

Identifying Bias in Education Against Student's Innate Abilities

Introduction

The Basics

This document will describe the research and analysis on the results of the Student Aptitude™ Quiz (SAQ) and Kolbe Self-Efficacy™ Metric (SEM), along with GPA data, from 215 students at a low performing Nevada middle school. The goal of this study was twofold: First, to identify potential educational bias towards (or against) student's innate abilities as measured by the SAQ as it relates to self-efficacy, grades, and academic interests. Secondly, to determine if those metrics can be improved by providing students information about their instinctive strengths as measured by the SAQ, such as providing tips for utilizing natural volitional methods more effectively in school and identifying careers that match those instinctive strengths.

Background

The SAQ identifies the individual's natural volitional methods, which are determined by the conative part of the mind. This functionality is distinct from the cognitive and affective aspects. Cognition refers to the conscious intellectual activity of the brain and is often measured through various tests designed to determine intelligence level. One's intelligence level changes through-out life, based on a myriad of factors such as age and recency to education. Affect refers to the experiencing of feelings, emotions, and moods. Again, this changes through-out life, even hour to hour, depending on various internal and external factors. Conation, from the Latin conat-, meaning "to endeavor, or to try", refers to one's natural way of taking action. Unlike cognition and affect, conation remains constant through-out one's life, as validated by test-retest studies, with some results spanning over 30 years. The SAQ is a validated assessment designed to measure one's conative profile. Further, it is important to understand that no individual's result as measured by the SAQ is better or worse than any other. Every innate method of taking action is equally powerful in creative problem solving. For these reasons, conative bias is an issue of great importance.

The SEM is a validated assessment to measure self-efficacy, defined as a belief in one's ability to take purposeful action to produce desired outcomes. Self-efficacy is a dynamic measurement. Positive self-efficacy indicates that one believes success is likely when given opportunities to exert free will. As such, possessing positive self-efficacy increases the likelihood that students will expend effort to overcome educational challenges. On the other hand, negative self-efficacy has been linked to depressive thoughts and suicidal ideation.

Purpose

As previously stated, the main goal of this study was to identify the trends of potential conative bias in education. Do students with certain innate abilities have higher self-efficacy, or grades, than students with a different set of innate abilities? For this reason, much of the analysis is built upon dividing our sample of students into different groups, with each group representing a particular aspect of an innate ability. These innate abilities are discussed in more depth below, in the definitions section. After grouping, various metrics were calculated across the sub-samples. The analysis section contains information regarding the average self-efficacy, average GPA, and average response to statements about academic beliefs for each sub-sample. Evidence of statistically significant bias to the detriment of students with a particular conative strength would indicate a possible systemic unfairness to students with that profile and an area ripe for school improvement.

Definitions and Methods

Design

The middle school students were studied over the course of one semester. The first step was having students take both the SAQ and SEM without previous knowledge of the full scope of the program or theory behind possible results. Students received the results of their SAQ online immediately after taking the assessment. Included in the results were suggestions for doing better in school tailored to their specific identified natural strengths. Results of the SEM were not shared with students. Students were then taught about their respective SAQ results in a one-hour group setting where they learned more strategies to leverage their natural strengths in school. Students also participated in the OPgig® Career Program, a conatively based assessment that matches students with careers that are in good alignment with their instinctive strengths and career interests. For the purposes of this study, the OPgig

results were not analyzed, but its inclusion is important to mention as the program's ability to show students exciting potential career paths that fit their strengths has proven to be a positive factor in helping students develop a deeper awareness of the importance of their innate volitional drives. Approximately 1 month after the first SEM administration, students took the SEM again. This allowed for tracking of any changes in self-efficacy. Information regarding the student's semester GPA was collected and analyzed.

Definitions

Student Aptitude Quiz: The SAQ is an assessment that identifies students' authentic abilities in each of four conative Action Modes®. Each respondent is given a score on a 1-10 scale in each of the modes. As a note, there is no "perfect score" – this is not a merit-based assessment, and every possible result represents the unique way its user takes action. The four conative Action Modes are:

- Fact Finder (FF) – how one gathers and shares information
- Follow Thru (FT) – how one stores and sorts
- Quick Start (QS) – how one deals with uncertainty and risk
- Implementor (IM) – how one handles space and tangibles

Additionally, the 1-10 scale for each mode is broken into three Zones of Operation. Thus, an example score would consist of 4 numbers (one for each mode), and each of those numbers would place the respondent in a specific Zone for that mode. These Zones are used heavily in the overall analysis to create disjoint sub samples of the data. The three Zones are:

- CounterAct Zone: this is a mode score between 1 and 3. This indicates an ability to resist in the mode as needed.
- ReAct Zone: this is a mode score between 4 and 6. This indicates an ability to accommodate in the mode as needed.
- Initiate Action Zone: this is a mode score between 7 and 10. This indicates an ability to insist in the mode as needed.

The following section lists a brief description of what is meant by having a score in each of the four modes and three Zones (12 Kolbe Strengths):

- People who Initiate Action in Fact Finder focus on the priorities and are driven to be as thorough as possible.

- Someone who ReActs in Fact Finder gets as much information as necessary.
- Those who CounterAct in Fact Finder go right to the heart of things.
- People who Initiate Action in Follow Thru act sequentially and create systems.
- Someone who ReActs in Follow Thru maintains established processes.
- CounterActive Follow Thrus work unburden themselves from prescribed processes and find alternate ways to meet goals and get things done.
- People who Initiate Action in Quick Start act with a sense of urgency and experiment to see what will happen.
- Someone who ReActs in Quick Start tests things out before trying them.
- CounterActive Quick Start energy refuses to be rushed and won't get caught up in competitive deadlines or risky endeavors.
- People who Initiate in Implementor take the time to handcraft solid solutions and smoothly operate things by hand.
- Someone who ReActs in Implementor manipulates things to make them work the way they should.
- Those who CounterAct in Implementor figure things out abstractly.

Lastly, it is possible for a response to compute as a “Seeker” result, also known as “Transition”. This indicates the respondent is not currently able to discern their natural abilities in one or more Action Mode, and is likely trying different approaches to respond to expectations. These results were included in the analysis, but were largely kept in separate sub samples, eliminating any potential noise they introduce to the data.

Kolbe Self-Efficacy™ Metric: The SEM asks respondents to rate statements on a 1 to 7 scale in an effort to identify a measurement of their self-efficacy at the time of administration. The result of this assessment is one number, on the same 1 to 7 scale, with 1 representing low self-efficacy, and 7 represented high self-efficacy. This number is sorted into categories:

- Arrogant
- High Confidence
- Humility
- Low Confidence
- Insecure
- Very Insecure

Additionally, two extra statements were included in the SEM for the participants in this study, but only in the first time taking the SEM:

1. "I like school"
2. "I do well in school"

These statements did NOT contribute to the SEM score, but the responses are analyzed in the analysis section below.

Methods

Multiple analysis methods were deployed to gain insight from the collected data. A primary method to identify trends was the splicing of the overall sample into sub-samples based on a respondent's SAQ Zone placement in a given Action Mode. For instance, when looking to analyze to potential impacts one's FF score has on their SEM score, the sample was split into three subsamples: CounterAct FF, ReAct FF, and Initiate FF.

Multiple pairings of data sets were tested for correlations, including: Action Mode scores, SEM scores, GPAs, and responses to the two additional questions mentioned above.

As a test of statistical significance, unpaired t tests were performed between sets of data from different sub samples of the overall sample. This included such data sets as: SEM scores of Initiate FF vs Counteract FF. Paired t tests were also performed when comparing pre-SEM scores with post-SEM scores.

Frequency tables provide a detailed look at the responses to the two additional questions included on the SEM mentioned above. The sample was sliced by two criteria: first, breaking the data into sets based upon the numerical value reported: responses of greater than or equal to 1, greater than or equal to 2, etc., up to 7. Then, of each of those sets, the percentage likelihood that a given response contained in that set was from a participant who scored in a particular Zone in a particular Action Mode was reported.

Analysis

SEM vs SAQ

Several data subsets were created to identify correlative trends between the SAQ and the SEM (pre). Each involved splicing the overall sample by choosing an Action Mode, and splitting it into its three Zones, plus a 4th group for Seeker(Transition) results.

Self-Efficacy by SAQ Zones

FF				Correlation: 0.118
Zone	Count	Percentage	Average Efficacy	
CounterAct	37	17.2%	4.86	
ReAct	117	54.4%	4.91	
Initiate	55	25.6%	5.06	
Transition	6	2.8%	4.67	

FT				Correlation: 0.152
Zone	Count	Percentage	Average Efficacy	
CounterAct	54	25.1%	4.85	
ReAct	102	47.4%	4.85	
Initiate	50	23.3%	5.14	
Transition	9	4.2%	5.26	

QS				Correlation: -0.063
Zone	Count	Percentage	Average Efficacy	
CounterAct	59	27.4%	4.99	
ReAct	89	41.4%	4.96	
Initiate	46	21.4%	4.85	
Transition	21	9.8%	4.82	

IM				Correlation: -0.176
Zone	Count	Percentage	Average Efficacy	
CounterAct	29	13.5%	5.11	
ReAct	144	67.0%	4.99	
Initiate	36	16.7%	4.59	
Transition	6	2.8%	4.82	

n=215

Figure 1

Figure 1 shows the average score on the SEM for each of these 16 groups, each group being defined by a particular Zone of a particular mode. The figure also shows the correlation coefficient between the Action Mode Zone placement and the SEM score. Both Fact Finder (0.118) and Follow Thru (0.152) display a positive correlation, indicating that as FF and/or FT scores rise, so do SEM scores, whereas Quick Start (-0.063) and Implementor (-0.176) show negative correlations, indicating that as QS and/or IM scores rise, SEM scores fall. Highlighted in each Action Mode’s table is the score of the zone with the

highest SEM average (excluding Transition results). These Zones are Initiate FF, Initiate FT, CounterAct QS, and CounterAct IM.

Unpaired t tests were calculated between different subsets of the overall sample. Table 1 details the p values calculated when performing the t test on the SEM scores across all paired subsets of Initiating zones.

	Fact Finder Initiate (n=55)	Follow Thru Initiate (n=50)	Quick Start Initiate (n=46)	Implementor Initiate (n=36)
Fact Finder Initiate	-	0.6583	0.2493	0.0338
Follow Thru Initiate	-	-	0.0857	0.0077
Quick Start Initiate	-	-	-	0.2440

Table 1

Statistically, two extremely significant differences are found: between Initiating Implementors and Initiating Fact Finders, and between Initiating Implementors and Initiating Follow Thrus. This generally agrees with the numbers found in Figure 1, as those two Initiating Zone pairings had the largest average SEM score differences. In addition, a moderate statistical significance was found between Initiating Follow Thrus and Initiating Quick Starts.

Table 2 details the p values calculated when performing the unpaired t test on the SEM scores between each mode’s Initiating Zone versus its CounterAct Zone.

	Fact Finder Initiate (n=55)	Follow Thru Initiate (n=50)	Quick Start Initiate (n=46)	Implementor Initiate (n=36)
Fact Finder CounterAct (n=37)	0.2730	-	-	-
Follow Thru CounterAct (n=53)	-	0.0883	-	-
Quick Start CounterAct (n=59)	-	-	0.4289	-
Implementor CounterAct (n=29)	-	-	-	0.0379

Table 2

This statistical test shows an extremely significant difference in SEM scores between Initiating IMs and CounterAct IMs, while Follow Thru shows a similar discrepancy, albeit to a smaller degree. The takeaways from the unpaired t tests align with the evidence found when examining the correlation coefficients previously discussed.

Pre-SEM vs Post-SEM

Table 3 shows the distribution of categories of the Post SEM scores, based upon what category the Pre SEM score fell into.

Pre-Result (n)	Post-Result					
	Arrogant	High Confidence	Humility	Low Confidence	Insecure	Very Insecure
Arrogant (3)	67%	33%	0%	0%	0%	0%
High Confidence (7)	14%	43%	29%	14%	0%	0%
Humility (84)	6%	12%	68%	13%	1%	0%
Low Confidence (37)	0%	0%	54%	30%	14%	3%
Insecure (5)	0%	0%	20%	20%	40%	20%
Very Insecure (1)	0%	0%	0%	0%	0%	100%

Table 3

An example on the interpretation of a percentage: 54% of the 37 respondents who fell into the Low Confidence category during the first instance of the SEM moved into the Humility category in the second instance.

A paired t test was also done on the 137 pairs of SEM scores (before and after intervention period). The details are shared in Table 4:

Group	Pre SEM	Post SEM
Mean	4.927	5.070
Std Dev	0.842	0.946
Standard Error of the Mean	0.072	0.081
N	137	137

Table 4

The two tailed p value equals 0.0228, a difference considered to be statistically significant – this shows there is a notable difference between the SEM scores before and after the interventions discussed above, an indication the inventions were successful in improving self-efficacy.

GPA vs SAQ

The same data splicing was done to look at potential GPA trends by SAQ Zone.

GPA by SAQ Zones

FF			
			Correlation: 0.136
Zone	Count	Percentage	Average GPA
CounterAct	37	17.2%	2.71
ReAct	117	54.4%	2.75
Initiate	55	25.6%	2.88
Transition	6	2.8%	2.92

FT			
			Correlation: -0.071
Zone	Count	Percentage	Average GPA
CounterAct	54	25.1%	2.93
ReAct	102	47.4%	2.74
Initiate	50	23.3%	2.80
Transition	9	4.2%	2.35

QS			
			Correlation: -0.025
Zone	Count	Percentage	Average GPA
CounterAct	59	27.4%	2.83
ReAct	89	41.4%	2.66
Initiate	46	21.4%	2.84
Transition	21	9.8%	3.03

IM			
			Correlation: -0.084
Zone	Count	Percentage	Average GPA
CounterAct	29	13.5%	2.91
ReAct	144	67.0%	2.83
Initiate	36	16.7%	2.53
Transition	6	2.8%	2.62

n=215

Figure 2

Figure 2 is formatted in the same way as Figure 1 – except average GPAs are shown in place of average SEM score. Correlation coefficients are positive for Fact Finder, but negative for all other action modes, with the largest negative correlation belonging to Implementor. Initiate FF, CounterAct FT, Initiate QS, and CounterAct IM are the Zones in each Action Mode with the highest average GPA (excluding Transition groups).

Academic Beliefs vs SAQ

The same data splicing was done to look at the responses to the statements “I like school” and “I do well in school.” As a reminder, respondents were asked to assign each statement a score between 1 and 7, dependent on how much they agreed with the statement, during the first SEM.

Academic Beliefs by SAQ Zones

FF				
		Correlation: 0.177		Correlation: 0.133
Zone	Count	Percentage	I like school (1-7 Avg)	I do well in school. (1-7 Avg)
CounterAct	37	17.2%	2.97	4.78
ReAct	117	54.4%	3.16	4.81
Initiate	55	25.6%	3.85	5.11
Transition	6	2.8%	3.33	5.17

FT				
		Correlation: 0.048		Correlation: 0.086
Zone	Count	Percentage	I like school (1-7 Avg)	I do well in school. (1-7 Avg)
CounterAct	54	25.1%	3.21	4.70
ReAct	102	47.4%	3.32	4.93
Initiate	50	23.3%	3.36	5.08
Transition	9	4.2%	3.44	4.56

QS				
		Correlation: -0.092		Correlation: -0.055
Zone	Count	Percentage	I like school (1-7 Avg)	I do well in school. (1-7 Avg)
CounterAct	59	27.4%	3.41	4.95
ReAct	89	41.4%	3.48	4.88
Initiate	46	21.4%	2.98	4.80
Transition	21	9.8%	3.05	5.00

IM				
		Correlation: -0.132		Correlation: -0.129
Zone	Count	Percentage	I like school (1-7 Avg)	I do well in school. (1-7 Avg)
CounterAct	29	13.5%	3.69	5.03
ReAct	144	67.0%	3.36	4.99
Initiate	36	16.7%	2.78	4.42
Transition	6	2.8%	3.33	4.83

n=215

Figure 3

Correlation coefficients in Figure 3 match the patterns seen with SEM scores. Positive correlations were found for both questions with Fact Finder and Follow Thru, and negative with Quick Start and Implementor. Again, the Zone with the highest rating is highlighted for each question in each mode’s table (excluding Transition).

Tables 5 and 6 give a detailed breakdown of the likelihood a respondent is to be in the Initiate Zone of a given mode, in different subsets of the data, based upon how each statement was rated.

Response Breakdown to “I like school”					
	<u>Likelihood to Initiate per Action Mode:</u>				
Responses greater than or equal to:	Fact Finder	Follow Thru	Quick Start	Implementor	Total n
1	26%	23%	21%	17%	214
2	27%	25%	21%	15%	177
3	29%	27%	20%	13%	119
4	34%	23%	19%	11%	97
5	38%	20%	15%	9%	55
6	44%	22%	11%	8%	36
7	40%	10%	0%	20%	10

Table 5

Response Breakdown to “I do well in school”					
	<u>Likelihood to Initiate per Action Mode:</u>				
Responses greater than or equal to:	Fact Finder	Follow Thru	Quick Start	Implementor	Total n
1	26%	23%	21%	17%	214
2	25%	24%	22%	16%	209
3	26%	25%	21%	16%	199
4	27%	24%	21%	14%	180
5	31%	24%	20%	15%	137
6	28%	24%	21%	13%	92
7	31%	38%	31%	6%	16

Table 6

As an example on how to properly read these percentages: for the red number in Table 3 (found on the intersection of the row titled 6 and the column titled Fact Finder), this would be read as: Among respondents who rated this statement a 6 or higher, 44% of them initiate in Fact Finder. As the sample is continually limited to respondents rating each statement at higher and higher agreeance, the percentage of the sample Initiating in Fact Finder increases, while the percentage of the sample Initiating in Quick Start and Implementor decreases.

Conclusions

It is evident from the data that students with higher scores in Fact Finder and Follow Thru tended to have higher self-efficacy, while the inverse was true for Quick Start and Implementor. This finding is supported by the significant differences among Initiating Implementors compared to both Initiating Fact Finders and Follow Thrus, as well as between Initiating and CounterAct Implementors. While other modes did not have p values of less than .05, there is a clear trend of a positive correlation between self-efficacy and scores in Fact Finder and Follow Thru. There was a negative correlation in the Quick Start and Implementor modes.

Paired t-test of SEM results before and after the intervention period show a statistically significant difference between the two sets of results. This indicates the material shared with students was successful in promoting self-efficacy. Fifty-four percent of the 37 students whose initial SEM results reported low confidence improved to a result of humility after learning about their conative strengths.

With respect to GPA vs SAQ results, similar trends were found in Fact Finder and Implementor. Initiating Fact Finders and CounterAct Implementors had some of the highest sub sample average GPAs. This GPA data was gathered over a short period of time, so further research is warranted to gain a better understanding of potential impacts an SAQ result may have on GPA.

Very similar patterns are found when looking at the two additional questions on student perceptions of their school experience included in the first SEM when compared to SAQ results. Again, positive correlations exist among the statements for Fact Finder and Follow Thru, with negative correlations for Quick Start and Implementor. Key findings from these responses include:

- Initiating FFs report a 30% higher score for “I like school” than CounterAct FFs
- Initiating FTs reported 5+% higher scores for both statements than CounterAct FTs
- CounterAct IMs report a 33% higher score for “I like school” than Initiating IMs
- CounterAct Qs report a 14% higher score for “I like school” than Initiating Qs

When looking at the detailed response breakdowns in Table 5 and 6, there is more evidence that shows Initiating FFs and FTs disproportionately have more expressed interest and confidence in academics. Of those that rated the statement “I like school” a 6 or higher, 44% initiated in FF, compared to just 11% in QS, and 8% in IM, a more than 4x difference.

There are clear patterns, including statistically significant results, that indicate Initiating FF and FT have higher self-efficacy, interest in school and self confidence in school than the average student. The

opposite trend is seen for Initiating Qs and IMs. There is also statistically significant evidence showing that explaining SAQ results to students can increase self-efficacy. The identification of these trends of conative bias suggest that certain students are victim to a bias in school that hampers the expression of their natural volitional efforts. This study clearly demonstrates that students who Initiate Action through the Implementor mode, and to a somewhat lesser extent in the Quick Start mode are negatively impacted at school. Intervention, through learning about their innate conative strengths, can improve their self-efficacy and would likely increase the efforts they make towards learning.