increase in efficiency which was observed when successful instructors switch to online is not so easy to explain. At first glance, the change should be of the opposite sign: at least at first, the instructors need some time to adjust to the new learning environment, and, as a result, their efficiency should decrease. Maybe, since they are experienced in adjusting to different situations, their efficiency should not decrease as much as for inexperienced instructors, but still we would expect it to somewhat decrease. In practice, it increases. Why?

This is a question that we study in this paper.

## **OUR EXPLANATION**

*What does it mean that an instructor is successful.* Success comes from using

teaching strategies which are appropriate for a given teaching environment. The fact that these instructors are more successful than an average teacher means that they are using novel innovative strategies. Of course, successful instructors usually do not throw away all the pedagogical techniques and replace them with new ideas, they introduce these ideas first a little bit, to see if these ideas work, and if they do, they introduce more and more of these techniques – until the further addition of the new techniques stops helping. This is how all new strategies are introduced, whether it is an additional emphasis on active learning, the use of flipped classroom techniques, using project-based approach, etc.

In the ideal situation, when the effectiveness of teaching depends only on the teaching strategy, this approach of gradual introduction of new teaching strategies would lead to a perfect stopping point – a point where further increasing, e.g., the proportion of time allocated for groupwork is not longer productive. In reality, however, the effectiveness of teaching depends not only on the teaching strategy, but also on many factors which are beyond the instructor's control: it can be affected by weather, by experience in other classes, by the general political and economic processes. These factors add a significant random noise to the effect of teaching strategy.

As a result, even for an appropriate strategy, instead of a stable increase of effectiveness with the increase in the use of this strategy, we get an increase plus strong random oscillations. In in-person teaching, when the instructor (especially an experience instructor) get a very accurate moment-by-moment indication of the teaching effectiveness, the instructor stops increasing this use when effectiveness stops increasing – which, taking into account random fluctuations, occurs much earlier that the actual optimal use. In mathematical terms, these random effects create a lot of small local maxima way before the desired global maximum – one can see a lot of these local maxima in any image showing the trajectory of a random motion. So, in in-person teaching, an instructor stops at the first local maximum – and thus, does not use the full potential of the novel strategies.

In contrast, in online teaching, when feedback is much less accurate, the small random decreases are not visible and thus, do not lead the instructor to stop. In such cases, the instructor will continue increasing the proportion of new techniques until he or she really reaches the global maximum of these techniques' effectiveness.

So, the seemingly negative effect of online teaching – the diminished moment-by-moment feedback – actually has a positive effect: it allows instructors to reach the full potential of novel innovative techniques and thus, to further increase their effectiveness. This explains the mysterious empirical phenomenon that we mentioned earlier – that for experienced instructors, the switch to a seemingly more challenging online-only teaching actually increases the effectiveness of their teaching.

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