Memetics, Knowledge Diffusion and Social Learning Theory

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Abstract: In this research paper, I will look to explore the causal relationships between social learning and improved academic outcomes. A common problem with looking for causal connections in education with intervention and outcome is the reality that errors often erode strong causal evidence. This research proposes using a Randomized Control Trial (RCT) where a treatment group is presented with a number of memes that will ideally improve collective thought a particular set of topics and a control group that is not presented with these memes. The design of this experiment will require a careful analysis of knowledge diffusion in these communities to ensure lack of knowledge overlap. The design of knowledge diffusion in our paper will take a similar approach to the method of citations as a metric for knowledge diffusion.

Introduction: Social Learning Theory is roughly defined around the concepts of expectations and incentives. Social Learning Theory is the brainchild of Albert Bandura and Bandura roughly identified several expectancies and incentives in SLT which are the following:
Expectancies:

- beliefs about how things are connected
- belief about how personal actions influence outcomes
- beliefs about one's abilities to perform the action that leads to the outcome

Rewards:

- The value placed on a particular outcome.[1]

Julian Rotter also proposed a theory of Social Learning which was predicated on the idea that personalities cannot develop absent of its environment. Rotter too proposed expectancies and rewards and in addition spoke about action and expectancy potentials. Rotter believed that there are two ways to change behavior. Change the way someone speaks, or change the environment a person interacts with.[2]

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[1] Irwin Rosenstock et al (summer 1988), Social Learning Theory And the Health Belief Model, Health Education Quarterly, retrieved from: chrome-extension://oemmndcbldboiebfnladdacbdfmadadm/https://deepblue.lib.umich.edu/bitstream/handle/2027.42/67783/10.1177_109019818801500203.pdf?sequence=2&isAllowed=y

[2] 2018, The Social Learning Theory of Julian Rotter,
Retrieved from: http://psych.fullerton.edu/jmearns/rotter.html

Social Learning Theory is of particular interest because the current political environment has proven to display a strong connection with tribal identity and thought. This is of no surprise, we are inherently social creatures, however the prevalence today may actually offer the exposure and interest in researching how to alter behavior by shifting environment. The implication of this is relevant for larger societal issues such as politics, but is also increasingly important in educational institutions. In several studies over the past two decades researchers in economics and other disciplines have attempted to determine how people learn in groups. Two major styles proposed were the bayesian learning method and the degroot learning method. Two prominent studies in the field shed light that communities tend to lean towards degroot learning.[3] Degroot learning is characterized by the idea that if a community reaches a consensus, they will never change the opinion even if they are wrong. This is of striking similarity to they way public discourse seems to shape out in our society in general and may shed light on similar phenomena in smaller group settings. But why is this important to point out?

Decision making at group setting and/or using group information to make individual decisions can be incredibly helpful according to many studies. Groups can pool together information and in some problem solving cases errors can cancel other ones out to reach a more unbiased estimate of something.[4] But there many cases in which social learning and group decision can go south, referring back to Degroot learning, it is possible for groups to be lead astray because of issues related to convergent thinking. Diversity also itself can become a problem if a group is struck with equality bias, which may result in weighting reliability of information to evenly upon the group.[5] While these elements are discussed in the literature in terms of group decision making, I propose that the ill effects of the convergence and equality bias can be found at an individual level who relies on learning through interactions with the environment.

Through case studies designed to draw on the causal connection between environmental factors and student decision making we have seen in at least some cases there is strong evidence to support imitation in learning that can lead to poor outcomes. In one study it was demonstrated that where a learning culture void of virtue ethics existed in business education students were much more likely to think unethical

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[3] Cite esther duflo and achemoglu chrome-extension://oemmndcbldboiebfnladdacbdfmadadm/https://web.stanford.edu/~arungc/CLX.pdf

[4] Bang, D., & Frith, C. D. (2017). Making better decisions in groups. *Royal Society open science*, *4*(8), 170193. doi:10.1098/rsos.170193

[5] Bang, D., & Frith, C. D. (2017). Making better decisions in groups. *Royal Society open science*, *4*(8), 170193. doi:10.1098/rsos.170193

behavior was ok based on their perception of how their role models in business interacted with the world.[6]

This all leads back to a huge problem I would like to tackle, Is there a causal connection between social learning and student outcomes? More concretely can we quantify the difference between learning outcomes by shifting a groups way of thinking which will provide a proper learning environment for improved learning outcomes?

While the overarching problem is that presented above, this problem cannot be separated from typical problems in methodological design which often result in some form of error which usually are the result of temporal or spatial differences in intervention.[7]

Theory/Goal: Holding to the idea that our society tends to operate using degroot learning style, It seems plausible to follow the line of reasoning of Rotter which is to "change the environment in which an individual interacts." We may not physically be able to put them in a new environment, but what if their environment subtly shifted?

Memes were originally posed by Richard Dawkins as way of explaining evolutionary components of culture.[8] Memes have since been studied as a theory of information transformation, as a way of developing genetic algorithms etc. I propose of the use of memetics as a means of transmitting new information to a group to nudge them in a direction to reaching a more optimal consensus.

The purpose of this research is to first determine a causal connection between social learning an improved outcomes in learning and decision making. The second has policy and social implications which would suggest that there is a need to put resources into innovations in education and society that improve the environment which learning can flourish.

The Methodology: Randomized Control Trials require a well designed experiment to delineate the Treatment and Control group, ensure the two groups are statistically identical and use the use of statistical tests to determine that after treatment the two groups of statistically different.

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[6] Richard Hanna et el. (2013), Social Learning Theory: A Multicultural: Study of Influences on Ethical Behavior, Journal of Marketing Education, xx(x) 1-8, DOI: 10.1177/0273475312474279

[7] Sullivan G. M. (2011). Getting off the "gold standard": randomized controlled trials and education research. *Journal of graduate medical education*, *3*(3), 285-9.

[8] Chavalarias, David. (2019). Human's Meta-cognitive Capacities and Endogenization of Mimetic Rules in Multi-Agents Models.

Because memetics are essentially viral information, there is potential for information overlap in treatment and control if we are not careful. For this reason I propose designing a way of capturing knowledge diffusion within the group to explore a way of preventing information leaks. In the literature citations are a way of tracking knowledge diffusion in academia.[9] My goal is to design and informal citation system in both the treatment and control groups to determine knowledge diffusion within these groups. This informal citation system serves multiple purposes of which some are tangential to the goal of this article. These will be explored more in the appendices of this paper. There is potential for exploring a two part RCT, where there is a traditional method of delivery of information to another identical group, which will also be compared to the control group. This will give us quantifiable differences between individuals whose behavior is being augmented directly, those with no treatment and those whose behavior is potentially augmented through environmental changes. I believe this may deliver us more robust results on our findings.

Implications to Educational Technology:

While I think the implications are clear, it is worth mentioning explicitly. Finding a strong causal relationship between social learning and better education outcomes can lead automating memetics in affinity networks in MOOCs to drastic improve learning outcomes. The informal citation system can also be an additional way of identifying the strongest information pipelines in MOOCs or other learning social networks to improve the potential of adoption of new ideas. It has als been stated in a few articles (will go back and site) the need for program evaluation of learning theories. This is a step in the direction of proving the importance of the theory, which should ultimately lead to more funding in programs that aim to work within this learning pedagogy and delivery design. Since there are currently few market mechanisms available to kill bad ideas on educational delivery, providing a causal connection between a pedagogy and outcomes is a great close second.

[9] Liu, Y. and Rousseau, R. (2010), Knowledge diffusion through publications and citations: A case study using *ESI*-fields as unit of diffusion. J. Am. Soc. Inf. Sci., 61: 340-351. doi:10.1002/asi.21248