Asynchronous Workflow: How to Speed up a Bulky Task

Teaching to Different Types of Learners

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By
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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Introduction

My technical and STS research topics are related in that they are both part of the same domain - each regarding both sides of the education coin (learning and teaching). As a Computer Science student, my technical paper is about my internship work this past summer and how my learning at UVA has applied to it. I will frame this paper to address the problem of prioritizing professional-based skills over technical skills like learning a programming language. This is an important problem because building professional skills can result in becoming a more holistic person and having a more effective impact on society. This paper will address the problem of educating a student who has a gap in material knowledge, and effectively communicating the material between the educator and student; why and how narrowing down the true fault in miscommunication is important. This connection is largely influenced by the type of learner the student is, for example, Visual or Verbal, along with the learning environment or other potential external factors not related to the material itself. This is important because if every student learns in different ways, then some may be left behind depending on how the teacher teaches. This paper will approach this problem by framing teaching as a “debugging” problem - narrowing down what the student is missing and how they learn.

Technical Topic

My technical research topic is related to my internship work this past summer, and how my UVA courses have prepared me for it. The problem that this will address is how to prioritize

learning - technical skills, like syntax or applications of programming languages, or professional skills, like problem-solving, willingness to learn, or cooperation. I am grateful for UVA's Computer Science curriculum teaching me plenty of both - however, I still think this is an interesting problem to study because our time in education and our brain power is limited. It is impossible to learn everything, and this past summer during my short stint in the software engineering industry has taught me that those professional skills may be more important, as they enable technical skills to be learned more effectively. Not focusing on or even neglecting the improvement of these skills could be harmful to oneself, and by extension society. A more holistic and less specialized skill set could transfer over more to other professions and parts of life.

I will approach this problem by considering how an important professional skill, problem-solving, is taught and measured in education and how it plays a key role in success in different industries or subfields of Computer Science. This could be achieved by researching studies that relate to the effect of professional skills on success/productivity or reaching out to professors to see how problem-solving skills help students in their classes, or even reaching out to recent graduates in the field who used problem-solving to succeed in something they weren't specifically taught at UVA. Part of the learning I experienced this summer was that problem-solving is baked into lots of work I would do as a Software Engineer. Understanding the technical skills required to use and program different components at hand is necessary, however, the problem-solving skills needed to grasp the product and codebase allowed for more effective, higher-quality programming. Malik, et. al. (2021) agrees with the claim that problem-solving is a basis of programming, as a University-sanctioned experimental study determined that a problem-solving-based approach to an intro programming course resulted in improved student

performance. This kind of experiment with statistical analysis can be useful to my research as it can provide a basis for the relationship between professional and technical skills. Chen (2010) is a similar study that studies problem-solving skills under the scope of databases instead of programming. While the results of the study do not indicate a positive correlation between problem-solving and database skills, it is notable that tangential fields like statistics are interested in problem-solving as a foundation skill as it is in Computer Science - highlighting the transferability aspect of professional skills. Resulting questions regarding the approach and timing of presenting problem-solving skills are an interesting follow-up to my research - which might be related to my STS topic.

STS Topic

My STS research addresses the problem of educating a student with gaps in material knowledge and effectively communicating the material between the educator and student. This problem is obviously important because the foundation of education is the educator, and if there is a disconnect with students, it could affect them negatively and compound in the future. It is interesting to me personally because as a TA there have been countless instances of not being able to connect with a student, and narrowing down what went wrong or what they truly misunderstand became sort of a fascinating concept. I will approach this problem by framing the tackling of students' lack of understanding as a "debugging" problem, as a mindset and means to truly understand the problem before solving it. A large factor to be considered is the learning environment at hand, which includes the student's preferred learning style, medium of learning, or aspects of the student like their race, gender, or even views on the subject matter. The learning environment's effect on teaching could be achieved through researching studies that relate the

aforementioned components to academic success, surveying or interviewing students and teachers on how cognizant they are of learning environments during their studies and reading more on the evolution of teaching towards different learning styles throughout history. Each research aspect is a component under the debugging framework, isolating each to find the true gap in material knowledge.

The first academic relation to isolate is learning style. The teacher, student, and content itself have their own "preferred" learning style, one that can effectively get the point across. Since each student learns differently, they could be advantaged or disadvantaged in regard to the material and how the educator teaches. Felder, et. al. (2005) agree that student learning styles have a high impact, and even argue that the content can be framed according to different learning styles. This source provides a good foundation for learning styles and introduces a wider perspective that teaching and learning from different styles is a skill itself, which leads me to question the boundaries of learning styles in the context of my research - perhaps the gap in a student's learning is actually a gap in their learning style skills.

The increase in online learning due to COVID-19 and advancements in technology could have positive and negative consequences on students. For example, tests tend to be denser but open-note, and professors can record their lectures for the future but have a harder time conveying information visually via whiteboard. Dağ et. al. (2009) discuss the state of the relationship between online learning and learning styles. This source agrees that the change in physical learning environments affects students based on learning styles, and the more developed online environments take that into account. This leads me to consider newer technologies used today in online learning, and how they can cater to different learning styles. Cela et. al. (2015) delves deeper into the relationship between online learning and learning styles, and the impacts

that could have on students. This research paper observed an online course and studied the activity and success of students aggregated by learning styles. The results signified that students with more active learning styles had more success than reflected learners. I agree with the researchers that a change could be not grading discussion posts to close the gap between learners. This study leads me to believe that the structure of online courses could hold relatively more influence than the engagement of students and that in general learning environments should ideally be compatible with a student's learning style to increase the odds of success.

Other aspects of students' learning to research are less about the learning and more about the students themselves. My research is largely focused on learning styles' effects on success, but it is important to consider other effects of learning styles - or things that correlate with learning styles - in order to be more inclusive. Goulão (2013) concluded that there is a relationship between gender and learning style. One impact of this relationship could be implicit discrimination on gender if a professor, class structure, or environment favors one learning style heavily over another. Future research could involve scrutinizing material or major curricula to see if there is a favored teaching style and a large difference in gender in the industry. Fisher et. al. (2013) use more statistical approaches to reach the same conclusion regarding gender and learning style, with males preferring visual learning more on average. The study also finds a relationship between attitude toward math and the student's major or race, although it does not discuss the impacts of learning styles, gender, and attitude toward math together. The future research stated before, scrutinizing teaching styles and industry demographics could also benefit from considering attitudes toward the material. If attitudes towards subjects like math or science are an important factor in success, notably among different demographics, then it is worth researching how students get excited about different subjects, especially at an early age.

Conclusion

Potential findings from researching these problems are getting a better understanding and perspective of each side of the learning coin - what to focus on when learning (technical paper), and how to better understand how to narrow down where a student is going wrong - especially as a TA (STS paper). The general problems could be improved by my research by me being a more holistic software engineer and person by having a better understanding of professional skills, and me improving as a TA and person by understanding the process of teaching as a problem-solving skill and being cognizant of each type of learner. Impacts of research in this area could help educators alter their potentially fixed teaching approach into one that adapts more towards the individual needs of the student that reflects their corresponding learning style.

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