Annotated Bibliography

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Amanda Martin, Ed.D et al, The Impact of Flipped Instruction on Middle School Mathematics Achievement, Journal of Education and Human Development December 2016, Vol.5, No.4, pp.98-108, URL: https://doi.org/10.15640/jehd.v5n4a10

The problem present in this article is the need to close achievement gaps for black and hispanic students on mathematic standardized tests. The study uses flipped-classroom pedagogy as method for closing this gap and uses a causal-comparative model for assessing the success of this pedagogy. The model takes the flipped-classroom method as the independent variable, 7th grade STAAR mathematics assessment score as the covariate and the dependent variable is the 8th grade STAAR mathematics assessment score. Propensity score matching was used as a method for finding statistically equivalent treatment and control groups. The study ultimately found a statistically significant change in scores from 7th to 8th grade assessment from African Americans in the flipped-classroom model.

This article is relevant to my research because it addresses an attempted solution through a hybrid internet/classroom to improve math outcomes for disadvantaged students.

Rech, J., & Stevens, D. (1996). Variables Related to Mathematics Achievement among Black Students. The Journal of Educational Research, 89(6), 346-350. Retrieved from http://www.jstor.org/stable/27542056

This study was focused on identifying the variables that impacted mathematical achievement among Black students as the title suggests. Once the variables were identified that authors suggested prescriptions to the issues at hand. The study took 251 Black students from the Fourth and the Eighth grade, both male and female, as the sample to conduct this study. Using MANOVA, the study found that different variables were better predictors at different grades. For fourth graders attitudes toward mathematics and social economic status were the strongest predictors. For Eighth graders the strongest predictors were gender and learning style. Prescriptions for fourth graders were to have parents and teachers work to create an environment to develop role models in the field as well as make students aware of the importance of mathematics and their future in a high tech work space. Studies have shown that black students have a stronger propensity towards field-dependent learning and therefore it is necessary for educators to focus on developing a curriculum to conceptualize mathematics for the learners.

This article is relevant because it is important for me to have theoretical and empirical bases for suggesting that cultural factors are at play in academic achievement

Fullilove, R., & Treisman, P. (1990). Mathematics Achievement Among African American Undergraduates at the University of California, Berkeley: An Evaluation of the

Mathematics Workshop Program. *The Journal of Negro Education, 59*(3), 463-478. doi:10.2307/2295577

This study begins by analyzing the problem of low representations of African Americans and non-asian minorities in engineering and mathematics fields. The study addresses previous attempts at addressing this issue in predominantly white university and outlining the role of remedial math classes. The authors however outline how the persistent gap has demonstrated that these methods are ineffective in their current state. As an attempt to demonstrate that minority identity alone isn't the contributing factor, they draw on the successes of asian students and study methods of success in asian students. Of particular note was asian students desire to work in groups and help each other through challenging problems and seek help of educators when the problem is perceived as sufficiently difficult. Using some of the tools that asian students used to be successful a program was developed to mimic their study habits for african american students at UC-berkeley. The results were consistent with the hypothesis and the sample students in this program showed significant improvements in their academic achievement compared to their counterparts not in the program. This study shed light on the reality that a peer group that created an environment for academic achievement was vital to the success of these students. The authors noted the transferability of this program to other institutions.

This article is relevant because it identifies environmentally specific things that when changed can improve learning outcomes for African American students

McGee, E. O., & Alvin Pearman, F. (2014). Risk and Protective Factors in Mathematically Talented Black Male Students: Snapshots From Kindergarten Through Eighth Grade. Urban Education, 49(4), 363–393. https://doi.org/10.1177/0042085914525791

This articles analyzes the lives of 13 high achieving Black Male Students to understand that factors of success and risk to their overall success. The authors believed that by understanding these two types of factors that affect the potential of these high achievers, we can better understand prescriptions to the larger Black dominated schools. Following the analysis a few prescriptions are made. Several of the success factors for these 13 individuals included strong family support, intrinsic motivation, additional support and resources from educators who recognized their abilities and additional self-learning by students outside of the classroom for fun. Some of the risks included violent neighborhoods and physical or sexual abuse by superiors. Developing a culturally sensitive environment to allow male support at schools as well as creating a culturally relevant mathematics curriculum were the two most important policy prescriptions for this issue.

This article services multiple purposes, the first is additional support of factors that influence success, while serving as basis to critique solutions that isolate successful black students and syphon resources while not addressing institutional changes. (institutional changes are resource intensive and there is certainly a level of pragmatism to the current methods. This is ultimately the basis of much of my future research in the paper for this course)

Kumar Yelamarthi (2008), A Pre-Engineering Program for the Under-Represented , Low-Income and/or First Generation College Students to Pursue Higher Education, Journal of STEM Education Volume 9•Issue 3 & 4 July-December 2008

This paper aims at describing the impact of the Science Technology Engineering Prep Program offered at Wright State University's Engineering School. The program was established in 1988 to help underrepresented youth enter into STEM programs and is designed around several core principles, creating an environment of competent peers, requiring high achievement (3.0), establishing role models for students, creating incentives (completing this four year high school program guarantees full scholarship to the university) and creating hands on education in STEM fields. In a study of the program through the years of the 600 students who have gone through the program 303 have attended the university with a 73% retention rate. In terms of areas of study 47% studied in the STEM field compared to 23% of the students at the university who did not complete the program. The success of the program by the numbers are unquestionable.

This paper demonstrates that you can design entire institutions that ultimately essentially eradicate academic achievement through properly designed programs that often rely again on environmental changes for these students. This is of importance because it again shows support of environmental changes having huge impacts on outcomes, but it also is a source of critique again in isolating gifted students and not also redesigning institutions to incorporate the successful characteristics of these programs, but adjusted so as to be suitable for the potentially average students as well.

Megan MacGarvie,The determinants of international knowledge diffusion as measured by patent citations,Economics Letters,Volume 87, Issue 1,2005,Pages 121-126, ISSN 0165-1765,https://doi.org/10.1016/j.econlet.2004.09.011. (http://www.sciencedirect.com/science/article/pii/S0165176504003362)

This paper uses patent citations to measure international diffusion of technological knowledge. It finds that diffusion is enhanced by physical and technological proximity and by sharing a common language. While FDI is positively associated with diffusion, trade facilitates diffusion only when countries' inventions are similarly distributed across technical fields.

A big part of my research design is looking at knowledge diffusion through networks in my experiment to ensure that there is little overlap with the treatment and control group.

Lewison, Grant & Rippon, Isla & Wooding, Steven. (2005). Tracking knowledge diffusion through citations. Research Evaluation - RES EVALUAT. 14.5-14.10.3152/147154405781776319.

Citations in the serial literature provide a method of investigating how published biomedical research influences work in other countries, in other subject areas and at different research levels (from clinical to basic). This paper examines four successive generations of papers citing to a set of UK arthritis papers to evaluate its trickle down influence. The citing papers are progressively more international, less within the arthritis sub-field and on average more basic in nature.

This paper is relevant for the same reason as above. While these papers use citations as knowledge diffusion, I will be designing a more youth specific method of citations, while using similar metrics to measure, velocity, intensity etc of diffusion.

Travis Roach, Student perceptions toward flipped learning: New methods to increase interaction and active learning in economics, International Review of Economics Education,Volume 17, 2014, Pages 74-84, ISSN 1477-3880, https://doi.org/10.1016/j.iree.2014.08.003.

The “flipped classroom” has begun to revolutionize the way that students receive information from their teachers and is ushering in a new era of active and creative thinkers. Although flipping the classroom has gained popular attention, very little research has focused on flipping the classroom at the collegiate level. This paper documents the implementation of a “partially-flipped” class over one semester of a large enrollment microeconomics course, as well as presents results of students’ perception toward flipped learning. Students respond favorably to these pedagogy and there is evidence that it is learning style dynamic.

This paper is also relevant to my study for several reasons, I ultimately am proposing the economics be treated to contextualize mathematical reasoning. Many of the papers on improving Black student interest and achievement in mathematics education has a lot to do with creating culturally relevant material. I believe it is possible to use economics to maintain the rigor of math education, while providing opportunities to explore mathematics as it relates to real life issues with the students.

Bishop, A. (1994). Cultural Conflicts in Mathematics Education: Developing a Research Agenda. *For the Learning of Mathematics, 14*(2), 15-18. Retrieved from http://www.jstor.org/stable/40248109

The author addresses issues with definitions of cultural differences in mathematics education and addresses the desire in some research to ultimately acculturate and have cultural consonance. Cultural consonance referring to the idea of convergence to a prototypical cultural belief. The author states that this idea is problematic as it still attempts to assert that mathematics is a culture free pursuit. He addresses that mathematics at home and mathematics at school can provide cultural dissonance. The authors ultimate goal is to offer ideas on research agenda moving forward in the area of cultural mathematics. The author states that the research agenda for future math curriculum can take the form of formalized math curriculum with culturalized examples, the dominant culture in the schooling system should take over mathematics education, and informal mathematics education in which we learn to understand the ways in which the informal communities surrounding the education system in particular communities interacts with mathematics.

This paper is relevant because it is the precursor to the previous citation. Ultimately many method educators believe that maintaining a rigor of math education while bringing in cultural elements is the best option for combining culture and math. There is currently no literature on using economics to bridge that gap.

Rajshree Agarwal & A. Edward Day (1998): The Impact of the Internet on Economic Education, The Journal of Economic Education, 29:2, 99-110

This is an older paper, with interest in exploring how the internet affects economic education from two perspectives. The first improved interaction with economic material, the second improvement in perception of economics. The authors used MRA to determine the effect of the internet specifically on three dependent variables, student exams scores, student final grades and attitude toward economics. The results suggested that there were statistically significant improvements on performance, while stating that perception was not statistically significant.

In order to use economics for the purposes of contextualizing mathematics, the course must be taught with the best structure and pedagogy to improve results. For this reason I explored this paper, which also nicely ties back into flipped classroom pedagogy.

Walstad, W., & Soper, J. (1989). What Is High School Economics? Factors Contributing to Student Achievement and Attitudes. *The Journal of Economic Education, 20*(1), 23-38. doi:10.2307/1182715

This paper explored the factors of success in high school economics as the title suggests. The authors used MRA to determine factors with the highest predictive power. These factors were broken up into multiple categories, individual and environmental factors. In terms of environmental factors that lead to the most success in economics education was interestingly enough a course in economics. The authors demonstrated that empirically there is no bases for infusing economics education into other social sciences to help students understand economics. The other contributing factor was if educators were themselves trained in economics.

See above

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

This paper uses a Bayesian framework to explain the interplay between past experience and new evidence, and the difficulties of exploring environmental states and action potentials. That paper identifies some of the biases that go along with these decision making problems. While heuristics are efficient methods of exploring large spaces of information they can often lead to poor decision making. In these situations group decision making can be beneficial. The authors highlight that there are shortcomings to both convergence and diversity in group decision making and narrow in on the importance of weighting reliability of information in a group setting to ultimately come to better decisions.

This paper is relevant to the research because the implementation of culture specific math education, and flipped classroom methods relies heavily on social learning and group projects. In order to ensure that a group converges to optimal decision making (studying on time, solving a math problem) rules should be in play to ensure this takes place, especially among students.

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

This article addresses the issues of RCTS in education research, while RCTs control for errors due to evenly distributing unobservable factors that may affect the treatment, they do not control for other errors. These errors include differences in location of trial, differences in teachers of the trial, differences in time period the time has been conducted, no actual comparable comparison group. The article goes on to address alternatives to RCTs which include Pragmatic Control Trials (two concurrent interventions compared), pretest/posttest analysis, using historical controls among a few others.

This paper is relevant because it is a motivation for a more complex undertaking to control for more biases in my RCTs. This is the reason for the use of understanding information diffusion through networks as well as the usage of private affinity spaces to deliver some new knowledge in the treatment group.

Simy Joy, Are there cultural differences in learning styles? Learning Styles and Culture, International Journal of Intercultural Relations
https://pdfs.semanticscholar.org/c53a/d7f11ccb392b3b34737bc1d3b393bf6b6edc.pdf

This study explored the comparison of culture to other demographic features in relationship to learning style. The study identified 533 individuals from 7 countries for the analysis. The paper concludes that culture has a significant impact on learning styles comparable to other demographic features. Culture had a significant impact on determining whether someone was more of an abstract or concrete learner, however its impact on whether someone was an active or reflective learner was marginal. The authors suggested this was important in designing instruction in which learners were accommodated for learning style, but others were aware of the differences in learning style. The authors also identified that there were limitations to the study, one in which there was an aspect of selection bias in the study design that may have contributed to reducing the true impact of cultural differences.

More empirical data on the importance of culture in mathematics. Also allows us to identify specifically what researchers mean by cultural impacts on education. This is relevant to the design of how far we need to go for cultural infusion into education. Is it a nudge or an overhaul?

Jon Dron, Designing the Undesignable: Social Software and Control
Journal of Educational Technology & Society,Vol. 10, No. 3, Advanced Technologies for Life-Long Learning (July 2007), pp. 60-71 (rephrase)

Social software, such as blogs, wikis, tagging systems and collaborative filters, treats the group as a first-class object within the system. This paper proposes a model of e-learning that extends traditional concepts of learner-teacher-content interactions to include emergent

properties of the group. It suggests that this feature of social software can facilitate an approach to e-learning that is qualitatively different from and capable of significantly augmenting traditional methods. This paper also identifies design suggestions for educational designers and potential issues with social software design.

This paper is relevant because I ultimately suggest the design of affinity spaces as a part of the economics curriculum which is to essentially create a subcultural that is designed to create an optimal environment for learning.

Irish, C. (2002). Using Peg- and Keyword Mnemonics and Computer-Assisted Instruction to Enhance Basic Multiplication Performance in Elementary Students with Learning and Cognitive Disabilities. Journal of Special Education Technology, 17(4), 29–40. https://doi.org/10.1177/016264340201700403 (rephrase)

This paper describes the effectiveness of Memory Math, a multimedia software program developed to teach students with learning and cognitive disabilities to effectively use a peg- and keyword mnemonic strategy to learn basic multiplication facts. According to the math Standards (National Council of Teachers of Mathematics, 2000), accuracy with basic facts is a critical element in the development of new skills and achievement in higher levels of math. One avenue for improving accuracy on basic skills is computer-assisted instruction (CAI). CAI offers an alternative to the teacher-intensive coaching often required to facilitate self-directed performance on basic skills. This paper demonstrates that CAI provides an effective mechanism for teaching students a mnemonic memory strategy to increase their independent performance and accuracy on tasks of basic multiplication.

My idea for Mnemonics and memetics for the project was to operate a vehicle of transmission of ideas unique to the subcultural created in the affinity space. Any memes that come through our affinity space will be easily identifiable if they find themselves in different networks of students.

Mantiri, Oktavian, The Influence of Culture on Learning Styles (February 17, 2013). Available at SSRN: https://ssrn.com/abstract=2566117 or http://dx.doi.org/10.2139/ssrn.2566117

This paper also explores how culture influences learning style, only it focuses on styles of asian students. Its study also ultimately concludes that culture is relevant to learning styles which can affect academic achievement if they are not accommodated.

Same as other cultural studies.

Swiatek, Lukasz. (2016). Constructing cultural memory: A memetic approach. International Journal of Media & Cultural Politics. 12. 129-142. 10.1386/macp.12.1.129_1.

This article examines how memes are used to construct cultural memory. It uses the Nobel peace prize ceremony as a case study for memetics. It makes two arguments: first, that cultural memory can be engineered through memes and can take the form of texts, artefacts or practices. Second, large sets of such memes can help societies not only remember, but also help with optimal future decision making. However, these processes are problematic, and the article discusses these tensions.

This article is relevant because it provides me with the theoretical and empirical background to engineer cultural identity in the affinity space through the use of memes in our treatment group.

Effects of Problem Based Economics on High School Economic Instruction, Department of Education. Department of Education, https://ies.ed.gov/ncee/edlabs/regions/west/pdf/REL_20104012.pdf

This report is grounded on the need for economic literacy as advocated for by economists at all levels. The report explains why economics is important and then goes to explain why problem based economics. The remainder of the report actually explicitly outlines methods of learning for the student in terms of data collection, modeling, designing hypothesis etc.

This article is relevant because it outlines a strong economics course framework in which to use for my study.

Ohio State University. "Fractals Provide Unusual Theme In Much African Culture And Art." ScienceDaily. ScienceDaily, 27 July 1999. <www.sciencedaily.com/releases/1999/07/990727071229.htm>

The article starts by explaining that the author of the research on African Fractals, Eglash, believes that our conception of African mathematics is not well understood since the design of many cultural things throughout Africa provide a new belief their math was deeply complex. The author of the article then goes on to try and synthesis this new reality with the need for providing cultural specific education to Black students. In studies of African-American students' poor math performance, researchers have suggested that computer-based teaching methods or the presentation of real-world math applications might encourage students to learn more. According to Eglash, the use of African fractals in math classes could combine both solutions.

This articles was meant to outline one of the ways in which culture could be infused into mathematics education.

Orey, Daniel & Rosa, Milton. (2007). Cultural assertions and challenges towards pedagogical action of an ethnomathematics program. For the Learning of Mathematics. 27.

This paper is based on two mathematics researchers who anecdotally talk about their experiences with implementing ethnomathematics. It highlights the successes and the failures. One of the largest failures is the lack of an established syllabus, the difficulty of transferring ethnomath to standardized tests and scaling. The last two provide evidence for me to assert along with other research on ethnomathematics, that because of its barriers of implementation in the way it is discussed in the literature, we need to find a way of implementing formal education with a cultural spin. This is my ultimate reasoning for being a proponent of economics to bridge that gap.