Engaging Students in Quantitatively-Based Courses Is the Challenge

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Abstract

This study investigated the influence of a "challenge event" (treatment) on final grades for 103 students in an upper-level quantitative methods course required of all business and information systems majors at a small, liberal arts college. There were two semesters used as the control (traditional coverage of returning test) and four semesters where students were encouraged to challenge and justify responses that had been marked incorrect (treatment group). A traditional review of the returned test was not conducted. Historically, the students taking the quantitative methods course struggle with the critical thinking components of the course. The grades in the control group ranged from 66.34 to 70.42. After the treatment (challenge event) the final grades ranged from 78.97 – 81.38. The difference in the final grades between the control and treatment groups was statistically significant with p < .000. This paper discusses the treatment (challenge event) and provides an analysis of the statistics used to test the impact of the treatment.

Keywords: engaging students, critical thinking, empowering students, quantitatively-based courses, course excitement

1. Introduction

It is widely acknowledged that resolving student challenges and attempts to actively engage them in academics can be a formidable task. Actually, the challenges are not limited to the classroom. Visit the student center about nine o'clock at night and it can be a disconcerting place. The behavior and the use of language can appear as if we just landed on an alien planet. *Attempting to communicate* with them seems like a difficult chore. Yet, many of the pundits consider it our charge, as faculty, to "tame the beast," to help students become contributing members of society at personal and professional levels. Classroom management and control have become highly discussed topics. Nevertheless, engagement of students in the classroom can be a daunting task. Even faculty at large, elite universities experience the "enough is enough" syndrome. Dr. Irwin Horwitz, a veteran professor at Texas A&M, flunked his entire strategic management class for reasons faculty commonly face in the classroom on a weekly basis. Colleges and universities have even developed institutional course templates addressing classroom civility, with cell phones remaining a pervasive problem. Indeed, searching for literature on this topic of "challenging students" results in articles providing unlimited advice and recommendations on how to manage the difficult, unmotivated student. But, the essence of this challenging students is: how do educators facilitate student engagement and the development of critical thinking in their courses with so many distractions for students who are frequently unprepared or under-prepared for college? This is especially relevant for quantitatively-based courses where students lack the basic preparation for college mathematics, prompting a significant number of remedial mathematics classes needed at the collegiate level. *The Remediation: Higher Education's Bridge to Nowhere* (2012) states that 1.7 million students enter undergraduate institutions needing remedial education at a cost of $3 billion per year, unfortunately with limited success. And, frequently, the students do not have any understanding of what is required for them to progress toward graduation. The disparity between what is required to graduate from high school and what is required to graduate from college continues to grow. This has become

the focus for quantitatively-based courses, such as those required in most business programs, at the under-graduate and graduate degree levels.

This paper investigates a pedagogical technique (the treatment) where students are encouraged to "challenge" answers on a test that have been marked as incorrect. The final grades in the courses, where the students participated in the challenge event (treatment), were compared to the final grades in courses where students did not have an opportunity to participate in the challenge event (control groups). The challenge event is issued to the class and the students *must work together* to "make their case" for why their answers should earn additional credit; it is a class effort. Refer to Appendix A. The challenge event was issued to students in a quantitative methods class that all business and information systems majors must complete. It is considered, by many, to be "the hardest course on campus." Students frequently have to repeat it, with a few students taking it as many as three times before its successful completion.

The research question was: Are the grades higher in the quantitative methods courses where the challenge event was the treatment compared to the control groups where there was no challenge event?

2. Literature Review

There are articles into perpetuity on "challenging," students. Just key in the words "challenging students" and within 0.24 seconds the array of articles numbers approximately 122,000,000. Most of these address the difficult student. *The 7 Rules of Handling Difficult Students* (Linsin, 2011) helps teachers avoid the most common pitfalls, and the outcomes of avoiding these pitfalls can ultimately result in students looking inward. *Managing Aggression* by Braithwaite (2001) was written to address aggression in the workplace, but has become recommended reading for teachers as well. In the article *Dodging the Power-Struggle Trap* (n.d.), three tactics, disengaging, interrupting, and deescalating, are discussed in detail to moderate the behavior of the noncompliant student. Nevertheless, many of these analyses have merit of their own.

The literature on underachieving students and even underachieving colleges is remarkable. Watch almost any news program or read the headlines on the internet; there are countless talking heads lamenting the state of American education. For several years, these naysayers reserved their apoplectic comments for elementary and secondary education. But, *A Nation at Risk: The Imperative for Educational Reform* (Gardiner, 1983) thrust problems concerning higher education into public awareness. Based on Gardiner (1983) assessment, it has been over thirty years since the report lamented the stark reality that SAT scores had fallen in the last twenty years (compared to 1963) by 50 points. One-quarter of the mathematics courses at four-year higher educational institutions are remedial and College Board achievement tests in English and physics have consistently declined. This was thirty years ago. We need not recite studies to know that there has been no improvement. Bennett (2013) goes so far as to state in his book *Is College Worth It?* that only 150 out of 3,500 colleges or universities are worth the money as far as return on investment. Although this has been challenged by Zac Bissonnette in *Debt Free U*, he contends that those in the bottom 40% of their graduating class would, in all likelihood, not have earned adequate value when compared to the cost of a four-year college education. Many teaching in small, liberal arts institutions have significant numbers of these less than optimal students. Even though a strong case can be made to counter Bissonnette accusations, this article is not the place for such as discussion.

Even if the needs of the lower academic tiers of students are not addressed, a plethora of literature laments the lack of success of the academically capable as far back as 45 years ago (Heller, 1968; Balduf, 2009) and "the amount of time students spend on their studies…has fallen about 15 hours a week since the early 1960s…" (Brint & Cantwell, 2011, p. 1). No one would consider challenging the notion that the American educational system has continued to decline significantly over the last 45 years. Even high-achieving high school students, including gifted students of color, frequently appear to lack discipline and self-control, and these deficiencies interfere with successful progress towards graduation for the completion of a four-year college degree. (Bok, 2013; Honken & Ralston, 2013; Moore, Ford, Milner, 2005) There appears to be limited engagement by the students in their academic work.

Any paper discussing underachievement of students and colleges would be remiss without, at least, mentioning Derek Bok's book (2006), *Our Underachieving Colleges*. He indicates that concerns about higher education have been part of the academic landscape for more than a century. Although he espouses that pedagogy grounded in research needs to become an integral part of curriculum revision, he also states: "Admittedly much of the research on education reaches conflicting results or is subject to criticism on methodological grounds…" (p. 51). In addition, he acknowledges that many professors try new techniques, but do not follow up on them with reliable

feedback. However, in fairness, frequently the institutions do not support certain types of experimentation, especially if the research involves "something outside the box" and can be difficult to measure.

It seems that, even with this comprehensive research, there have been few pedagogical methods that proactively engage the students in their academic classes. It is a difficult activity to implement—engaging students. And many times, more difficult to assess.

3. Initiative for the Study: Universal Struggles

This study was conducted in the quantitative methods course required in the business and information systems programs at a private, church-affiliated liberal arts college. As many four-year institutions are experiencing, students struggle, not just in mastering the concepts in their disciplines, but being *motivated* to want to LEARN. Many of us find ourselves just wanting students to retain the material long enough to be able to discuss the test that is being returned, and why the answers are incorrect. It is a tradition to meticulously go over each question and explain why the students' answers could *not* be correct and relate it back to the concepts that have been studied, or more importantly learned. During the review of the returned test, students seem to understand and insist "how could I have possibly put that answer. I am embarrassed. I did KNOW it—I swear, I knew it." But the next test period comes with the same results. As these events occur repeatedly, the returning the test experience starts to resemble the professor being the main character in the Ground Hog Day movie.

4. Methodology

For the past four semesters, I have "experimented" with a pedagogical technique, the "challenge event," that was developed out of desperation at the lack of student interest and engagement in their learning. I had tried "high impact" practices, but with limited success. The impetus for implementing the "challenge event" was the progressive deterioration from semester to semester of the grades and the increasing repeat rate in the quantitative methods course.

The variables, the treatment, and control groups are defined as:

Independent variable: Challenge event
Dependent variable: Final course grade
N = 103

Treatment groups: The treatment groups consisted of final grades from Bus 330 Quantitative Methods for four semesters with the challenge event—fall 2013 (f13), spring 2014 (s14), fall 2014 (f14), and spring 2015 (s15)
Control groups: The control groups consisted of final grades from Bus 330 Quantitative Methods for two semesters with traditional test review—fall 2012 (f12) and spring 2013 (s13)

4.1 Brief Description of Challenge Event

The challenge event (treatment—independent variable) replaced the traditional review (control) of the returned, graded tests. With the traditional review, the graded tests were returned to the students and every test question would be carefully reviewed, as well as why an answer was correct or incorrect. Unfortunately, every returned test review yielded the same results—there was no improvement in subsequent students' test grades. The critical thinking abilities that were the focus of meticulously reviewing the test did not transfer to subsequent tests.

With the challenge event approach, the test questions were not systematically reviewed—nor, was there an explanation as to why the answers were incorrect. The students had to review their answers and if they wanted credit for an incorrectly marked answer, they had to provide a convincing justification for their answers. Students were encouraged to participate in this process as a *group* of colleagues in their quantitative methods class. They could use each other, their notes and textbook, other faculty, and the internet to compare their answers and assist those with incorrect answers to build a case for earning additional points. For a more detailed description of the challenge event, refer to Appendix A. There were a few, but very limited, rules. Refer to Appendix B. In addition, it is important to know what I *did not do*. This information is provided in Appendix C.

4.2 Statistical Analysis

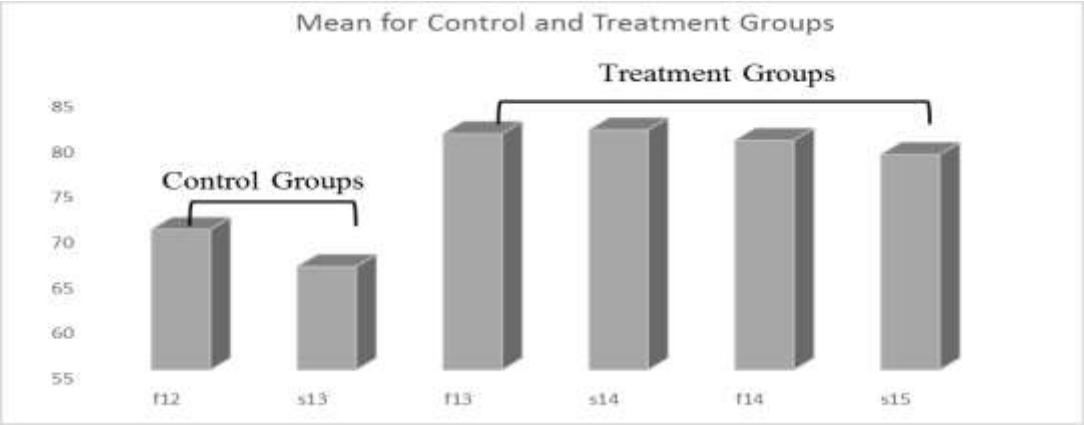
This section represents the statistical techniques used to analyze the data to determine the impact of "challenge events" on final test scores. Figure 1 represents the mean, standard deviation, minimum and maximum of the six semester final grade scores. The control groups are f12 and s13 and the treatment groups (challenge event) are f13, s14, f14, s15.

Figure 1. Basic Statistics

semester	Mean	Std. Deviation	Minimum	Maximum
f12	66.187550	18.6052498	23.4186	95.5732
s13	67.992986	14.0459841	31.4115	83.5390
f13	80.969474	8.4598466	70.0000	95.5900
s14	81.379524	7.7027050	62.7000	93.6800
f14	79.226667	10.3531750	53.4900	93.6500
s15	78.670000	9.7382354	61.4300	90.4200

Figure 2 visually illustrates the differences between the final grade scores for the control groups and for the treatment groups.

Figure 2: Bar Graph of Grades between Groups



The overall mean for the control groups was 67.14 and for the treatment group was 80.29. An independent t-test was conducted with the resultant $t = 5.305$, $p < 000$.

Lastly, a one-way ANOVA was performed to determine if there were any differences between any of the semesters. There were no statistical differences between the final grade scores of the control groups (f12 and s13) and there were no significant differences in the final grades of the treatment groups (f13, s14, f14, and s15). However, there were statistically significant differences between the both control groups and the four treatment groups—$p < .000$ to $p < .038$. Refer to Appendix D for the ANOVA table.

5. Discussion of the Results

The statistical analysis supported the research question that the treatment (challenge event) improved student performance. Not only did the mean grades of the treatment group increase, the standard deviation narrowed, and the minimum grades were much higher. The bar graph visually illustrates the differences between the means of the control group and treatment group. See Figure 2.

The grades on the first test that the challenge was issued were quite low even with the 1.5 additionally earned points that were negotiated during the challenge event. However, the students insisted that the challenge event become an official part of the class after every returned test. The scores on the remaining three tests in fall 2012 were significantly improved. The average for the next two tests was about 9 points higher, and on the last test it was 11.5 points higher. The overall average was a full letter grade higher by at least 10 points. This increase is crucial at the practical level for the students as they attempt to pass the courses they need for graduation. The standard deviation decreased from a high of 18.65 (control groups) to between 7.7 and 10.5 (treatment groups). This led to the assumption that even the "weaker" students were benefiting from the challenge event, but certainly not just the "weaker" students. In addition, the minimum final grade in the control group was 67.19 and the treatment group 78.65.

As data driven educators, our statistical results provide us with measurable criteria to assess "experimentation" with pedagogy. However, anecdotal data can also provide valuable insights. To this end, a few of the comments students made in class, e-mails, and course evaluations are given below.

- We had a very interactive test challenge. Well, you had given 1.5 extra points to everyone. Thank You for such FUN!!!!
- This e-mail is a reminder that I negotiated an additional 1.5 points during the challenge period. (Yes, the students actually started using the word "negotiated.")
- This is the most fun class I have ever had.
- I am understanding and remembering this material. I seldom do that.
- Thank you for allowing us to negotiate our points and justify our answers. It was a great time.
- I understood the topics. I didn't just take it in for a semester, I actually understand the concepts and can take something away from the class.

Certainly, having challenge events in a few classes does not mean that students have mastered the critical thinking skills needed for future leadership. But, it does interactively engage classmates—partners, collaborators, and team members—and augments their opportunities to hone this important ability set. The students in the class began to own the knowledge, were focused on paying attention to detail, used quantitative language in an effective manner, and learned to organize that knowledge that connected the difficult concepts in an "omg, I got it" way. I would like to think that their critical thinking abilities were advancing to a higher order during the challenge event.

Nevertheless, they enjoyed the challenge event and seemed to be more focused during the remainder of the semester. Without question, the challenge events were intense, but not intimidating. This period was about the students and the control they had as individuals and as a group to discover their innate instincts for learning. The literature addressing innate and instinctual components of learning is vast and diverse (Barnacle, 2009; Chomsky, 2010; Cruz & Smedt, 2009; Kgakudu, 2007; Marcus, 2009; Paavola & Hakkarainen, 2005; Terry & Ervin, 2012; Waks, 2006; Wight, 2009)

6. Student Accountability

There is still a student accountability piece that needs to be addressed. Because of earning additional points, their scores on some of their tests had to be revised and reentered. The students were responsible for e-mailing the author the points that they had earned back with an explanation of whether the points were earned individually or as a class. They also had to put the changes on the front page of their tests. They were informed that they were on their "honor" and they were trusted to provide the correct number of additional points. The tests were randomly checked to determine if they had been honest in their reporting and all students had correctly reported their revised scores.

E-mails with the negotiated points had to be sent within 24 hours of the challenge event. Some students from the first challenge event missed the designated deadline and did not earn back additional points. This oversight was rapidly disseminated to their classmates. After that, there has only been one time where a student neglected to report his or her scores. This follow-up behavior was an important activity for them to take responsibility for owning the negotiations and exercising control in improving their grades.

7. Future Inquiries

There were other outcomes that emerged that are not discussed in this paper. Students had to learn how to present their cases in a firm, but non-aggressive way. They also learned how to present their ideas in persuasive, tactful formats, as well as how to market themselves. However, these were after-thoughts, so no evaluation of how their demeanor affected their final grades. Another area that needs to be studied is how the challenge events impact their disposition and openness to learning. Future research in this area would include administering a disposition test to students before the challenge event and again at the end of the semester.

8. Conclusion

In conclusion, it is not clear that this challenge event is innovative and it would not be considered technologically advanced, which seems to be where pedagogy has become intentionally focused. After all, learning happens in a "black box" and it is difficult to measure, but faculty continue to investigate indicators that measure it. Nevertheless, statistical and anecdotal results were presented to support that this pedagogical "experiment" is something to be continued in future semesters because it had a positive impact on student learning at so many

levels. And, the challenge event is applicable for many college classes. The challenge events empowered the students to take responsibility for their learning, even if it meant challenging the professor.

Appendix A

Description of Challenge Event

Upon returning the graded quantitative methods tests, students were encouraged to compare answers, check their textbooks and notes, use the internet, and seek out other professors to develop their justification for earning points back when reviewing the returned quantitatively-based tests. As is well-known, when it comes to extra-credit or getting points back, students will spend extraordinary energy to get even one additional point. After recovering from their initial shock (of being mandated to challenge the professor), they became very animated. In fact, the level of collaboration, not cooperation, and forming partnerships were at a very high level. Interestingly, when united for a common and very meaningful cause, bonds were formed unexpectedly. Students who hardly knew some of their classmates' names were connected and engaged in what almost appeared to be a "sporting activity." They were a team. They were attempting to make that all-important penalty kick or field goal in the final seconds. Even students that had responded correctly were assisting those that had not formulated their justification in a logical manner. In one instance, a student had challenged a short answer response and she did not earn additional points—which happened frequently. However, another student with a similar answer to the question made a challenge and was awarded 1.5 points. When the first student protested, she was instructed to present a stronger justification. She wisely used the other student (as an important resource) to assist her in developing her defense. She also earned the additional 1.5 points.

Sometimes, the class would get a bit chaotic and intense as students were excitedly collaborating with each other, thoroughly searching their textbooks and notes, and even looking up concepts on the internet. In one challenge issued by the class, a student pulled up an example on my webpage and stated, "I see why our answer was wrong." The class was quick to begin their justification in a more intense, determined way. I decided at this point to leave the classroom and wait in the hall until they got things "sorted out" and had developed a proper defense. It was about five minutes before I was called back into the classroom. To my surprise, they had graphically drawn the relationship between assets in a portfolio on the board with bulleted explanations. And they had done this on their own volition as a class and they were excited. They had legitimate points and the class earned points back. The cheers, "high-fives," and fist pumping were fun to be a part of. They were "really into," quantitative methods. (Sorry about the colloquialism). It is almost difficult to fathom, but they had joy on the faces and in their body language. It was FUN to be a part of it.

Appendix B

Rules

There were very few rules and these were to maintain some type of order.

- Only one student could speak at a time—sometimes they had to be reminded of this.
- The challenge period was limited to 30 minutes and closely timed.*
- Students had to prepare and delivery a reasonable justification for why I had incorrectly taken points away for their answer.

*The time limit is important so that the students feel some urgency in mounting their challenges as well as not using the challenge event as a stalling technique to avoid having new material introduced later in the class session.

Appendix C

I Did Not….

I did not have many rules. I did not systematically go over each question and discuss it. I did not teach them how to collaborate with the other students. I did not encourage students who had the correct answers to assist their classmates. I did not help them with their justifications. I did not explain what was incorrect about their answers. I did not provide them with a list of resources they could use during the challenge event. I did not give them back points unless they earned them. I did not indicate what methods to use in developing their justification. I did not function as a facilitator. I did not provide a rubric or an outline to guide them in developing their justifications and responses. I did not control their behavior, except to maintain a level of civility. I did not conduct a "deep

modeling" activity, although it was TBD, teaching by doing. (Kohn, 2004). I did not control the class. I did not direct the discussion.

So, what *did* I do? I required that they have some knowledge of the concepts and principles that were being studied. Actually, if they do not have necessary tools based on the concepts or principles of quantitative methods, they will not have a successful challenge. For example, they cannot discuss duality, unless they have been exposed to what it is and the models used to calculate it. In addition, I did function as the expert determining if the challenge was successful and to assign the points earned back.

Appendix D

ANOVA Table: Dependent Variable: grades

LSD

(I) semester	(J) semester	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
f12	s13	-1.8054362	4.1024986	.661	-9.947760	6.336888
	f13	-14.7819239*	4.0513752	.000	-22.822782	-6.741066
	s14	-15.1919741*	3.9622006	.000	-23.055845	-7.328103
	f14	-13.0391169*	3.9622006	.001	-20.902988	-5.175246
	s15	-12.4824503*	5.1701824	.018	-22.743831	-2.221069
s13	f12	1.8054362	4.1024986	.661	-6.336888	9.947760
	f13	-12.9764877*	3.9272906	.001	-20.771073	-5.181903
	s14	-13.3865379*	3.8352320	.001	-20.998412	-5.774664
	f14	-11.2336807*	3.8352320	.004	-18.845555	-3.621807
	s15	-10.6770141*	5.0735350	.038	-20.746577	-.607452
f13	f12	14.7819239*	4.0513752	.000	6.741066	22.822782
	s13	12.9764877*	3.9272906	.001	5.181903	20.771073
	s14	-.4100501	3.7804960	.914	-7.913288	7.093188
	f14	1.7428070	3.7804960	.646	-5.760431	9.246045
	s15	2.2994737	5.0322860	.649	-7.688221	12.287168
s14	f12	15.1919741*	3.9622006	.000	7.328103	23.055845
	s13	13.3865379*	3.8352320	.001	5.774664	20.998412
	f13	.4100501	3.7804960	.914	-7.093188	7.913288
	f14	2.1528571	3.6847717	.560	-5.160395	9.466109
	s15	2.7095238	4.9607757	.586	-7.136243	12.555290
f14	f12	13.0391169*	3.9622006	.001	5.175246	20.902988
	s13	11.2336807*	3.8352320	.004	3.621807	18.845555
	f13	-1.7428070	3.7804960	.646	-9.246045	5.760431
	s14	-2.1528571	3.6847717	.560	-9.466109	5.160395
	s15	.5566667	4.9607757	.911	-9.289100	10.402433
s15	f12	12.4824503*	5.1701824	.018	2.221069	22.743831
	s13	10.6770141*	5.0735350	.038	.607452	20.746577
	f13	-2.2994737	5.0322860	.649	-12.287168	7.688221
	s14	-2.7095238	4.9607757	.586	-12.555290	7.136243
	f14	-.5566667	4.9607757	.911	-10.402433	9.289100

*. The mean difference is significant at the 0.05 level.

References

Austin, H. (2015, April 28). Texas A&M Galveston Professor Irwin Horwitz Flunks His Entire Class. NBC News. http://www.nbcnews.com/news/us-news/texas-university-prof-fails-entire-course-n349431.

Balduf, M. (2009, Winter). Underachievement among college students. Journal of Advanced Academics, 20(2), 274-294.

Barnacle, R. (2009). Gut instinct: The body and learning. Educational Philosophy and Theory, 41(2), 22-33.

Bennett, W. (2013, April 30). The future of higher education in America. Panel discussion at the Milken Institute Global Conference. Los Angeles, CA http://www.milkeninstitute.org/ events/gcprogram.taf?function=detail&eventid=gc13&EvID=4042

Bennett, W. with Wilezol, D. (2013). Is college worth it?: A former United States Secretary of Education and a liberal arts graduate expose the broken promise of higher education. Nashville: Nelson, Thomas, Inc.

Bissonnette, Zac. (2013). Debt-free U: How I paid for an outstanding college education without loans, scholarships, or mooching off my parents. New York: Penguin Group

Bok, D. C. Our underachieving colleges. (2006). Princeton, New Jersey: Princeton University Press.

Braithwaite, R. (2001). Managing aggression. New York: Routledge.

Brint, S., Cantwell, A. M. (2011, March). Academic disciplines and the undergraduate experience: Rethinking Bok's "Underachieving Colleges" thesis. From Center for Studies in Higher Education. Research & Occasional Paper Series: CSHE.6.11, 1-17.

Chomsky, N. (2010). Language and mind, 3rd ed., Cambridge: Cambridge University Press.

De Cruz, H. & De Smedt, J. (2010, December). The innateness hypothesis and mathematical concepts. Topoi, 29, 3-13.

Dodging the power-struggle trap: Ideas for teachers. (n.d.). From Intervention Central. Retrieved May 3, 2013 from http://www.interventioncentral.org/behavioral-interventions/challenging-students/dodging-power-struggle-trap-ideas-teachers

Heller, H. L. (1968, December). Can underachieving college students be helped? Educational Leadership, 281-284.

Honken , N. B., Ralston, P. A. High-achieving high school students and not so high-achieving college students: A look at lack of self-control, academic ability and performance in college. Journal of Advanced Academics, 24(2), 108-124.

Khalidi, M. A. (2007, February). Innate cognitive capacities. Mind and Language. 22(1), 94 – 115.

Kohn, A. (2007, November). Challenging students…And how to have more of them. Phi Delta Kappan. http://www.alfiekohn.org/teaching/challenging.htm

Linsin, M. (2011, April 23). The 7 rules of handling difficult students. Smart Classroom Management. http://www.smartclassroommanagement.com/2011/04/23/7-rules-of-handling-difficult-students

Marcus, G. (2009, November). How does the mind work? Insight from biology. Topics in Cognitive Science, 145- 172.

Moore III, J. L., Ford, D. Y., & Milner. (2005, Spring). Underachievement among gifted students of color: Implication for educations. Theory into Practice, 44(2), 167-177.

Paavola, S & Hakkarainen, K. (2005). Three adductive solutions to the meno paradox—with instinct, inference, and distributed cognition. Studies in Philosophy and Education, 24, 235-253.

Remedial Education's Bridge to Nowhere. (2012, April) Complete College America. https://www.insidehighered.com/sites/default/server_files/files/CCA%20Remediation%20ES%20FINAL.pdf

Terry, N. & Ervin, B. (2012). Student performance on the California critical thinking skills test. Academy of Educational Leadership Journal, Special Issue, 16, 25-34.

Waks, L. J. (2006). Intuition in education: Teaching and learning without thinking. Philosophy of Education property of Philosophy of Education Society, 379-388.

Wight, J. B. (2009, March). Adam Smith on instincts, affection, and informal learning: Proximate mechanism in multilevel selection. Review of Social Economy, 67(1), 95-113.