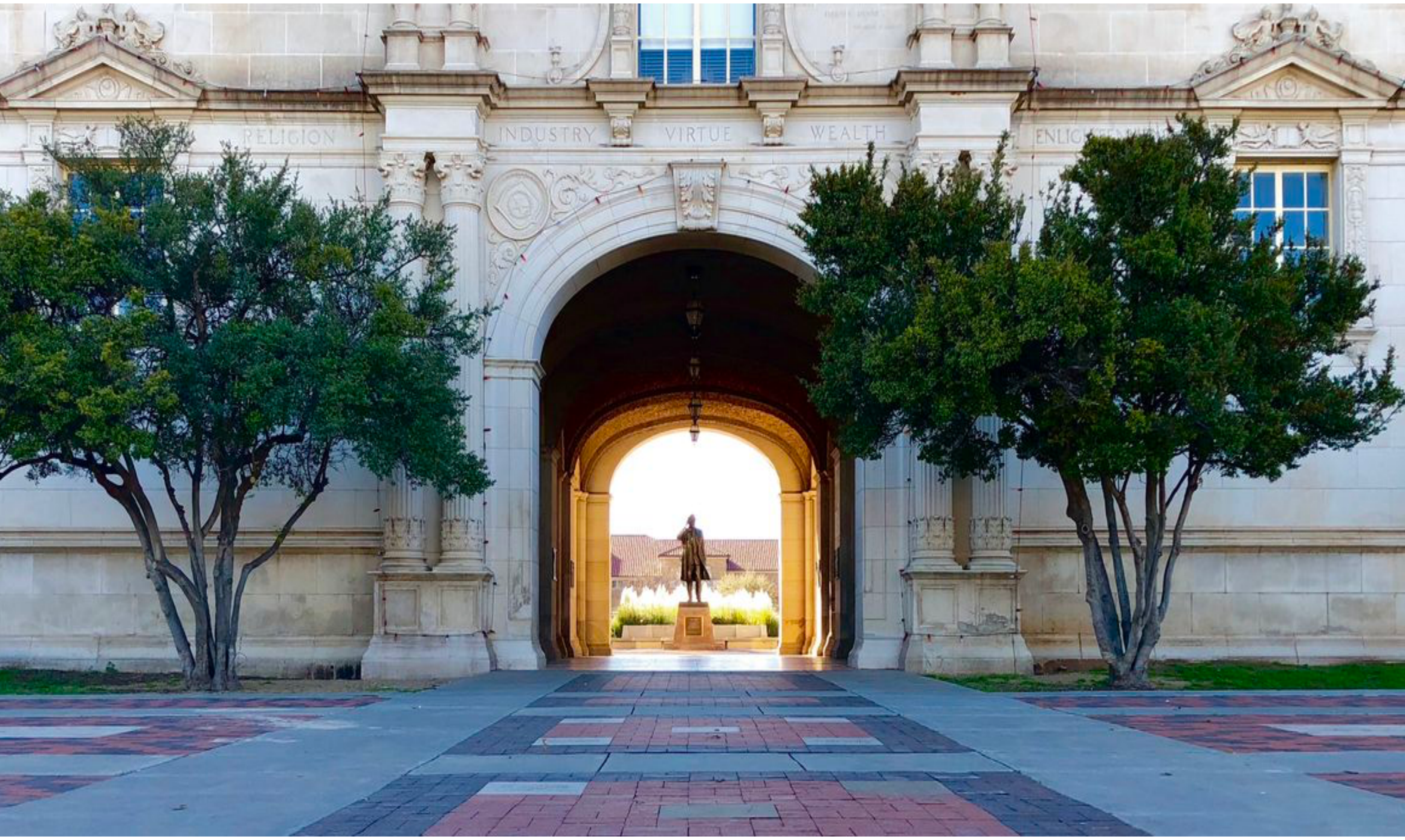
The STEM & Leaf Journal

Innovation. Education. Service.



FALL 2020

PUBLISHED BY THE STEM & LEAF CORPS,

TEXAS TECH UNIVERSITY, LUBBOCK, TEXAS

"The STEM & Leaf Corps are a family of talented individuals seeking to cultivate a passion for learning in the Lubbock community.

We prioritize our students and adapt to their needs through hands-on learning, one-on-one tutoring, and high-quality mentoring aimed at elevating the scholastic capabilities of students in the community. By engaging in a diverse array of activities within our organization, we are able to cater to many student needs.

Everything we do at STEM & Leaf is geared towards bettering education and bridging the gap between what students learn and the enrichment of their lives. We engage our students and invite them to act upon their own curiosities. Our tutors are dedicated to innovation, service, and leadership in the Lubbock community.

- **Haley Lavergne**, ***Editor-in-Chief of The STEM & Leaf Journal***

Features

Acknowledgements

The STEM & Leaf Corps organization would like to extend our deepest gratitude to the Lubbock community for providing us with the opportunity to grow into who we are today, to Dr. Michael San Francisco and Chad Cain for providing endless support as advisors, and to the 7 Founding Fathers of STEM & Leaf for establishing our esteemed organization. We would not be where we are today without the continuous support and passion for our organization that we have received from you.

To our tutors,
Thank you for your service to the Lubbock community. Your hard work and dedication have enabled us to expand to numerous locations community-wide and have left insurmountable impacts on the lives of each student. Our tutors continue to show up and inspire students every day, and for these reasons, we are forever grateful.

Lastly, a very special thanks to Lubbock ISD and teachers for granting us the opportunity to mentor their students. We are so appreciative of your dedication to these students and your continuous support of our mission to provide excellent mentoring services.

Partnered Institutions

The STEM & Leaf Corps partners with several schools in the Lubbock Independent School District including:

- Lubbock High School
- Commander William McCool Academy
- Estacado High School
- Southcrest Christian School
- Bayless Elementary School
- Guadalupe-Parkway Sommerville Center

What STEM & Leaf Corps Means to Me

William Kariampuzha

Cramming into the back of the Mesa room during The STEM & Leaf Corps first meeting, Charlie Zhu and I saw dozens of Honors students excitedly listening to Mr. Chad Cain speak about Denzel Washington and the power of mentorship. The next week, I jumped right into tutoring algebra I, physics, and STAAR test at Lubbock High School. After weeks working with these students, I saw their grades and understanding of algebra and physics improve significantly. I felt the most joy serving here than in any previous role I have ever served.

Two years later, I have poured my heart out for this organization and the students that we work with in the Greater Lubbock Community. I have done science experiments with elementary students at the Parkway Sommerville Center, served as the Assistant Coordinator at O.L. Slaton Middle School in East Lubbock, and acted as Treasurer, Primary Investigator, and leader of a pilot High School – Undergraduate research mentorship program. Yet even while transitioning roles, I never forgot the initial joy from serving these students. Every single time I go out to a school to tutor Electrochemistry to a struggling Lubbock High student or make lava-lamps with third graders at Bayless Elementary, my face cannot handle the inevitable smile that comes from the joy of seeing students have the "aha" moment or engage with science the way I did when I was their age. It is truly the highlight of my week to see their joy and successes.

We can win Overall Student Organization of the Year from the Texas Tech Center for Campus Life, or the "Get Involved" Award from the Volunteer Center of Lubbock, or even 1st prize in Community and Service Developments at the 24th American Medical Students Association National Conference, but those awards do not bring us the same joy that simply volunteering brings.

The joy I had in tutoring and the successes that I have had with these students drove me to give back to the organization as Treasurer last year. After receiving generous donations from our partners, The STEM & Leaf Corps was able to be incorporated as 501(c)(3) non-profit which will allow us increase our outreach with major U.S. Department of Education funded programs such as the East Lubbock Promise

Neighborhood initiative and national organizations such as Communities in School. Through my ongoing work with The STEM & Leaf Corps, I have found that our motto of "Innovation. Education. Service." is not fulfilled by solely by rethinking organizational development or presenting our educational findings, but more so by continuously tilling the soil of service and cultivating a love of learning with a smile each and every day. My time in STEM & Leaf won't last forever, but when I look back on this time I know I will reminisce the countless memories of high-fives after solving for y, collections of "thank you's" after balancing redox reactions, and being hugged by students after their experiment bubbled over; all to cultivate a lifelong passion for learning so that they could change their lives for the better.

INNOVATION.

Nuclear Fusion: A Brief History

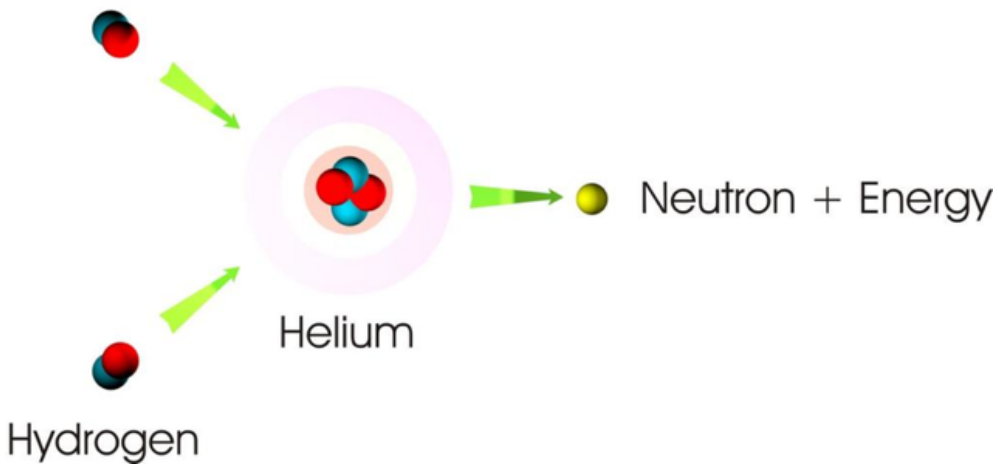
Rohan Pendse

Everyday technology and science continuously adapt to changing technology and our ever-growing pool of knowledge. There seems to be no shortage of human talent and ingenuity increasing our future standards of living. However, one of the biggest problems we currently face has been a shortage of clean energy. Humans inherently need power for everything - from transportation, to cooking food and a myriad of other tasks. Although fossil fuels are still widely used, the next age of energy production has already begun. Nuclear fission is now thought of as a preliminary energy source. However, because it generates waste, this process is still capable of being perfected. The ability to generate clean energy is the true last stage of human energy production and is a perfect example of innovation in technology.

When people first hear about nuclear fusion, they tend to think about science fiction and the technology that goes with it. Although nuclear fusion may someday be a reality, there is a tumultuous path towards the final goal. There have been several exciting developments in the last few decades, with further advancements comning every year. While coal and natural gas are the world's most used fuels for electricity, they are a diminishing and costly resource. Over numerous decades of research, scientists have learned of the detrimental effects of coal and natural gas on the environment as they contribute greatly to the greenhouse gas effect. Nuclear fusion is theoretically a limitless source of energy that does not produce toxic waste, nor does it pose a threat to biodiversity and the environment.

Nuclear fusion at its simplest level is defined as lower atomic number nuclei fusing together to form a heavier nucleus with a release of energy. Nuclear fission on the other hand, is defined as a heavier nucleus impacting and breaking apart, releasing energy. The problem with the latter method is that toxic radioactive waste is created. Unfortunately, this is the reaction that runs in the world's nuclear reactors.

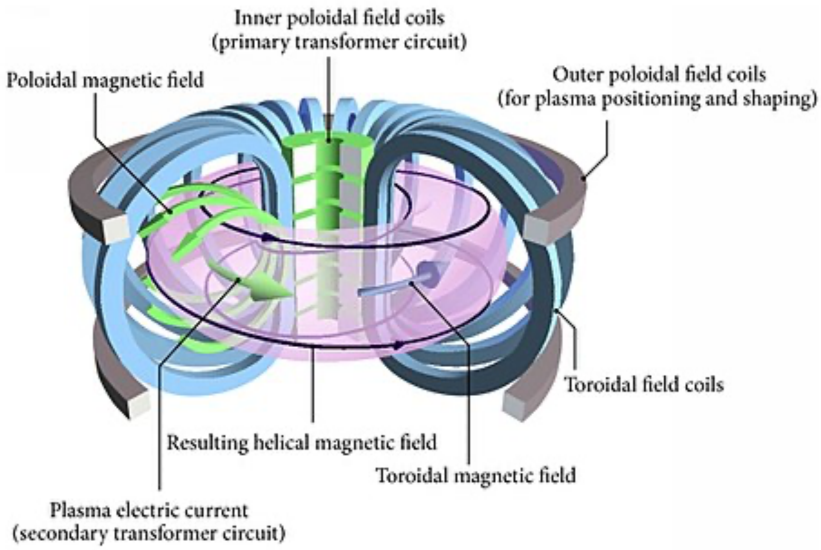
The process of nuclear fusion has advanced in stages through numerous experiments. Arthur Eddington kickstarted the process in the 1920s [1] when he suggested that stars draw their power from fusing hydrogen into helium. He published this claim in 1926 in the Internal Constitution of the Stars. With his now famous 1934 experiment, Ernest Rutherford demonstrated the fusion of deuterium into helium, cementing the foundation of early fusion experimentation.



[3] Hydrogen fusing into Helium with a release of energy.

Hans Bethe provided the last piece of the puzzle when he suggested that the stars release energy through proton-proton chain reactions. This laid down the base for modern theoretical astrophysics and the world soon moved towards replicating this process on Earth as an energy alternative.

In the 1950s, Soviet scientists Andrei Sakharov and Igor Tamm [1] proposed their plans for a magnetic confinement device, the tokamak. This device would confine hot plasma in a toroid to produce fusion. This device, although practical on paper, proved to be exceptionally difficult to follow through physically. By the 1970s, the science community had realized that fusion would be an elusive puzzle to crack. The Joint European Torus (JET) was completed by 1983, becoming the world's largest magnetic confinement device. Experiments using tritium were conducted after construction and in 1997, JET set the current world record for fusion output. 16 MW from 24 MW of input. This was a Q value of 0.67. A Q of 1.0 is breakeven, higher is needed for a net positive output of energy from fusion.



[4] Tokamak schematic.

In 2005, the International Thermonuclear Experimental Reactor (ITER) [2] was completed in Cadarche, France. As of November 2017, the project had passed the fifty percent of work scope completed to first plasma. The project features an impressive cast of 35 nations. When completed, this project will be the world's biggest magnetic confinement experiment, bigger than the aforementioned JET. The goal of fusion, if reached, has enormous potential for the planet and the future of the human race as a whole. While 100 kg of deuterium could produce roughly 7 billion kilowatt-hours, it would take a coal fired power plant 1.5 million tons of coal to produce the same output. To put this into scale further, fusing atoms in a controlled environment releases four million times more energy than a chemical reaction such as coal, oil, or gas. This would also produce four times the energy output of a fission reaction. Although the path ahead for fusion is difficult, in the wise words of Isaac Newton, "If I have seen further, it is by standing on the shoulders of giants." Advancements are continually made, and nations are putting together coordinated efforts to crack the energy puzzle that is nuclear fusion.

To say that humans are great at innovation is a massive understatement. From the first smolders of fire made by cave men to the massive fission reactors in place today, there is no doubt that our energy needs will grow even greater. To combat this exponential need for power, science will have to continue to break the boundaries of energy production and maximize its potential. Nuclear fusion is a process nature has intended for the stars, but with enough talent and ingenuity, it will one day be a core pedestal that humanity can use to power through the ages.

EDUCATION.

Test to Learn? A Look at the Forward Testing Effect

Tingzeng Wang

It's 8:30 AM. You have not slept in the past 24 hours and consequently, your nervous system is on the brink of collapse. Your fingers are shaking, eyes bloodshot. All around you are scattered notebooks which you have flipped through for the thousandth time and, in various precariously placed positions, cups of now-cold coffee and half-finished cans of energy drink. It's 8:47 AM and your final exam for advanced quantum mechanics will begin in less than 15 minutes.

Exams, tests, quizzes - formative and summative assessments of all sorts are frequently sources of stress for students, and as result, the targets of much complaint. Yet, research has begun to suggest that testing, when conducted in a strategic manner, may in fact carry more benefits than just putting a grade to a student's classroom performance - it could help individuals learn in the long-run.

The History of Testing

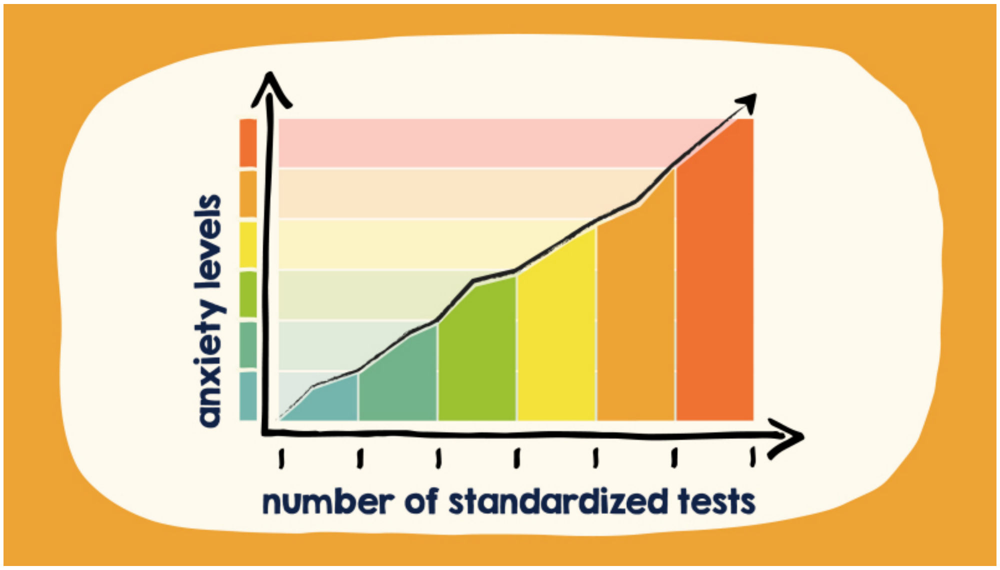
Before we take a closer look at how assessments could improve the acquisition and retention of information, we need to first understand a little bit about the history of educational testing. The first standardized tests were administered as job applications for government positions in 7th century Imperial China [1]. These civil service exams would take place in the form of rigidly structured essays which tested the examinee's ability to recall passages memorized from Confucian texts and other Chinese classics [1]. Flash forward several centuries, and the farm to factory migration catalyzed by the industrial revolution is in full swing. The sudden surge of urban populations, particularly that of children and youths, sparked a need for schools and a means by which a large number of students in those institutions can be assessed [2].

Taken from: TIME Magazine, Francis Miller, High school students take the first-ever National Merit Scholarship Program exam [2].

In the United States, the origins of standardized testing are often traced to the 1840s when renowned educator Horace Mann challenged the claims of English grammar schoolmasters in Boston that their students were receiving a proper education. He argued that the oral examinations popular at the time, which involved younger students reciting the ABCs or older students repeating from memory poems and speeches, were mere performances and not reflective of actual learning [3]. The Boston school committee eventually accepted his views, and this led to a move away from rehearsed recitations towards unannounced written questions as a means to judge learning in schools. Today, large-scale scantron-based tests, such as the SAT, which was taken by 2.2 million students in 2019, are widely accepted by colleges in their consideration of applicants [4]. Even at the state and local levels, standardized assessments are being pushed for their purported ability to evaluate teacher quality. From university final exams to the infamous pop-quizzes given by your middle school history teacher, tests are now a ubiquitous part of American education.

The Problem with Tests

Today, much debate is occurring in the field of testing in general and standardized testing in particular. Two major concerns include the stress induced by high-stakes exams and the time test-preparation takes away from other instructional activities [5].



Taken from: We Are Teachers, Stacy Tornio, More kids than ever are dealing with testing anxiety, and we need to help (2019) [21].

A 2015 survey by the Organization for Economic Co-operation and Development (OECD) found that 55% of students feel very anxious about tests even when they are well prepared, and 37% of students are very tense when studying [6] [7]. This stress is not proportionally distributed across student populations as bottom performing students feel more anxious about tests than those students who receive top scores with the OECD report showing a 17% difference in test-induced stress between the top and bottom quarters of science students [6] [7]. Still, even high achieving students frequently report that their fear of making mistakes often adversely impact their testing performance [6] [7].

Preparations for high-stakes tests in particular also take a substantial amount of time, the hours in the school day are often reallocated from other educational activities to allow for additional test-prep. According to an American Federation of Teachers report published in 2013, testing and test-prep consumed 19 full school days in one Midwestern school district and a month-and-a-half in an Eastern U.S. school district in the highly tested grade levels [8]. This heavy focus on tests and their preparation is not surprising as district funding, school evaluation, and teacher employment are all affected by scores on standardized exams. And thus, in efforts to improve performance in these metrics, "71 percent of the nation's 15,000 school districts had reduced the hours of instructional time spent on history, music, and other subjects [that are not tested] to open up more time for reading and math [which are tested],” according to a 2006 article by the New York Times [9].

Testing to Learn

While up to this point we have mainly considered tests as a means to evaluate, it is also understood that testing can benefit student learning. The most well-known mechanism by which this can occur is through enhancing the retention of previously learned information. An example of this “backward testing effect” was famously demonstrated in the experiment by Roediger and Karpicke (2006) in which participants were asked to study two passages with one passage being studied twice and the other being studied once but then tested over once [10]. It was found that the participants were better able to recall the passage that was tested than the passage that was studied twice [10]. Figure 1 summarizes this phenomenon based on the work by Roediger and Karpicke. By testing after studying, students are asked to process the information they have learned, construct new frameworks that transform acquired information into usable knowledge, and put into practice the knowledge that was formed. Interestingly, it was also mentioned that repeated studying “inflated students’ confidence in their ability to remember the passages in the future,” and created the impression that the students were making “rapid [but ultimately] short-term gains” [10]. In contrast, testing pushed the students to space their studying and introduced a “desirable difficulty” which promoted long-term retention of information studied [10].

In an investigation by Christopher Wahlheim (2016), a researcher from Washington University in St. Louis, it was shown that testing can counteract the interference caused by previously learned information [11]. This disruption to learning, known as proactive interference, occurs when previously learned material, which is related to the current material one is attempting to learn, reduces memory performance [12]. Proactive interference promotes forgetting and hinders the learning, as well as the retention, of new information [12]. In Wahlheim’s experiment, participants were asked to recall different as well as similar paired-associates from two lists [11]. What was paired in one list was paired differently in the second list which enhanced the effect of proactive interference. However, when participants were tested after reviewing one list and prior to reviewing the second list, they were able to better recall the paired-associates from the second list in the final test [11]. This suggests that testing encourages learners to segregate old and new information when the two groups of information compete with one another.

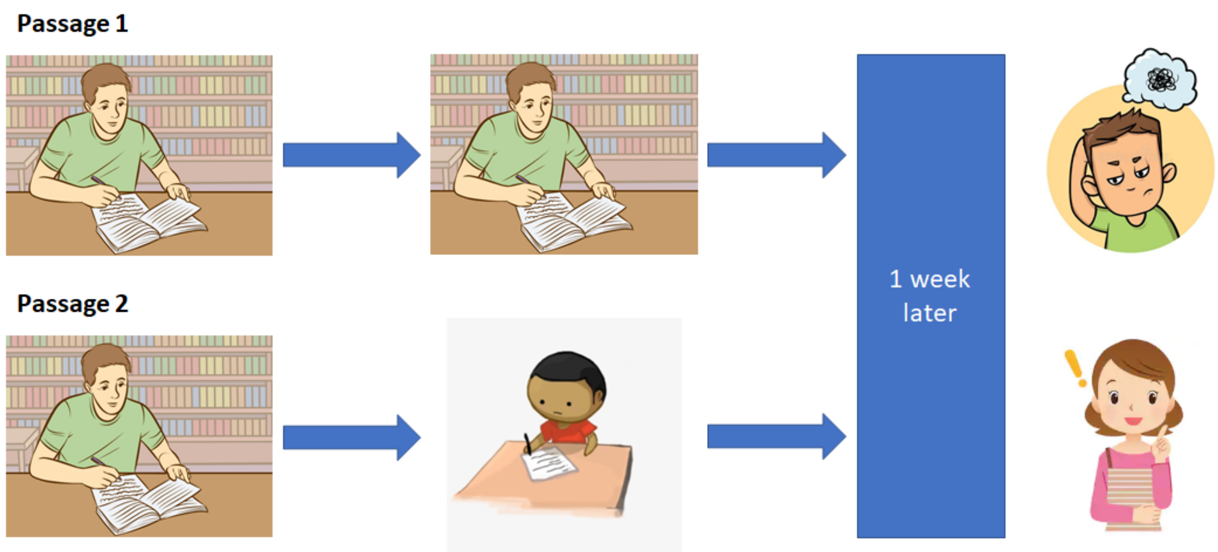


Figure 1. A schematic of the backward testing effect:
Participants were better able to recall the passage they studied once and then took a test over, as opposed to the passage they studied twice, one week after the experiment. Testing learned information helps individuals retain that information.

What is the Forward Testing Effect?

Wahlheim's observation that testing diminishes the negative effects of proactive interference leads to the interesting idea that testing may improve the learning of new information. This concept (in contrast to the preservation of previously learned information) has been supported by several recent studies and is known as *the forward testing effect*. A review article by Yang, Potts, and Shanks (2018) details recent findings regarding this phenomenon. Figure 2 shows a schematic of the forward testing effect adopted from the outline provided in their review [13].

In essence, the forward testing effect describes the observation that testing after studying a certain item or set of information enhances the acquisition and retention of new information which can be entirely different from the tested material. This implies that the act of testing itself is, at least on some level, conducive to the learning process. The forward testing effect has been shown to be relevant in single item learning as well as the learning of paired-associates. An experiment conducted by

Szpunar et al. (2008) divided participants into three groups each tasked with studying the same five lists of words [13] [14]. One of the groups had two studying time blocks for each list, another had a distractor block after each studying block where the group's participants were asked to solve math problems, and a third group took a test over the studied words after each study block. All of the groups were asked to take a test over list five after studying the fifth list of words. Surprisingly, the "interim test" group recalled twice as many list-five words as the other two groups on this test [14]. As the list-five test did not ask participants to recall words from previous lists, it is noteworthy that the groups which took four previous tests over information not covered on the fifth test performed better than the group which studied the fifth list of words twice. It was also observed that, similar to what was shown in the study on learning of paired-associates, "interim testing" abrogated proactive interference as the testing group had significantly fewer intrusions from prior lists during their recall of words from list-five.

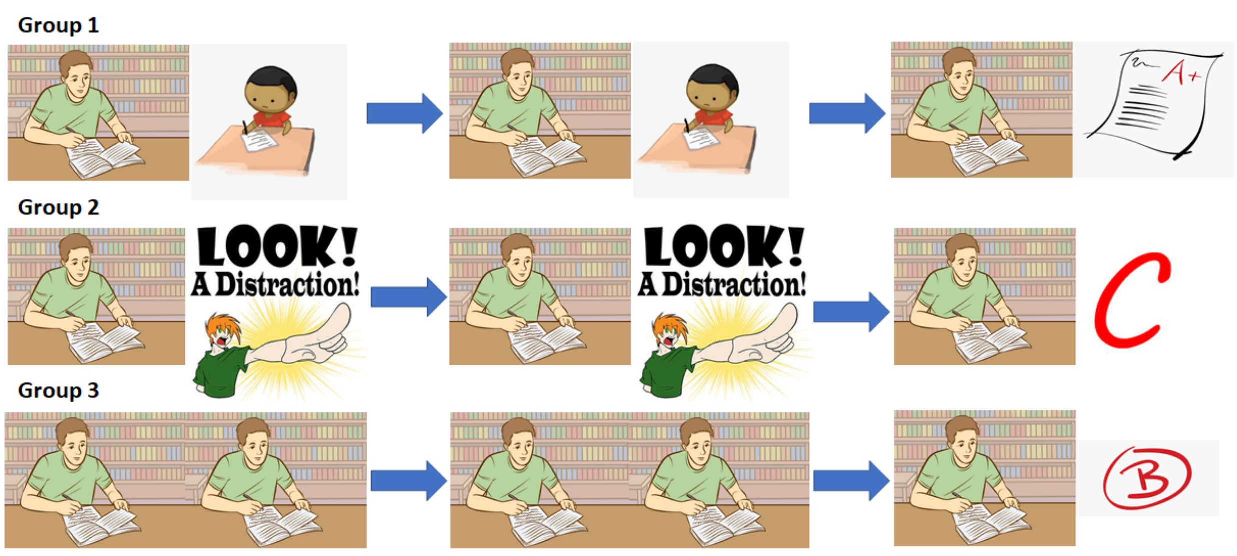


Figure 2. A schematic of the forward testing effect:
Participants who took a test over the studied information after each study block (as opposed to those who had a distractor or restudied after each study block) performed better on the test after the final study block. The testing of previously learned knowledge can improve learning of new knowledge.

Yang, Potts, and Shanks (2018) also explored the role of the forward testing effect in the learning of complex information, self-regulated learning, and inductive learning. [13].

In two studies examining the impact of testing on the learning of text passages and lecture videos, it was found that interval testing resulted in more "on-task mind-wandering" (during which the participant thought about the lecture material and contemplated the material's relation to personal experience) and less "off-task mind-wandering" while also leading to more active notetaking by the participants [13] [15] [16]. This suggests that testing may lead to more active student participation in the learning process and higher degrees of cognitive engagement with the studied material, both of which aid in the comprehension and memory of more complex information.

While less research has been done on the topic of the forward testing effect in the areas of self-regulated and inductive learning, the available evidence seems to point to a positive relationship between testing and motivation as well as testing and inductive reasoning.
It was shown in an earlier study by Yang, Potts, and Shanks (2017), which followed the same structure as figure 2, that when participants were given a choice as to how long they spent studying each list of words, those subjects in the interim testing group maintained the same study time for each list while participants in the other groups gradually decreased their study times for each successive list [13] [17]. Longer duration of time spent studying is often considered evidence of greater motivation and this personal drive is especially important for students participating in self-regulated learning.

A set of experiments performed by Lee and Ahn (2018) (also following the format displayed in figure 2), in which participants were asked to recall artist names corresponding to paintings made by the artists, showed that students who were tested after examining the painting-artist pairs later performed better than those in other groups when tasked with classifying new paintings to the same artists [13] [18]. This suggests that those participants who were tested developed better understandings of the artists' individual styles and were able to reason based on those formed conceptions.

How to Take Advantage of This Phenomenon

The emerging conclusions surrounding the forward testing effect is not only tremendously exciting from a research standpoint but also incredibly pertinent to a wide range of fields due to the clear implications these ideas have on the ways we can improve learning in general. While more research is needed to grant us a complete picture of the mechanism, impact, and limitations of the forward testing effect, our current understanding may already warrant practical changes to the way we approach learning and teaching. Below are some ways we can apply knowledge of this phenomenon to various learning situations.

Adopt frequent interim testing for learning of materials which rely heavily on memorization. Students at all stages of education, but particularly those in primary and secondary school, are often asked to memorize significant amounts of information such as words and their definitions, chemical elements and compounds, etc. An effective way to boost the rate at which bulk amounts of such information can be acquired and retained may be to divide the material into small manageable portions and regularly test the students on their learning of each portion through weekly or even daily assessments.

Favor multiple short low-pressure quizzes over single high-pressure cumulative exams in the typical classroom. While the backward testing effect might not provide the answer to which form of testing is more beneficial, as it is possible that both quizzes and exam help students retain the tested information for a longer than otherwise length of time, the forward testing effect suggests that the former is more conducive to learning than the latter. Although cumulative exams assess end-time-point student learning and may provide the pressure necessary to motivate longer durations of studying, they lose the main benefit associated with the forward testing effect, which is that testing help students learn in the future. On the other hand, periodic quizzing not only aid in the long-term memory of the quizzed knowledge but more importantly is likely to help students grasp the content in the following units. Additionally, quizzing allows for iterative cycles of interim testing which amplifies the forward testing effect.

Incorporate elements of testing into complex job training and technical education. Technical training often involves some degree of onsite mentorship where the trainee learns the ropes by observing a senior practitioner. Adoption of regular testing of trainee skills or quizzing of job knowledge, systemically or informally, may enhance the learning and retention of new skills. As mentioned in the previous section, the forward testing effect may be relevant for improving inductive reasoning which is used across various disciplines and career fields. Implementation of testing after learning of a specific skill timed spontaneously or otherwise, along with existing protocols may thus facilitate the training of laboratory technicians, museum curators, chefs, repair mechanics, etc.

Emphasize periodic testing for homeschooled, distant learning, and self-teaching students. As discussed previously, the forward testing effect has been demonstrated to prevent a successive decrease in study time - a major concern for students not in the physical classroom. Thus, frequent and consistently-timed testing in conjunction with the reading of textual information and watching of lecture videos might not only provide the typical benefits associated with both the forward and backward testing effects but also serve a protective function (halting the development of poor study habits, cursory reading, in addition to false confidence) and a motivational role which is critical for successful self-directed learning.

Utilize cyclic testing patterns for standardized exam preparation. Test preparation is often a stressful experience and many students struggle to formulate effective strategies for tackling high-stakes exams such as the SAT, GRE (Graduate Record Examinations), or MCAT (Medical College Admissions Test). One potential method for optimizing studying for such tests is, humorously enough, taking more tests! Not only do the answering of practice questions help students acclimate to the question formats and general content of the tests, cyclic arrangement of content review and minature practice tests capitalizes on both the benefits associated with the forward and backward testing effects.

Craft spontaneous assessments while learning new information. Learning is an ongoing life-long process. Every day we encounter new information which assist us in a particular task, will likely be of use in the future, or are simply interesting. Often, such pieces of knowledge are quickly forgotten due to the temporary nature of their storage in short-term memory. It is possible that developing a habit of creating and answering simple questions immediately after learning information that one desires to retain (such as a phone number, name, directions, or even a curious fact) will lead to a general improvement in long-term memory. This is a reasonable hypothesis given the broad scope of the forward testing effect and should it be true, could result in major improvements to an individual's quality of life.

Conclusions

Our growing knowledge about the forward testing effect not only provides a fascinating insight into human learning but also the perfect opportunity to reevaluate and redefine the role tests play in education. Historically, and even today, tests serve primarily, and often exclusively, to assess. Yet, the evidence surfacing rejects this limited notion and challenges our understanding of how content and questioning can and should be integrated. Rather than separate the test and the lecture or view the exam as simply a ruler by which to measure and subsequently categorize students, it is perhaps necessary to more closely conjoin the two parts of formal education (for example through a heavier focus on mid-lecture assessments) and shift away from large scale final exams towards more regular quizzing. A transition of this type may also help reduce testing-induced stress as students are given more opportunities to acclimate to the testing format and avoid being pressured to perform exceptionally on a particular day. Mistakes are thus accepted as part of the learning process rather than categorically judged as evidence of failure.

The forward testing effect has been shown to be robust and pertinent across multiple forms of learning. A recent study has even demonstrated that this phenomenon is independent of the learner's working memory capacity [19]. This suggests that the forward testing effect may beneficially impact a wide range of individuals with drastic variations in traditionally interpreted intellectual capabilities and at differing levels of education. Such a realization makes it even more important for us to alter our perceptions of what testing is and how it fits into the larger schematic of learning. Should we identify testing as a support mechanism for learning rather than the goal of classroom instruction, it may very well disrupt the paradigm of "test-prep for testing's sake." If the resulting transformation occurs, it is possible that such changes will significantly improve the quality of education for students around the world.


CATAPULT
STEM & LEAF CORPS
GROWING EDUCATORS
LAVA LAMP
Who We Are
MAGIC MILK
An education -oriented outreach initiative associated with TTU Honors College
Help support and provide high-quality academic enrichment for local K-12 students
Where We Are
What We Do
SPAGHETTI ENGINEERING
We meet in the OL Slaton cafeteria from 4-5pm on Tuesdays and Thursdays
Project-based learning to help instill a passion for the STEM fields

SERVICE.

A Project-Based Learning Approach

Jess Ritter

Success in school or in any career comes from knowledge of the job, not memorization of facts. This has become apparent in the past year as a Texas Tech professor once stated that his class was the only class where the students must know material taught, just as well or better than him. Since hearing this, I now believe that this professor's unorthodox teaching method was correct, and luckily, I have been given the opportunity to impact the students at the Guadalupe-Parkway Sommerville Center in the same way my professor impacted me.

Project-based learning can appear daunting to both students and teachers who are charged with devising such projects, but the knowledge imparted on these students becomes worthwhile in the end. The greatest benefit that project-based learning has on students is the curiosity it stirs in the mind. Curiosity leads to questions, and questions lead to answers. Hands on learning engages students and pokes at the mind spawning curious thoughts. For elementary students at Guadalupe-Parkway Sommerville Center, the thought of getting their hands dirty immediately grabs their attention. Furthermore, the freedom students have to both make mistakes and experience success in their own right drives their curiosity and determination to succeed. When students' curiosities pique, they begin to ask questions, and it is through these questions that the true learning process begins. With a project-based learning approach, the instructor can almost always expect an overwhelming response of engagement from students as they hypothesize the result of the project and attempt to answer why certain events and outcomes occurred. The beauty of project-based learning is that the answers to all student questions unfold before their eyes.

Students exposed to project-based learning have an advantage when it comes to critical thinking skills. Students naturally are inquisitive; however, project-based learning invites the students to act upon these curiosities. One example of the critical thinking is a density experiment performed by mentors with students at Guadalupe-Parkway Sommerville. The students poured liquids varying in density into a clear cup and watched the "magic" of density. Students were immediately curious as to why honey was denser than syrup. At first, the answer was not obvious, however, after adding a few more substances, the answer became clear. Eventually the students were able to guess which substances would float or sink to the bottom. I believe that if the students had not observed the project and the real-life example of density, this concept would have never made sense to them. Project-based learning trains the mind to think critically by posing questions that are derived from the students' curiosity and is a method teaching that prepares students to critically think and solve difficult problems they may encounter.

Continuing Education

Heath Hampton

As college mentors, our ability to be positive role models is the greatest influence we could have over students in middle and high school. Every time we sit down with a student, we serve as a source of encouragement reminding them that a college education is attainable. Many students we encounter are overwhelmed with misconceptions and doubts about what it is like to be a college student, what college students may look like, and where college students come from. As mentors, showing students in primary and secondary education that we, as college students, have experienced the same classes, extracurriculars, application processes, trials, and tribulations, is imperative in encouraging students to pursue a post-secondary education.

When we provide this positive example to students, we help to catalyze their transition into higher education and perpetuate a cycle of learning and discovery. This grand cycle of learning, which ultimately includes every student, teacher, and mentor in education, requires participation. Particularly the participation of a wide array of personalities, perspectives, and experience. Being current college students allows us to exploit our experiences to foster each student's individual passion for education, answer their questions regarding college, settle their doubts about their abilities to engage in higher education, and ultimately encourage them to pursue a degree. At STEM & Leaf, we aspire to leave a lasting impact on every student we encounter, but most of all, we want them to choose to continue their education despite whatever challenges may scare them away.

While we cannot do students' homework for them, take their tests, or write their applications, we can work with students on these things. At STEM & Leaf, our goal is to minimize the fear associated with earning a college degree. We aspire to show students that each and every one of them is just as capable as we are in continuing their education, and we want to push them to achieve every goal they may set. Once given the encouragement, students quickly realize their capabilities and the effects of making use of their resources. Many students only need the reassurance that they can achieve whatever they work for. It is our responsibility as mentors to provide support and hold each student accountable for their education. In the end, one of the most important lessons we can pass on to our students is that being a student never really ends. It remains our responsibility to cultivate a genuine passion for learning in each student such that no student feels failed by the public education system.

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Nuclear Fusion: A Brief History:

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