



Mind the Gap: Investigating cognitive dissonance and self-esteem correlations in academia

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Abstract

This study investigates the relationship between cognitive dissonance and changes in academic self-esteem. Theoretical evidence, such as Aronson's Self-Consistency Theory, reinforces the role of self-esteem in the cognitive dissonance process. However, despite extensive research on this theory, few extant studies have investigated how dissonance affects self-esteem, a key assumption within Aronson's framework. This study employed statistical analyses to explore how cognitive dissonance predicts changes in academic self-esteem. A sample of thirty-five 11th and 12th-grade Early College Experience (ECE) students, enrolled in a statistics course, provided data on their cognitive dissonance levels through the difference between their actual and expected performance task scores. They also responded to the Academic Self-Esteem Scale, a seven-question, five-point Likert scale, to assess their academic self-esteem. After receiving their initial performance scores, they completed another survey, revealing the predictive impact of cognitive dissonance on the change in academic self-esteem. The study's findings indicated that cognitive dissonance significantly predicted changes in academic self-esteem. This result empirically supports a key theoretical relationship within the Self-Consistency Theory, enhancing its credibility and implications. The discussion focuses on the psychological implications that Aronson's theory offers, situating them within an academic context.

Keywords

Cognitive dissonance, Dissonance, Self-esteem, Cognitive consistency, Self-Consistency Theory, Academic Self-Esteem Scale, Consonance, Dissonance reduction, Rationalization, High decision freedom

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1. Introduction

Leon Festinger's theoretical framework of cognitive dissonance, a cornerstone in psychology, proposes that when an individual holds two or more relevant but inconsistent elements of knowledge, it creates a state of discomfort called cognitive dissonance, or more simply, dissonance (1). These elements, or cognition, include attitudes, behaviors, social norms, and communications, making virtually any perceivable phenomenon relevant to Festinger's theory. This theory delineates cognitive relationships into irrelevant, dissonant, and consonant relations. Irrelevant relations occur when cognition bear no overt influence on each other, dissonant when they contradict and cause discomfort, and consonant when they fit well together (1). The latter two relationships form the basis of dissonance theory, which underscores the psychological discomfort dissonant relations instill and the innate motivation to rationalize inconsistencies to achieve consonance.

To elucidate the behavioral implications of this theory within an academic context, consider an individual who values their intellectual competence yet performs poorly on an exam. This contradiction induces psychological discomfort, motivating the individual to either rationalize the unsatisfactory performance or reassess their self-perception. This example illustrates a negative discrepancy, wherein an individual's performance falls below their expectations, eliciting cognitive dissonance that necessitates either action justification or self-concept revision. Conversely, a positive discrepancy may arise when performance exceeds expectations, prompting re-evaluation of prior standards. Such cognitive adjustments illustrate the fundamental mechanism of

dissonance reduction, wherein individuals strive to reconcile conflicting beliefs and behaviors, often leading to adaptive or maladaptive coping strategies.

In light of this phenomenon, this study addresses a critical gap in dissonance research. In particular, Aronson's Self-Consistency Theory suggests that dissonance may impact self-esteem prior to rationalization efforts (2,3). Despite this theory, few studies have investigated the influence of cognitive dissonance on short-term self-esteem. Given the theoretical relationship between dissonance and self-esteem, confirming this connection empirically would support Aronson's theory. This leads to the question, "To what extent does cognitive dissonance predict changes in academic self-esteem in high school students?" Therefore, this study aims to elucidate the extent to which dissonance-related mechanisms contribute to short-term academic self-esteem, a sense of self-worth tied to academics. The contributions of this research advance the theoretical understanding of cognitive dissonance and self-esteem. Specifically, by evaluating the existence of a relationship between cognitive dissonance and changes in academic self-esteem, this study confirms a key assumption of Self-Consistency Theory, enhancing the credibility of this theory and its implications.

1.1 Study overview

To address this study's research question, the literature review first examined Festinger's Cognitive Dissonance Theory, explaining the psychological tension and drive to reduce inconsistency. It then examined the necessary conditions for dissonance to occur. By exploring the theory's foundational principles

and these conditions, the review highlighted a framework for effectively capturing this phenomenon in research. Subsequently, the review explored the relationship between dissonance and self-esteem through the lens of the Self-Consistency Theory. This theory illustrates the motivational drive to maintain self-worth in the face of dissonance, providing a basis for examining the relationship between dissonance and changes in academic self-esteem.

The methodology built upon these theoretical foundations, employing a quantitative research design to examine how dissonance predicts changes in academic self-esteem. After confirming the presence of necessary dissonance conditions, cognitive dissonance was measured by subtracting students' initial score expectations from their actual assessment scores. Academic self-esteem was assessed using the Academic Self-Esteem (ASE) Scale. Additionally, the procedure involved a pre- and post-assessment ASE scale to capture changes in academic self-esteem following the performance discrepancies. Data analysis employed two t-tests to examine whether positive and negative discrepancies corresponded to increases and decreases in academic self-esteem respectively. Since these opposing directional effects would suggest a systematic relationship between cognitive dissonance and academic self-esteem shifts, regression analysis offered a means to quantify the strength and predictability of this association. A simple linear regression was thus employed to determine the extent to which cognitive dissonance predicted changes in academic self-esteem, providing empirical evidence to address the research question.

Finally, given the confirmation of the relationship between dissonance and academic self-esteem, the discussion focused on the implications of Self-Consistency Theory within an academic context. It explored how discrepancies between students' self-concepts and their actual performance could motivate behavioral changes aimed at restoring consonance. The findings suggested that, regardless of whether students perceived themselves as underperforming relative to their expectations or excelling beyond them, dissonance prompted efforts to restore alignment between their academic self-concept and performance. This process underscored the dynamic role of self-consistency in academic motivation, demonstrating how students actively regulate both their behaviors and perceptions to manage cognitive dissonance across varying contexts.

2. Literature review

2.1 Cognitive Dissonance Theory

For nearly seven decades, Cognitive Dissonance Theory has guided psychologists in understanding how individuals experience and attempt to reduce discrepancies in their beliefs and actions. By examining the uncomfortable tension, termed dissonance, that emerges from incongruent beliefs and actions, this theory explains how individuals strive for cognitive consistency and psychological equilibrium. Consequently, it has advanced human understanding of the inherent drive for internal consistency and its influence on human conduct.

2.1.1 *Original dissonance theory*

At its core, Festinger's original dissonance theory highlights the psychological tension

when an individual encounters conflicting cognition states (4). These conflicting cognition states can stem from a disparity between attitudes, beliefs, values, or behaviors, leading to discomfort. Such inconsistencies lead to dissonance induction, which refers to the process of creating a state of cognitive dissonance by recognizing an inconsistency among cognition states.

Festinger further theorized that dissonance causes a drive reduction by creating uncomfortable tension that must be reduced (5,6). This human drive to reduce inconsistency is akin to relieving thirst or hunger, often leading to rationalization efforts. These efforts include altering one's attitudes or beliefs, seeking new information to outweigh the dissonant cognition, or downplaying the importance of the inconsistency. Dissonance research reveals that this attitude change aligns with the cognition most resistant to change (7). This suggests that individuals tend to adjust less firmly held attitudes to align with more entrenched beliefs or behaviors.

Festinger also introduced another key dissonance concept; the idea of varying magnitudes (8). When it comes to these magnitudes, Festinger suggested that the amount of dissonance experienced is proportional to the importance of conflicting cognition sources and the degree of disparity between them. The greater the disparity between cognition sources and the more significant they are to an individual, the stronger the dissonance and the greater the motivation to reduce it. Within the current study, this principle allows for the quantification of experienced dissonance based on the degree of discrepancy between students'

expected and actual performance scores. This provides a theoretically consistent measurement of dissonance when examining how well cognitive dissonance predicts changes in academic self-esteem.

In 1959, Festinger and Carlsmith began their first experiment with dissonance to prove dissonance theory (9). They induced participants to perform a monotonous task, offering them varying sums of money to persuade others that they enjoyed the task. Participants who received less compensation experienced greater dissonance as they altered their beliefs about task enjoyment to align more closely with their prior claims. This behavior reflects the impact of inconsistent cognition sources on the magnitude of discomfort and ensuing attitude change. Conversely, those with higher compensation better justified the attitude-behavior discrepancy, leading to lower dissonance and attitude change.

2.1.2 *Extensions and modifications*

Subsequent research expanded Festinger's Cognitive Dissonance Theory by examining necessary conditions for dissonance, including high-decision freedom, irrevocable commitment, and foreseeable aversive consequences. Ensuring these conditions enhances the likelihood of effectively capturing cognitive dissonance in research, considering their potential moderating role in the dissonance effect. Therefore, recognizing these foundational elements provides a framework for comprehensively examining the extent to which dissonance predicts changes in academic self-esteem within this study.

High-decision freedom

Rosenberg set out to disprove dissonance

theory by replicating Festinger and Carlsmith's experiment (10). He instructed participants to write counter-attitudinal essays for varying monetary incentives and found opposite results; higher compensation led to greater dissonance. However, as scholar Joel Cooper points out, Rosenberg mandated participants to write counter-attitudinal essays, contrasting with Festinger and Carlsmith's methodology, wherein participants voluntarily made counter-attitudinal statements (11). Researchers Linder, Cooper, and Jones tested this free-choice paradigm and found that decision freedom critically moderated the dissonance effect (12). Their findings indicate that the dissonance effect hinges on the participants' high-decision freedom.

Irrevocable commitment

Similarly, Davis and Jones demonstrated that cognitive dissonance emerges exclusively under conditions of high commitment, characterized by individuals' public commitment to a stance with no subsequent opportunity for rectification (13). For instance, if a student recorded score expectations and received a lower score than expected, they would only experience dissonance given an inability to change their recorded expectation after receiving the outcome score. Conversely, students may not have experienced dissonance if their teacher allowed them to revise their expectations after a practice test for a subsequent test. Therefore, to experience dissonance, individuals must make a commitment that is difficult to reverse, as the resulting social or personal consequences amplify psychological discomfort. Davis and Jones' work underscores the necessity of irrevocable commitment for dissonance induction.

Aversive or unwanted consequences

Later, Cooper and Worchel replicated Festinger's study and discovered an inverse relationship between incentive magnitude and attitude change, contingent upon the communicator persuading another to adopt a counter-attitudinal stance (14). Their controversial findings revealed that cognitive dissonance arises solely under conditions of aversive or unwanted consequences. Researchers Goethals, Cooper, and Naficy note that this aversive consequence must be foreseeable at the time of the participants' decision (15).

2.2 Self-Esteem

Having discussed the overarching principles of Cognitive Dissonance Theory, the review's focus now shifts to the concept of self-esteem and its relation to dissonance theory. First, Rosenberg defines self-esteem as an individual's evaluation of their self-worth (16). In academic environments, self-esteem represents students' perception of their academic abilities, behaviors, and worth. This self-perception also plays a pivotal role within Cognitive Dissonance Theory.

2.2.1 Self-Esteem and dissonance

In particular, cognitive dissonance not only encompasses the discomfort arising from conflicting cognition sources but also implies an effect on self-esteem (17). If dissonance threatens an individual's self-concept, it prompts a need to restore internal consistency and preserve self-esteem. In fact, Aronson's Self-Consistency Theory substantiates that the motivational drive for reducing dissonance intrinsically relates to reaffirming self-esteem. It is important to note that this theory agrees with Festinger's original dissonance theory in

that a negative drive state arises from discrepancies in cognition sources, prompting reaffirmation. However, it differs in its emphasis on the nature of this drive state. This theory argues that this drive state is related to the self and maintaining self-worth in the face of negative discrepancies, rather than solely alleviating cognitive discomfort. This discussion is important because it highlights the theoretical relationship between dissonance and self-esteem, providing a basis for investigating how dissonance predicts changes in academic self-esteem in the current study.

Self-Consistency Theory

Specifically, Aronson's Self-Consistency Theory radically proposes that dissonance arises exclusively when individuals act against their self-esteem (18,19). This theory posits that individuals generally view themselves as competent, rational, and moral; thus, dissonance arises when their behavior contradicts this positive self-view. This contradiction motivates individuals to reaffirm their self-esteem regarding this discrepancy, enabling the exploration of the impact of dissonance on self-esteem (20). This framework further emphasizes that dissonance manifests not only in negative discrepancy instances, where actions undermine individuals' self-concept, but also through positive discrepancies, where actions challenge previously held lower self-views. While both forms of discrepancy contribute to self-perceptual adjustments, the prevailing literature primarily examines negative discrepancies, as researchers more often link them to self-concept threats.

2.2.2 The gap

Despite the extensive research on self-related theories of dissonance, the inherent theoretical relationship between dissonance and self-esteem remains unexplored. Specifically, Aronson's theory emphasizes that dissonance, arising through self-standard discrepancies, prompts the reaffirmation of one's self-esteem. It then follows that experiencing dissonance may impact one's self-esteem prior to this rationalization. If this theoretical proposition is true, an inherent relationship between dissonance and self-esteem should exist. Confirming its existence would provide empirical evidence to support this theory and its implications. Therefore, this study aims to empirically validate the proposed relationship.

2.3 Current study

The current study attempts to elucidate the correlation between cognitive dissonance and the changes in academic self-esteem. This study addresses the insufficient research on dissonance's impact on self-esteem, thereby providing crucial support for the Self-Consistency Theory. Accordingly, this study empirically examines both positive and negative discrepancies to determine their respective predictive influence on academic self-esteem shifts. By exploring this dynamic, this study seeks to provide invaluable insights into the predictive efficacy of dissonance, addressing the question, "To what extent does cognitive dissonance predict changes in academic self-esteem in high school students?"

2.3.1 Hypothesis

The study formulated the following hypothesis to investigate the relationship between cognitive dissonance and changes in academic self-esteem.

Hypothesis 1 (H1): Consistent with Self-Consistency Theory, cognitive dissonance predicts directional changes in academic self-esteem; that is, negative discrepancies correspond with decreases in self-esteem, while positive discrepancies correspond with increases, with the magnitude of the discrepancy influencing the extent of the change.

3. Materials and Methods

Building upon these theoretical foundations, a quantitative research design was employed to examine the relationship between cognitive dissonance and changes in academic self-esteem. This study investigated whether cognitive dissonance predicted variations in short-term academic self-esteem.

3.1 Participants

The participants consisted of three Early College Experience University of Connecticut statistics classes, composed of 35 high school juniors and seniors. Students were selected through convenience sampling based on enrollment in the statistics class, providing a homogeneous sample for assessing academic self-esteem and performance. The sample excluded students who did not obtain parental consent or those with irregular attendance.

3.2 Ethical considerations

The study received IRB approval to comply with ethical standards, with the school principal approving the study proposal and informed consent forms, and the school psychologist authorizing the survey instruments. The participants necessarily returned these consent forms, which detailed the study's purpose, ensured confidentiality, and underscored the

voluntary nature of participation. The statistics teacher then assigned unique participant numbers to maintain confidentiality, with only they being privy to the corresponding student identities. Participants also received comprehensive verbal and written briefings on the voluntary nature of their responses.

3.3 Measurements

Cognitive dissonance measurement

Following preliminary considerations, cognitive dissonance was measured through the difference in students' initial score expectations on a performance task and their corresponding achieved performance scores. Specifically, dissonance was calculated by subtracting the expected score from the outcome score. Liu demonstrated the efficacy of measuring cognitive dissonance through the difference between participants' expected and actual grades, supporting this study's approach (21). This measurement demonstrated practical application as it enabled the quantification of the magnitude of dissonance relative to other participants. For instance, a student who received an outcome score two points lower than their expected score should, by Cognitive Dissonance Theory, experience more cognitive dissonance than one who held a similar value in academics but received an outcome score only one point lower than their expected score. Likewise, students whose outcome scores exceeded their initial expectations would also experience dissonance, with greater positive discrepancies reflecting greater levels of cognitive dissonance. To clarify whether the dissonance experienced resulted from a positive or negative discrepancy, the study represented positive discrepancies with positive

integers and negative discrepancies with negative integers.

To further assure the reliability of this measurement, the presence of the previously established conditions for dissonance induction was confirmed (see Section 2.1.2). Affirming these conditions ensured that dissonance should occur based on prior research. First, participants freely formed their expectations, fulfilling the high decision-freedom condition. Second, students committed to expected grades, recording them on a non-alterable survey. Third, students faced the unwanted outcome of underperformance, fulfilling the aversive consequence condition. Lastly, students held the possibility of not meeting their expectations, aligning with the requisite condition of foreseeable aversive consequences.

Finally, ensuring that the observed academic self-esteem shifts reflected pre-rationalization effects was critical to accurately capturing its theoretical relationship with cognitive dissonance. This was accounted for by operating under the widely held assumption in cognitive dissonance research that rationalization processes predominantly occur through slower, reflective post-decision evaluations minutes after dissonance induction (22). In contrast, Jarcho suggests that rationalization mechanisms may occur more rapidly, as an immediate response to dissonance (23). However, the rapid rationalization observed in some studies often pertains specifically to decision-making scenarios, where individuals must choose between two equally satisfactory options. In such cases, individuals resolve cognitive dissonance quickly by adjusting attitudes to

align with the chosen option. While this study cannot entirely rule out rapid rationalization, it focused on dissonance arising from discrepancies in academic performance rather than decision-making contexts. By measuring academic self-esteem changes immediately after participants received their performance expectations and outcomes, this study aimed to capture responses prior to substantial rationalization efforts, ensuring that the observed academic self-esteem changes reflected pre-rationalization effects.

Academic Self-Esteem measurement

Secondly, when determining how best to measure academic self-esteem, the ubiquitous Rosenberg Self-Esteem Scale (RSES) was initially considered. However, this scale failed to address domain-specific academic self-esteem. Academic self-esteem provides a more accurate depiction of self-esteem in the academic context, specifically concerning performance and abilities (24). Given that dissonance arose from discrepancies between academic performance expectations and outcomes, measuring academic self-esteem rather than global self-esteem offered a more contextually accurate and reliable assessment in the academic setting.

This study, instead, utilized the Academic Self-Esteem (ASE) Scale to measure academic self-esteem (25). This scale is a 5-question, 7-item Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Lower and higher scores on this scale indicate lower and higher academic self-esteem respectively. Scores range from seven to thirty-five and comprise the sums of each question. The change in academic self-esteem was calculated by subtracting the first ASE score from the

second. To evaluate reliability, Tiwari reported a Cronbach's alpha of 0.84, which indicated that the items within the scale highly correlated and measured the same construct (25). For validity, Tiwari demonstrated that this scale strongly correlated with academic achievement, a well-established relationship within research (25,26).

Academic performance measurement

Finally, this study assessed academic performance scores using a formative assessment comprising twelve normative statistics questions, scored at two points each, for a total of twenty-four points. The statistics teacher developed the assessment based on previous lessons to assess students' statistics proficiency. Specifically, the assessment evaluated the participants' knowledge and understanding of learned course material, ensuring that all content was familiar to the students. This approach aimed to accurately measure the participants' academic performance without introducing new or unfamiliar material, thereby providing a reliable assessment of ability.

3.4 Methods

As part of the initial setup, the study was introduced to the participants, which involved explaining the sequence of tasks they would need to complete for session one. These tasks included filling out the first Academic Self-Esteem Scale, recording expectations for the assessment, and completing the assessment. Afterward, the statistics teacher administered the first survey, which included the Academic Self-Esteem Scale and a question for assessment score expectations. Meanwhile, verbal and written instructions were issued, clarifying the nature of the academic self-

esteem questions and assessment score expectations. Afterward, participants completed this survey. Once the statistics teacher collected all completed surveys, they administered the assessment, consisting of twelve multiple-choice statistics questions, allocating the students fifteen minutes for completion.

Three days later, during the subsequent session, participants received a second survey which presented each student's expected and outcome grades from the first assessment, inducing dissonance. Immediately upon receiving their scores, participants completed the Academic Self-Esteem Scale to measure changes in academic self-esteem. This sequencing ensured that the academic self-esteem measurement occurred directly after exposure to the dissonance-inducing event, reducing the likelihood of rationalization processes significantly influencing responses. Participants were once again instructed regarding these academic self-esteem questions.

3.5 Data analysis

Following data collection, the Google Sheets functions were utilized to analyze the assembled data and investigate the relationship between cognitive dissonance and academic self-esteem changes. To establish the preliminary directional influence of cognitive dissonance on academic self-esteem, as outlined in the hypothesis, two paired t-tests were conducted first. These analyses examined whether positive discrepancies corresponded with significant increases in academic self-esteem and conversely; whether negative discrepancies corresponded with significant decreases, laying the foundation for a

subsequent regression analysis that quantified the broader predictive relationship. This simple linear regression then assessed the extent to which cognitive dissonance predicted the changes in academic self-esteem overall, encompassing both negative and positive discrepancies.

Next, the regression examination focused on two key statistical measures: the regression coefficient and the coefficient of determination. The regression coefficient (β) of this analysis quantified the overall relationship between cognitive dissonance and changes in academic self-esteem. Specifically, a positive β indicates that greater positive discrepancies, or positive values, corresponded with increases in academic self-esteem, whereas greater negative discrepancies, or negative values, corresponded with decreases, with the converse occurring for a negative β . Next, the coefficient of determination (R^2) reflects the proportion of variance in academic self-esteem changes that cognitive dissonance explained, demonstrating the overall predictive power of the regression model.

4. Results

4.1. Introduction

Having established the methodological framework and data collection procedures, the following analysis examines the statistical relationship between cognitive dissonance and academic self-esteem changes. This allows for a robust assessment of the research question: “To what extent does cognitive dissonance predict changes in academic self-esteem in high school students?” It was hypothesized that cognitive dissonance predicts shifts in academic self-esteem, with larger negative discrepancies leading to greater decreases and larger positive discrepancies resulting in more pronounced increases.

4.2. Descriptive statistics

Table 1 shows the descriptive statistics for the study. These statistics provide a concise summary of the major variables in relation to the sample. For clarification, “Overall Cognitive Dissonance” represents a composite measure incorporating both positive and negative discrepancies, offering a general representation of dissonance levels across the sample rather than isolating individual effects. For a more detailed breakdown of specific statistical values, including individual means and standard deviations, refer to Table 3.

Table 1. Summary of descriptive statistics (n=35)

	Mean	SD
Overall Cognitive Dissonance	-1.971	3.907
Academic Performance Scores	16.057	3.678
Academic Performance Expectations	18.029	2.985
Change in Academic Self-Esteem	-1.571	2.758

Table 2 shows the internal consistency of the extent to which items within a scale ASE scale. Internal consistency refers to the consistently measure the same underlying

construct. Cronbach's alpha assesses this internal consistency. Values of Cronbach's alpha range from 0 to 1, with higher values indicating greater consistency. Both scales demonstrate high internal consistency, indicating the reliability for academic self-

esteem measurements. The high Cronbach's alpha ($\alpha = 0.897, 0.867$) values suggested that the items within each scale are highly correlated and effectively measure the same underlying construct.

Table 2. Internal reliability of administered ASE scales (n=7)

Scale	Cronbach's Alpha
ASE Scale No. 1	0.897
ASE Scale No. 2	0.867

4.3. Paired T-tests

To assess the hypothesized directional effects of cognitive dissonance on academic self-esteem, paired t-tests were conducted to determine whether individuals exhibited increases or decreases in academic self-esteem by discrepancy type. Before proceeding to these analyses, Table 3 presents the descriptive statistics for academic self-esteem measures

across positive and negative discrepancies, summarizing the distributions that provide context for evaluating these effects. As shown in this table, "Before" shows the academic self-esteem score measured prior to the formative assessment, whereas "After" represents the academic self-esteem score following its completion.

Table 3. Paired T-tests descriptive statistics

Metric	Negative Discrepancy		Positive Discrepancy	
	Before	After	Before	After
Academic Self-Esteem Timing				
Mean	27.25	24.375	28	30.333
SD	4.346	4.576	5.138	3.983

4.3.1. Assumptions

The Shapiro-Wilk test was then used to evaluate whether the difference between pre- and post-assessment academic self-esteem scores met the normality assumption, ensuring that the paired t-tests were suitable for analyzing shifts in academic self-esteem. A p-value > 0.05 indicates that the distribution does not significantly deviate from normality,

supporting the suitability of the statistical analysis. Results from the Shapiro-Wilk test, shown in Table 4, confirmed this condition, with negative discrepancies yielding a p-value of 0.129 and positive discrepancies producing a p-value of 0.257. As the assumption is satisfied, the paired t-tests provided a reliable basis for examining academic self-esteem changes following each respective discrepancy.

Table 4. Shapiro-Wilk test for normality of differences

	n	Test Statistic	p-value
Negative Discrepancy	24	0.933	0.129
Positive Discrepancy	6	0.868	0.257

4.4.2. Paired T-tests' results

With this assumption confirmed, paired t-tests were performed for both the positive and negative discrepancies to evaluate the directional effects of cognitive dissonance on changes in academic self-esteem. These analyses directly assessed the study's hypothesis, which predicted that negative discrepancies would correspond with decreases in academic self-esteem, while positive discrepancies would correspond with increases. Results, presented in Table 5, indicate that

academic self-esteem significantly changed following dissonance for each discrepancy type. Specifically, for negative discrepancies, the paired t-test showed a significant decrease ($\bar{x} = -2.875$, $p < 0.001$), while for positive discrepancies, the test found a significant increase ($\bar{x} = 2.333$, $p = 0.0457$). These findings support hypothesis H1, indicating that negative discrepancies correlate with declines in academic self-esteem scores, while positive discrepancies correlate with increases.

Table 5. Paired T-test results summary

	n	Test Statistic	p-value	Mean Difference ($\bar{x}$)	SD of Difference
Negative Discrepancy	24	-7.342	<0.001	-2.875	1.918
Positive Discrepancy	6	2.646	0.0457	2.333	2.1602

4.4. Linear regression

The results of the paired t-tests provided conclusive evidence for the directional shifts predicted in hypothesis H1, demonstrating that academic self-esteem decreased and increased respectively following negative and positive discrepancies. However, confirming the full scope of the hypothesis required examining the extent to which the discrepancy magnitude influenced the degree of academic self-esteem change. To address this, a linear regression analysis was performed to determine whether larger discrepancies correspond to

proportionally greater shifts in academic self-esteem and vice versa. Building upon the findings from the t-tests, this approach enabled a more comprehensive evaluation of cognitive dissonance's predictive role in shaping academic self-esteem.

4.4.1. Linear regression assumptions

Prior to performing the primary regression analysis, all requisite data assumptions were verified for a valid interpretation of the results. Ensuring the assumptions of linearity, independence, homoscedasticity, and normality

demonstrated the suitability, accuracy and reliability of the regression model. This increased the robustness of the analysis, allowing for a precise evaluation of how cognitive dissonance predicted changes in academic self-esteem.

Linear assumption

Linearity within the regression of academic self-esteem changes on cognitive dissonance was measured.

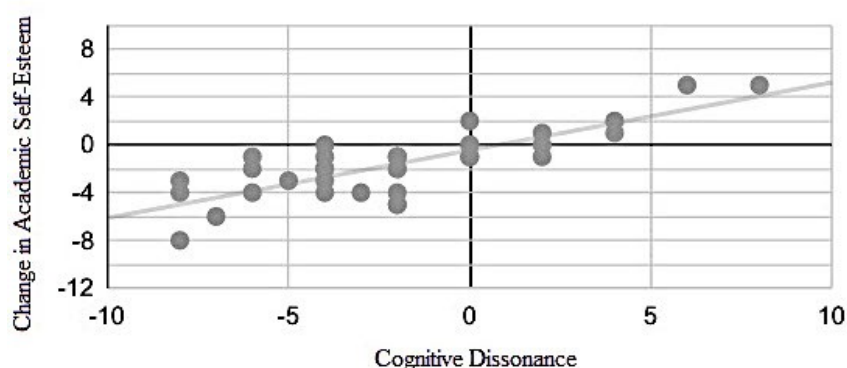


Figure 1. Correlation between cognitive dissonance and the change in academic self-esteem

As Figure 1 shows, the main regression line indicates that the relation between dissonance and changes in academic self-esteem was linear, confirming that a linear model could explain the correlation.

Independence assumption

The independence assumption asserts that residuals in the regression model should be randomly distributed, ensuring that spatial groupings do not influence the detected correlation. Residuals quantify the difference between the observed values and the values predicted by the regression lines. For this

assumption to hold true, these errors should not show any specific pattern among the studied groups. The spatial autocorrelation was analyzed within each class to ensure residual independence within the three sampled classes. Residuals for each class were divided into a binary negative and positive; then the tendency for individuals in the same group to have residuals of the same sign was examined (27). Table 6 shows the results for each class. The groups tended to have relatively even negative and positive residuals, suggesting no correlation between the error signs and class.

Table 6. Negative vs. positive residual trends among classes

Metric	Class 1	Class 2	Class 3
Positive Occurrence	8	5	6
Negative Occurrence	6	6	4

Homoscedasticity

Homoscedasticity assumes that the residual errors should have constant variance across all levels of the fitted values, thereby implying no correlation among the residuals. This allows for equal reliability of the model's predictions across the entire range of predicted values. To evaluate the assumption of homoscedasticity, the Breusch-Pagan test was conducted, using Python's stats model package, for dissonance and the change in academic self-esteem. The commonly accepted significance level for this test is 95%, indicating that if the p-value > 0.05, no significant correlation exists. The Breusch-Pagan resulted in a statistic of 1.782 and a p-value of 0.182. Since the p-value > 0.05 significance level, the residuals had no

significant correlation.

Normality

Lastly, normality of residuals assumes that the errors of the regression model should follow a normal distribution. This assumption ensures that the spread of residuals around the mean follows a bell curve. The assumption of normality was assessed using the Normal Q-Q plot, which compares the residual distribution to a normal distribution. The plot shows how the actual data points align with the theoretical normal distribution line. In Figure 2, the residuals closely follow the straight line, suggesting approximately normally distributed residuals. This alignment indicates that the assumption of normality is satisfied.

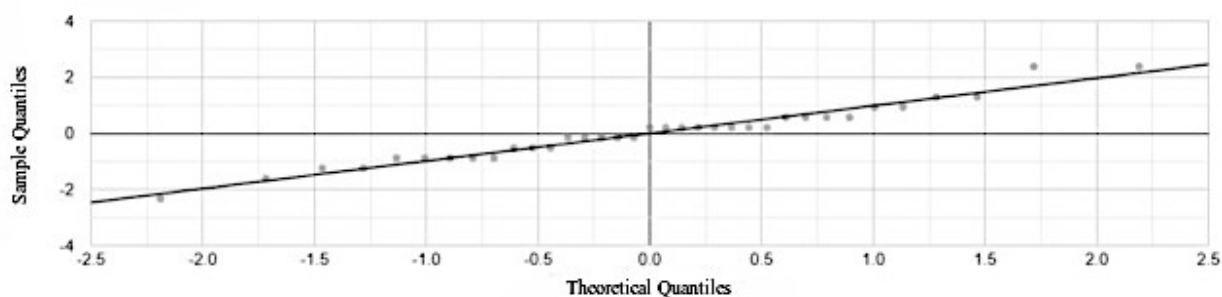


Figure 2. Normal Q-Q plot for change in academic self-esteem

4.4.2 Primary regression analysis

To examine hypothesis H1, which posited that cognitive dissonance predicts shifts in academic self-esteem, with larger negative and positive discrepancies leading to greater decreases and increases respectively, a simple linear regression model was employed. Academic self-esteem changes were regressed on cognitive dissonance. This model quantifies the degree to which larger discrepancies correspond to proportionally greater changes in academic self-esteem, providing a more precise

test of the hypothesized relationship. By regressing changes in academic self-esteem scores on discrepancy magnitude, the analysis determined whether cognitive dissonance functions as a significant predictor of academic self-esteem changes. The fitted regression model was $Y = -0.4524 + 0.5676X$ (eq1), where Y is the response variable (change in academic self-esteem), X is the predictor variable (cognitive dissonance).

To examine how well cognitive dissonance predicts changes in academic self-esteem, the model fit was first examined. The model summary in Table 7 indicates that the regression model provided a good fit for the data. The coefficient of determination (R^2) measures how well the predictor variable explains the variance in the response variable. An R^2 value of 1 means that the predictor

variable accounts for all the variance in the response variable. Conversely, a value of 0 indicates that the predictor variable does not explain any of the variance in the response variable. An R^2 value of 0.647 suggests that approximately two-thirds of the variance in academic self-esteem changes may be explained by dissonance using a linear model.

Table 7. Model summary

Metric	Value
Correlation Coefficient (R)	0.804
R-squared (R^2)	0.647
Adjusted R^2	0.636
Standard Error of Estimates (S)	1.664
Mean Squared Error (MSE)	2.611

The magnitude of the relationship between cognitive dissonance and changes in academic self-esteem was also examined. In regression analysis, regression coefficients (β) represent the magnitude and direction of the relationship between the independent and dependent variables. As shown in Table 8, the positive coefficient (0.568) indicates that greater cognitive dissonance is associated with a more pronounced shift in self-esteem, where negative discrepancies correspond to decreases and positive discrepancies correspond to

increases.

For significance, this study utilized a 95% confidence level since it is the most common significance level to ensure that the results are not due to random chance. Therefore, a p-value < 0.05 was indicative of statistical significance. The overall regression was statistically significant ($p < 0.001$). The strong negative and statistically significant correlation between dissonance and academic self-esteem supports hypothesis H1.

Table 8. Main regression table

Predictor Variable	Coefficient (β)	Standard Error	t-Statistic	p-Value	95% Confidence Interval
(Constant)	-0.4524	0.32	-1.43	.162	[-1.1, 0.19]
Cognitive Dissonance	0.568	0.073	7.77	<0.001	[0.419, 0.716]

4.5. The role of initial academic self-esteem in academic self-esteem shifts

Before interpreting these significant findings, it is important to consider whether students' initial academic self-esteem influenced their academic self-esteem shifts. To examine this, a correlation analysis was performed between the

initial academic self-esteem and the change in academic self-esteem (Figure 3). The results showed a weak correlation ($r = 0.058$) and a $p = 0.718$, indicating that academic self-esteem adjustments were not dependent on baseline self-esteem.

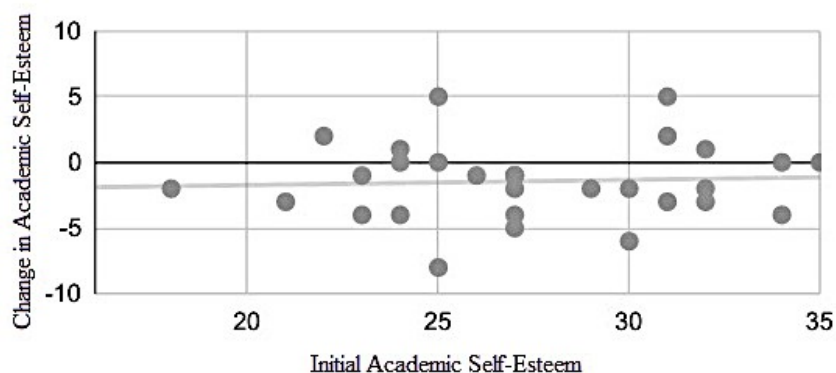


Figure 3. Non-dependency of the change in self-esteem on initial self-esteem

5. Discussion

While the statistical analyses found a significant correlation between dissonance and changes in academic self-esteem, a further exploration was performed within established theoretical frameworks below. This discussion first explores the results of this study, which address the question: “To what extent does cognitive dissonance predict changes in academic self-esteem in high school students?” It then situates the implications of these findings within Aronson’s theory, highlighting the psychological implications of the Self-Consistency Theory.

5.1 Cognitive dissonance as a predictor of academic self-esteem

In addressing the research question, this study’s hypothesis explored the relationship between cognitive dissonance and changes in academic self-esteem. The results confirmed hypothesis

H1, which posited that cognitive dissonance predicts shifts in academic self-esteem, with larger negative discrepancies leading to greater decreases and larger positive discrepancies resulting in greater increases. Initial paired t-tests provided evidence for the directional effects of cognitive dissonance, demonstrating that negative discrepancies corresponded with decreases in academic self-esteem while positive discrepancies led to increases. Building upon these findings, the regression analysis further validated the hypothesis by establishing that the magnitude of discrepancy significantly predicted the extent of academic self-esteem shifts. The positive regression coefficient reinforced the expected trend, indicating that as cognitive dissonance increased, academic self-esteem adjustments followed accordingly.

5.2 Implications of findings

Building upon the discussed results, the implications of this study lie in the confirmation of a key relationship central to the Self-Consistency Theory. Specifically, Aronson's Theory implies that dissonance may affect self-esteem prior to rationalization efforts. Thus, this study aimed to empirically investigate the theoretical relationship between cognitive dissonance and self-esteem. Demonstrating that cognitive dissonance predicted both the direction and magnitude of academic self-esteem changes through hypothesis H1 supported this key theoretical proposition, reinforcing the credibility of this theoretical framework and its broader implications.

Self-Consistency theory

To elucidate the significance of these findings, it is crucial to consider its implications within the framework of Aronson's Self-Consistency Theory (28). Verifying a key assumption of Aronson's Theory within an academic context holds profound implications. It implies that students' efforts to maintain self-consistency in terms of their beliefs and academic behaviors may serve as a driving force behind their academic motivations (29). Specifically, when students perceive a gap between their academic self-concept and their performance, whether their performance surpasses, or falls short of their perceived standards, the resulting dissonance may drive them to close this gap, such as through increased study efforts, adjusting academic expectations, or by seeking academic support. Conversely, they may also attempt to raise or lower their self-standards to achieve a self-perception more consistent with their performance.

At the opposite end of this spectrum, *Educators* and *Teachers* must therefore deliberately incorporate pedagogy that – in the event of dissonance arising from lower test scores than expected - strives to increase the students' approach that focuses on the drive to increase performance, rather than on the drive to decrease self-esteem. The importance of pedagogical training for *Educators* and *Teachers* cannot therefore, be overemphasized.

Psychologically, this suggests that self-consistency is a powerful motivator for behavior. Recognizing that dissonance spurs students to align their actions with their self-concept underscores the importance of self-perception in driving behavior (30). It highlights how discrepancies between self-concept and actions can lead to cognitive and behavioral responses aimed at restoring balance, enhancing the understanding of the human desire for consistency.

5.3 Limitations

While this study offers valuable insights into the relationship between cognitive dissonance and academic self-esteem, there are several limitations. First, the small sample size and the use of convenience sampling introduced sampling bias, limiting the generalizability of the findings. Considering this sample limitation, the high school participants in this study had enrolled in a UCONN Early College Experience statistics course, which may suggest high academic prowess and impact the studied relationship. Secondly, the study's employed dissonance measurement failed to address potential differences in experienced dissonance in the case that students' value in academics differed significantly. An attempt was made to address this by selecting a

rigorous class as a sample; however, this assumption is insufficient to gauge students' value in academics. A reliable scale that measures experienced dissonance would be beneficial to better capture this phenomenon. Next, the study's reliance on self-reporting measures introduced social desirability and response bias. Future research should explore alternative definitions and measures to ensure a comprehensive understanding of these variables. Finally, given the specific focus on academic self-esteem, the findings may not be generalizable to other forms of self-esteem. Future research should explore the relationship between dissonance and self-esteem in different contexts and populations.

6. Conclusion

In an effort to evaluate a prominent self-related dissonance theory, this baseline study established a significant relationship between cognitive dissonance and changes in academic self-esteem. The findings from this research support a key assumption of the Self-Consistency Theory within an academic context. This enables further credibility for the theory and its implications, strengthening foundational understanding of cognitive dissonance processes in relation to self-esteem. Specifically, the discussion focused on the psychological implications of Self-Consistency Theory within the academic realm. Thus, this study highlighted the essential connection between cognitive dissonance and academic self-esteem, reinforcing the significance of this existing theory within the academic domain.

The results underscore the critical importance of future research to further understand the studied relationship. For instance, without a clear understanding of causative effects, researchers cannot effectively assess the psychological factors influencing students' self-esteem. Future research should prioritize methodologies that elucidate causal pathways, providing a more comprehensive understanding of how cognitive dissonance impacts academic self-esteem.

Additionally, future research should develop a scale that reliably measures dissonance to allow for a more nuanced measurement of how individuals experience dissonance. A standardized dissonance scale may help better understand the relationship between dissonance and academic self-esteem. Such a scale would enable researchers to capture the complexity of dissonance experiences accurately, as most theories acknowledge that the intensity and impact of dissonance differ between individuals with different properties, such as high and low self-esteem (31). By incorporating a standardized dissonance scale, researchers would be able to quantify the degree of cognitive dissonance experienced by students more accurately. This measurement tool would also facilitate the comparison of dissonance levels across various demographic groups and educational settings, enhancing the generalizability of findings and enabling further investigation.

7. Supplementary files

Formative assessment, Pre and Post assessment surveys

8. References

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