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Correlates of Critical Thinking and College and Career Readiness for Students With and Without Disabilities

Allison R. Lombardi, PhD[1], Jennifer S. Kowitt, MA[1], and Frank E. Staples, MS[2]

Abstract

Considered a non-academic factor that is not necessarily measured by academic indicators of college and career readiness (e.g., grade point average, college admissions exams scores), critical thinking is an important aspect of 21st century learning and thus should be embedded into secondary school instruction and assessment. In this study, secondary students with and without disabilities were assessed with a critical thinking measure and compared. Findings show significant differences between groups and the relationship to grade point average and PSAT scores. Implications are addressed for high school personnel to consider the assessment of critical thinking as part of career planning in a data-based decision-making framework to provide equal access and support to all students in terms of college and career readiness.

Keywords

assessment, high school, correlation, academics/standards, 21st century skills, critical thinking, multi-tiered systems of support

Recent policy initiatives have prioritized college and career readiness (CCR) for *all* students, with or without disabilities, and from all racial and socioeconomic backgrounds. Forty-five states have adopted the Common Core State Standards (CCSS; National Governors Association [NGA] & Council of Chief State School Officers [CCSSO], 2010), which were designed to address the (a) lack of clarity of what essential content knowledge and skills students need to be successful in college and careers (NGA & CCSSO, 2010), (b) high prevalence—30 to 60%—of underprepared high school graduates in need of remedial education upon entering college (National Center for Education Statistics [NCES], 2004; Strong American Schools, 2008), and (c) the anticipation that future jobs will require 21st century job skills. Thus, with this urgent policy priority, school personnel are left to implement and integrate more services, practices, curricula, and resources that will ensure greater numbers of students graduate college and career ready.

Yet implementation challenges persist in determining what all high school students need to be successful in a career with what some students will need that is more specialized and/or more individualized for their wide-ranging strengths, needs, interests, goals, and aspirations. This challenge is further complicated by recent policy initiatives that increase the urgency, accountability, and consequences associated with successful achievement of CCR for all students. To complicate this challenge even further, evidence shows that the current measures of CCR—high school grade point average (GPA) and college admissions exam scores (e.g., SAT, ACT)—are not necessarily aligned with expectations of postsecondary instructors (Brown & Conley, 2007). Other non-academic factors such as learning strategies, study skills, critical thinking, and a working knowledge of secondary-to-postsecondary differences are not systematically measured or evaluated by school professionals, despite recent research that has identified lack of student knowledge in these areas as a potential pitfall (Conley, 2010; Farrington et al., 2012; Savitz-Romer, 2013). Thus, while CCR is perhaps prioritized by secondary educators, the delivery of services, including assessment of non-academic skills, is inconsistent or absent.

Disadvantaged Students in Our High Schools

Stilwell and Sable (2013) found that the national high school graduation rate has steadily increased in recent years; however, dropout rates have also increased, and, more alarmingly, graduation rates among certain subgroups (e.g., students with disabilities) remain stagnant (Goodman,

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Hazelkorn, Bucholz, Duffy, & Kitta, 2011; Orfield, Losen, Wald, & Swanson, 2004; Stilwell & Sable, 2013). Furthermore, long-term results of the National Assessment of Educational Progress (NAEP) in reading and mathematics for 17-year-olds have remained stagnant since the early 1970s; meanwhile, 9- and 13-year-olds have shown growth over the same period of time (NCES, 2013). This evidence suggests that the current high school structure is inadequate for certain disadvantaged subgroups of students.

In regard to CCR, students are likely disadvantaged if they have a disability, are English language learners (ELLs), or come from a low-income family (as defined by free/reduced-price lunch status [FLS]). For example, students with disabilities are less likely to receive an academically rigorous curriculum in high school (Gregg, 2007). In addition, the course failure and dropout rates for high school students with disabilities are approximately twice those of students in the general education population (Dunn, Chambers, & Rabren, 2004; Kaufman, Alt, & Chapman, 2004; Wagner, Newman, Cameto, Levine, & Garza, 2005). Similarly, ELLs have been found to have lower rates of college access and degree attainment than English-proficient linguistic minority students and monolingual English-speaking students (Kanno & Cromley, 2013). Furthermore, students from low-income families are less likely to pursue academically rigorous colleges and tend to be misinformed or misguided on their options (Hoxby & Turner, 2013; Welton & Martinez, 2013). Students with disabilities from low-income families, or who qualify as ELLs, are dually disadvantaged in terms of college access and readiness (Newman, Wagner, Cameto, & Knokey, 2009). Together, these findings suggest that students with disabilities, ELL, and FLS status may have less exposure to demanding academic content, fewer opportunities to develop skills that can facilitate postsecondary access and success, and lack the basic prerequisite requirements needed to enter college. Thus, in regard to CCR, students who fall in any of the three subgroups are potentially disadvantaged, and those who intersect among two or more subgroups are dually disadvantaged (e.g., ELL student from a low-income family).

Delivery of CCR via Multi-Tiered Systems of Support (MTSS)

Educators and researchers alike understand the urgency to prioritize CCR in high schools. The challenge remains in how to implement CCR practices, programs, curricula, and support that have consistent messaging delivered across all school staff, and that also challenge, motivate, and adhere to the personalized needs of students. Thus, a schoolwide approach to assessing CCR that simultaneously considers individual student preferences, strengths, and weaknesses is needed.

To address CCR implementation challenges, researchers have recently proposed delivery via multi-tiered systems of support (Lombardi & Faggella-Luby, 2013). MTSS is characterized by elements at each tier that include (a) data-based decision-making, (b) implementation of research-based instruction and intervention, and (c) fidelity of implementation to ensure adherence to appropriate research-based practices (Fuchs & Fuchs, 2006; King, Lemons, & Hill, 2012; Sugai, 2012). In sum, the model is based on the assumption and expectation that effective and efficient implementation of evidence-based practices, with fidelity, will result in improved secondary school outcomes, including transition to college (Faggella-Luby, Flannery, & Simonsen, 2010).

Data-based decision-making should be informed by screening measures for placement and progress monitoring via curriculum-based measures to determine the rate and level of student growth. CCR is a multi-dimensional construct, and thus assessing it requires multiple sources of academic and non-academic data. Some of these data may already exist within school procedures; some may require consideration of new assessments delivered to all students at Tier 1. Thus, delivering CCR through a MTSS framework is sensible and logical in that it will allow for school staff to re-conceptualize the use of their current data as well as consider new data collection methods. Consideration of assessment in non-academic areas is warranted and necessary at Tier 1 to ensure that *all* students will benefit from data-based decision-making processes.

Critical Thinking

Although MTSS may be a viable framework in which to consider implementing CCR, another challenge is the development and validation of non-academic skill assessments focused on CCR. Researchers have identified important constructs that are considered non-academic (e.g., Conley, 2010; Farrington et al., 2012). These constructs help conceptualize areas we do not regularly or systematically assess and thus may overlook, compared with the well-accepted academic indicators used to measure CCR (e.g., high school GPA, SAT, or ACT scores). Thus, it is crucial to consider schoolwide assessment focused on non-academic factors of CCR in educational research studies. One example of a non-academic area that is not systematically measured is critical thinking.

Critical thinking, sometimes referred to as cognition, metacognition, or cognitive strategies (Conley, 2007, 2010), includes skills that most educators agree are important for secondary students to learn. The CCSS embed elements of critical thinking throughout math and English/Language Arts (NGA & CCSSO, 2010). In fact, postsecondary instructors across various disciplines agree that they expect incoming freshmen to use critical thinking skills in their

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classes (Conley, 2003). Furthermore, while we are not exactly sure what the job market will resemble 5, 10, or 20 years from now, we know we need to teach adolescents "21st century skills" including critical thinking. GPA and college admissions exams do not necessarily measure critical thinking; in fact, evidence shows misalignment in this specific area (Brown & Conley, 2007). Another assessment is needed to measure high school students' level of critical thinking.

In this study, we examined critical thinking skills associated with CCR of high school students with and without disabilities, along with several other demographic factors, including race, socioeconomic status, and ELL status. In this context, critical thinking skills were operationalized as a five-part model that includes problem formulation, research, interpretation, communication, and precision and accuracy (Conley, 2007, 2010; Lombardi, Conley, Seburn, & Downs, 2013). In college courses, regardless of academic discipline, students are expected to apply this sequence of critical thinking across content areas. For example, in a freshman writing course, college students have to formulate a thesis or "problem" statement, research the problem, find and interpret evidence, and then convincingly communicate the findings and conclusions back to an audience in different formats (e.g., essay, presentation) with minimal errors (Conley, 2007). Similarly, in a freshman science course, students have to formulate a hypothesis, test it by collecting data, interpret these data, and communicate findings and conclusions to an audience with few to no errors. Thus, despite the very different academic disciplines, college freshmen are expected to critically think as soon as they arrive on campus (Conley, 2003), and first-time job employees are expected to quickly master job-specific knowledge, skills, and tools. For example, solving an unexpected work-related challenge or material shortage, resolving a work conflict with a colleague or a supervisor, or setting new production goals are all skills that employers expect young adults to have.

There is some evidence of differences in critical thinking according to disability status and race. Rosenzweig, Krawec, and Montague (2011) measured the metacognitive verbalizations of eighth-grade middle school students with and without disabilities while they completed problems of increasing difficulty to compare thought processes taking place while solving the problem. While students across ability groups were relatively equivalent in their overall number of verbalizations, there were different patterns of metacognitive activity for different ability groups when the type of metacognitive verbalization and problem difficulty were considered: Students with disabilities gave more non-productive, off-task verbalizations than their peers without disabilities. Differences in critical thinking have also been found between racial groups. Gadzella, Masten, and Huang (1999) investigated whether there were significant differences between African American and Caucasian undergraduate college students on critical thinking and learning style as measured by the Watson-Glaser Critical Thinking Appraisal and the Inventory of Learning Processes. While no significant differences were found between the two groups on the learning style inventory scales, results show that Caucasian students had significantly higher means than the African American students on Total Critical Thinking score, as well as the four subtest scores of the critical thinking: Inference, Deductions, Interpretation, and Evaluation of Arguments. Together, these findings suggest that there are critical thinking differences in student subgroups based on race and disability. While this evidence is important to consider, it is equally important to recognize that there is limited evidence in regard to differences in critical thinking according to race, disability, ELL, and socioeconomic status. Thus, it is especially important to further investigate differences among student subgroups in regard to critical thinking in the context of CCR.

In this study, we focused on critical thinking for two reasons: (a) the currently used and well-accepted academic indicators do not necessarily measure critical thinking; in fact, evidence suggests misalignment between academic indicators and the expectations of postsecondary instructors of what students should know and be able to do as incoming freshmen (Achieve, Inc., 2007; Brown & Conley, 2007; Brown & Niemi, 2007; Conley, 2003), and (b) minimal evidence exists on differences between secondary students with and without disabilities and their critical thinking skills as measured by Conley's five-part definition: problem formulation, research, interpretation, communication, and precision and accuracy (Conley, 2007, 2010; Lombardi et al., 2013). Critical thinking has been prioritized by the CCSS (NGA & CCSSO, 2010) and further validated by postsecondary instructors as an expected skill for incoming freshman to possess and use when they begin first-year courses (Conley, 2003; Conley, Drummond, de Gonzalez, Rooseboom, & Stout, 2011). As such, we sought to address the following research questions:

> **Research Question 1:** What is the relationship between academic indicators of CCR and critical thinking skills?
> **Research Question 2:** Does this relationship differ for students with and without disabilities?

Method

Participants

The study participants were 857 students from one high school in an urban "fringe" (outskirts of the urban center) area of Connecticut. Table 1 shows demographic characteristics of the sample by the five outcome variables used in

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Table 1. Critical Thinking Means and Standard Deviations by Study Demographics.

		Critical Thinking Subscales				
		Problem Formulation	Research	Interpretation	Communication	Precision/Accuracy
Characteristic	*N*	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Gender						
Female	401	3.48 (0.85)	3.59 (0.86)	3.22 (0.96)	3.20 (0.92)	3.49 (0.91)
Male	456	3.35 (0.85)	3.42 (0.80)	3.12 (0.94)	3.01 (0.90)	3.25 (0.87)
Hispanic/Latino						
Yes	355	3.32 (0.84)	3.42 (0.81)	3.12 (0.89)	3.01 (0.88)	3.28 (0.86)
No	502	3.47 (0.86)	3.56 (0.85)	3.20 (0.99)	3.16 (0.93)	3.42 (0.92)
White						
Yes	164	3.52 (0.91)	3.59 (0.84)	3.21 (0.98)	3.20 (0.93)	3.44 (0.91)
No	693	3.38 (0.84)	3.48 (0.84)	3.15 (0.94)	3.07 (0.91)	3.35 (0.89)
African American						
Yes	295	3.40 (0.86)	3.48 (0.88)	3.15 (1.01)	3.10 (0.94)	3.37 (0.95)
No	562	3.41 (0.85)	3.51 (0.81)	3.17 (0.94)	3.10 (0.90)	3.36 (0.87)
English language learners						
Yes	91	3.09 (0.92)	3.23 (0.94)	2.96 (0.98)	2.88 (0.98)	3.17 (1.00)
No	766	3.45 (0.84)	3.53 (0.82)	3.19 (0.94)	3.12 (0.90)	3.39 (0.88)
Students with IEPs						
Yes	127	2.84 (0.91)	3.01 (0.91)	2.65 (1.01)	2.63 (0.98)	2.90 (1.03)
No	730	3.51 (0.80)	3.59 (0.79)	3.25 (0.91)	3.18 (0.88)	3.45 (0.85)
Students qualifying for FLS						
Yes	488	3.35 (0.83)	3.45 (0.80)	3.13 (0.90)	3.05 (0.88)	3.33 (0.88)
No	369	3.49 (0.88)	3.57 (0.88)	3.21 (1.01)	3.16 (0.95)	3.41 (0.93)
Total sample	857					

Note. IEPs = Individualized Education Programs; FLS = free and reduced-price lunch service.

this study. Among students with disabilities (n = 127), eight disability categories were represented, including specific learning disability (n = 61), emotional disturbance (n = 14), attention deficit/hyperactivity disorder (n = 13), speech/language impairment (n = 12), autism spectrum disorder (n = 10), intellectual disability (n = 9), multiple disabilities (n = 4), and orthopedic impairment (n = 1).

Procedure

Students were administered CampusReady, which measures critical thinking among other non-academic factors of CCR. CampusReady was created based on a validation study in 38 high schools and more than 4,000 students (Conley, 2010; Conley, McGaughy, Kirtner, van der Valk, & Martinez-Wenzl, 2010). For this study, we focused solely on critical thinking, in which there are five subscale scores: Problem Formulation, Research, Interpretation, Communication, and Precision/Accuracy. A cross-validation study with exploratory and confirmatory factor analysis resulted in preliminary internal validity evidence for the item content and five-factor model (Lombardi et al., 2013). Students select ratings according to a five-point Likert scale ranging from 1 (*not at all like me*) to 5 (*very much like me*), with a "don't know" option. The survey is administered online and takes approximately one class period to administer.

In addition to the critical thinking scores, we collected school data on student GPA and PSAT scores in critical reading, math, and writing; demographic data on gender, race, ethnicity, disability status, disability category, ELL status, and FLS status; and behavioral data that included attendance and number of discipline incidents.

Results

Descriptive Statistics and Correlations

To address our research questions, we first examined descriptive statistics and correlations of study variables. Table 2 shows the descriptive statistics of the five critical thinking subscale scores for students with and without disabilities overall and by grade level. Results of t test comparisons between groups are also presented.

Across grade levels, students without disabilities self-rated higher on the five subscales of critical thinking. When examined by grade level, larger and more significant differences were found in 9th and 12th grade between students

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Table 2. GPA and Critical Thinking Mean Scale Scores by Students With and Without Disabilities.

	Overall		9th Grade		10th Grade		11th Grade		12th Grade	
	SWOD (n = 730)	SWD (n = 127)	SWOD (n = 255)	SWD (n = 48)	SWOD (n = 132)	SWD (n = 23)	SWOD (n = 162)	SWD (n = 33)	SWOD (n = 181)	SWD (n = 23)
Subscale	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Critical Thinking	3.40*** (0.74)	2.80*** (0.83)	3.33*** (0.75)	2.73*** (0.91)	3.30** (0.69)	2.87** (0.60)	3.47*** (0.73)	2.94*** (0.76)	3.49*** (0.75)	2.69*** (0.95)
Problem Formulation	3.51*** (0.80)	2.84*** (0.91)	3.45*** (0.77)	2.78*** (0.95)	3.39** (0.80)	2.92** (0.60)	3.59*** (0.83)	2.98*** (0.88)	3.61*** (0.82)	2.67*** (1.10)
Research	3.59*** (0.79)	3.01*** (0.91)	3.53*** (0.79)	2.98*** (0.98)	3.53** (0.76)	3.05** (0.56)	3.67** (0.80)	3.12** (0.88)	3.63*** (0.81)	2.85*** (1.09)
Interpretation	3.25*** (0.91)	2.65*** (1.01)	3.19*** (0.93)	2.59*** (1.02)	3.16 (0.82)	2.73 (0.87)	3.31** (0.92)	2.78** (0.98)	3.36*** (0.94)	2.53*** (1.19)
Communication	3.18*** (0.88)	2.63*** (0.98)	3.15*** (0.91)	2.54*** (1.09)	3.08 (0.82)	2.66 (0.78)	3.22 (0.84)	2.84 (0.83)	3.26*** (0.90)	2.46*** (1.09)
Precision/ Accuracy	3.45*** (0.85)	2.90*** (1.03)	3.33** (0.89)	2.77** (1.16)	3.34 (0.80)	2.99 (1.03)	3.57*** (0.76)	2.99*** (0.89)	3.58** (0.87)	2.95** (0.99)
GPA	2.37*** (0.93)	2.02*** (0.87)	2.35** (0.96)	1.83** (0.98)	2.47** (0.86)	1.90** (0.72)	2.37 (1.05)	2.04 (0.70)	2.31 (0.84)	2.50 (0.85)

Note. GPA = grade point average; SWOD = students without disabilities; SWD = students with disabilities.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

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with and without disabilities, and fewer were found for 10th and 11th grade. In nearly all comparisons, students without disabilities self-rated higher in critical thinking. For the most part, students without disabilities' mean scores fell between 3 and 4, or *somewhat like me* to *a lot like me*, whereas students with disabilities' mean scores fell between 2 and 4, or *not like me* to *somewhat like me*.

We examined zero-order correlations to explore the relationship between academic indicators of CCR, as measured by GPA and PSAT scores, and critical thinking. Table 3 shows the results. Correlations were conducted separately for students with and without disabilities.

For students without disabilities, correlations were positive and ranged from .11 to .35. There were some correlations that corresponded to a medium effect size (Cohen, 1988), which were Problem Formulation and 10th grade GPA (r = .357), PSAT Math (r = .290), and PSAT Writing (r = .280), as well as Precision/Accuracy and 10th grade GPA (r = .304).

For students with disabilities, correlations showed a different pattern. In many cases, GPA was inversely and negatively correlated with critical thinking. However, the PSAT scores were positively related to the critical thinking scores. Some correlations corresponded to a large effect size, which were 12th grade GPA and all five critical thinking scores (r ranged from −.40 to −.57), and 10th grade GPA and Communication (r = −.472). There were also medium effect sizes for Problem Formulation and PSAT Writing (r = .308), Research and PSAT Writing (r = .292), and Precision/Accuracy and PSAT Writing (r = .315).

Critical Thinking as a Predictor of CCR Academic Indicators

To further examine the relationship between critical thinking and the academic indicators GPA and PSAT scores, we constructed a series of hierarchical regression models. In total, four models were constructed, each with the same theoretical structure or grouping of independent variables on the following outcomes: GPA, PSAT Critical Reading, PSAT Math, and PSAT Writing. The independent variables were entered in the following four steps: demographic, behavioral, critical thinking, and Individualized Education Program (IEP) status. At Step 1, we entered the demographic variables gender, race, ethnicity, FLS, and ELL status. Race was coded as two dummy coded variables: White (Y/N) and African American (Y/N). Ethnicity was coded as Hispanic (Y/N), gender was coded as males (1) and females (2), FLS and ELL were coded as Y/N. At Step 2, we entered two variables to assess the level of behavioral engagement in the school, which were the number of absences and discipline incidents. Discipline incidents ranged in type and included skipping class, disruption/disruptive behavior, insubordination/disrespect, verbal altercation, physical altercation (no injury), and failure to attend house or Saturday detention. At Step 3, we entered the five critical thinking scores as measured by CampusReady, which are problem formulation, research, interpretation, communication, and precision/accuracy. At Step 4, we entered one variable to indicate whether or not a student had an IEP and thus received special education services. We constructed the regression models as such for two reasons: (a) to determine the cumulative variance and effect of the five critical thinking skills on GPA and PSAT scores and (b) to isolate the unique variance attributed to IEP status to better understand how students with and without disabilities differed in terms of the effects of critical thinking on GPA and PSAT scores. These reasons are consistent with Research Questions 1 and 2. Table 4 shows the results.

Overall, 34% of variance in GPA was explained by the combination of predictors, $F(13, 857) = 28.98$, $p < .001$. The five critical thinking scores explained an additional 3% and IEP status contributed an additional 1% of variance. Problem formulation (β = .22) and Precision/Accuracy (β = .11) contributed unique variance to the equation. When Critical Reading PSAT was the outcome, 36% of variance was explained by the combination of predictors, $F(13, 173) = 6.28$, $p < .001$. The five critical thinking scores explained an additional 10% and IEP status contributed an additional 4% of variance. Problem formulation (β = .29), Communication (β = −.26), and IEP status (β = −.21) contributed unique variance to the equation. For the Math PSAT, 38% of variance was explained by the combination of predictors, $F(13, 173) = 6.94$, $p < .001$. The five critical thinking scores explained an additional 8% and IEP status contributed an additional 9% of variance to the equation. Problem formulation (β = .25) and IEP status (β = −.33) contributed unique variance to the equation. For the Writing PSAT, 37% of variance was explained by the combination of predictors, $F(13, 173) = 6.64$, $p < .001$. The five critical thinking scores explained an additional 11% and IEP status contributed an additional 6% of variance to the equation. Problem formulation (β = .30), Communication (β = −.27), and IEP status (β = −.26) contributed unique variance to the equation.

Discussion

In this study, we examined high school students' self-report of critical thinking to determine the relationship to academic indicators of CCR (GPA, SAT/PSAT). We also explored whether discrepancies exist in critical thinking, as measured by CampusReady (Conley et al., 2010; Lombardi et al., 2013), between high school students with and without disabilities. Specifically, our research questions were as follows:

Research Question 1: What is the relationship between academic indicators of CCR and critical thinking skills?
Research Question 2: Does this relationship differ for students with and without disabilities?

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Table 3. Correlations of Critical Thinking With GPA and PSAT Scores for Students With and Without Disabilities.

Critical Thinking Subscale by Group	GPA Overall	GPA 9th Grade	GPA 10th Grade	GPA 11th Grade	GPA 12th Grade	PSAT Critical Reading	PSAT Math	PSAT Writing
Students without disabilities	n = 730	n = 255	n = 132	n = 162	n = 181	n = 147	n = 147	n = 147
Problem Formulation	.246***	.251***	.357***	.189**	.250***	.244***	.290***	.280***
Research	.203***	.249***	.230***	.178**	.151**	.215**	.215***	.240***
Interpretation	.152***	.193***	.198**	.111	.121	.171**	.220***	.203**
Communication	.163***	.175***	.242***	.139	.137	.101	.196**	.130
Precision/Accuracy	.229***	.268***	.304***	.212***	.165**	.142	.229***	.201**
Students with disabilities	n = 127	n = 48	n = 23	n = 33	n = 23	n = 27	n = 27	n = 27
Problem Formulation	−.212**	−.160	−.033	−.088	−.517**	.147	.236	.308
Research	−.227**	−.110	−.185	−.141	−.574***	.215	.141	.292
Interpretation	−.158	.045	−.179	−.193	−.537***	.022	.238	.169
Communication	−.165	.038	−.472	−.061	−.566***	−.123	.014	−.036
Precision/Accuracy	−.083	.018	.045	−.255	−.405	.169	.234	.315

Note. .10 corresponding to small, .30 medium, and .50 a large effect (Cohen, 1988). GPA = grade point average.
*p < .05. **p < .01. ***p < .001.

Table 4. Hierarchical Regression Model Results and Standardized Beta Weights for Critical Thinking scores.

Block	GPA		Critical Reading PSAT		Math PSAT		Writing PSAT	
	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β
Step 1: Demographics	.10***		.17***		.16***		.18***	
Gender		.14***		.08		−.04		.08
FLS		−.04		−.04		−.11		−.06
ELL		.06*		.01		.02		−.03
Hispanic		−.23*		−.07		−.20		−.15
White		−.13*		.22		.03		.16
Black		−.25***		−.14		−.25		−.17
Step 2: Behavior	.20***		.05*		.04*		.02	
Absences		−.30***		−.13		.02		−.01
Discipline incidents		−.24***		−.10		−.13		−.05
Step 3: Critical Thinking scores	.03*		.10*		.08*		.11***	
Problem formulation		.22*		.29*		.13		.30*
Research		.01		.17		−.05		.11
Interpretation		−.11		.07		.02		.07
Communication		−.08		−.26*		.11		−.27*
Precision/Accuracy		.11*		−.09		.05		.01
Step 4: IEP status	.01		.04*		.09***		.06***	
Has IEP		.01		−.21*		−.36***		−.26***
Total R^2	.34***		.36***		.38***		.34***	

Note. Standardized beta weights are shown when all variables were included in the equation. GPA = grade point average; FLS = free and reduced-price lunch service; ELL = English language learner; IEP = Individualized Education Program.
*p < .05. **p < .01. ***p < .001.

Results from the hierarchical regression models suggest that demographics, behavior, critical thinking, and IEP status affect GPA and PSAT scores. The critical thinking framework explained significant, unique variance in academic outcomes (GPA, PSAT/SAT). IEP status also explained unique variance. Students who self-rated higher

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on the problem formulation and precision/accuracy aspects of critical thinking had higher GPAs. Similarly, students who self-rated higher on problem formulation and communication had higher scores on PSAT Critical Reading and PSAT Writing. These findings further clarify the importance of considering non-academic factors, particularly critical thinking, alongside academic indicators to measure and evaluate CCR.

Results suggest that for high school students without disabilities, there is a link between critical thinking and traditional academic indicators of CCR. For these students, the overall relationship between GPA and the five subscales of critical thinking was significantly positive. Broken down by grade, the relationship was stronger in the first 2 years of high school. Similarly, for these students, there were significant correlations between the majority of the critical thinking subscales and PSAT Math, Writing, and Critical Reading.

However, the relationship between academic factors and critical thinking looked very different for students with disabilities. For students with disabilities, the relationship between GPA and critical thinking was significant for only two subscales (Problem Formulation and Research). By grade, the only significant relationship between GPA and critical thinking was in the 12th grade. For these students, there were no significant correlations between the Critical Thinking subscales and PSAT Math, Writing, and Critical Reading.

In general, there were differences in critical thinking between students with and without disabilities. These results contribute to existing evidence of these differences (Rosenzweig et al., 2011) and extend the evidence base to include Grades 9 to 12. Descriptive results showed clear differences in self-report of critical thinking skills between students with and without disabilities; students without disabilities self-rated higher on critical thinking overall and on each of the five domains. Of particular interest is that these differences were more significant at the beginning and end of high school (9th and 12th grades), suggesting that students with disabilities struggle more than their peers without disabilities in these years of greatest transition. For students without disabilities, all correlations between academic indicators (GPA and PSAT) and critical thinking were positive. In contrast, for students with disabilities, GPA and critical thinking were often negatively correlated. This is consistent with previous research, which found that students with disabilities are disadvantaged in terms of CCR (Dunn et al., 2004; Gregg, 2007; Kaufman et al., 2004; Wagner et al., 2005). The findings of the current study contribute to the emerging body of literature that specifically examines critical thinking as an element of CCR and how this relates to secondary students with and without disabilities.

Limitations

CampusReady is a self-report measure. As a result, respondent bias is a limitation in this study. In addition, this study was conducted at one high school in a Connecticut urban "fringe" context. This limits the generalizability of its findings. Future research should replicate this study in multiple schools in different geographic locations and contexts. Furthermore, due to the limited number of students with disabilities included in the study, we collapsed analyses across disability categories. In future studies, researchers should disaggregate results by disability category to explore further the differences in self-rated critical thinking among students with different types of disabilities.

Implications for Practice

Critical thinking skills are essential to be productive in the working world. Today's high school graduates are expected to possess critical thinking and problem-solving skills to function in and be productive members of society. As global economies continue to increase, so will the importance of obtaining advanced skills and credentials in technology and service, among other fields (Hove, 2011; Wimberly & Noeth, 2005). During the 20th century, students with disabilities may have been able to transition into jobs or careers with limited skills and training. In the 21st century, students with disabilities will not fare well with limited skills acquisition. Therefore, it is imperative that secondary schools provide students with disabilities with multiple opportunities to develop critical thinking skills.

The results from this study suggest that teaching students critical thinking may improve the scores of all students on academic indicators of CCR. However, students with disabilities, who in general scored lower on CampusReady, may require additional and explicit instruction in critical thinking skills. For students with disabilities, teaching critical thinking according to the five-part model used in this study (problem formulation, research, interpretation, communication, precision/accuracy) may be a viable approach. Results from this study suggest areas of critical thinking in which students with disabilities may struggle and therefore require particular instruction (interpretation, communication, precision/accuracy). Teachers should use the five-part model to develop instructional lessons across content areas that encourage and embed critical thinking. Potentially, general and special education teachers may use assessment data to write IEP goals that focus on developing critical thinking skills. Finally, these skills are similar to those embedded within the CCSS (NGA & CCSSO, 2010) and are thus consistent with larger CCR policy initiatives.

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Conclusion

This research study is framed in MTSS as a schoolwide mechanism to emphasize and deliver CCR to ensure equality of access across multiple student subgroups that have historically been disadvantaged and are currently underrepresented among college student populations today. Assessment of critical thinking skills must occur at Tier 1, or at the universal level, which ultimately ensures that *all* students have the opportunity to be assessed in critical thinking. CampusReady is an instrument that can be used by schools to measure students' critical thinking. Such an opportunity allows for teachers and school counselors to collaboratively review data and make planning decisions regarding students across multiple subgroups, including those with disabilities.

The MTSS framework encourages data-driven decision-making to occur within a team-oriented approach. Ideally, school counselors, general and special education teachers, and other school personnel may use the CampusReady results as a starting point to assess all students in critical thinking. These "data teams" would then meet on a regular basis over time to better understand which students are adequately supported at Tier 1 (universal) and which students would be identified for more intensive support at Tiers 2 or 3. CampusReady data would not be interpreted in isolation; other academic, behavioral, and demographic data that are currently available in school databases should be integrated into the data team meetings. This process is followed in many high schools nationwide (e.g., Schoolwide Positive Behavior Supports); however, the assessment of critical thinking is not necessarily occurring. The results of the current study show that critical thinking is important to consider alongside other traditionally used academic indictors as a Tier 1 assessment, available to *all* students to ensure equal access to CCR programs, practices, and opportunities.

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