

Understanding Students' Critical Thinking Skills:

Summary of Evidence from AY 2021-2022

Cal Poly Pomona (CPP) is deeply committed to ensuring an educational experience that fosters student learning and success for every student. As part of that commitment, the Office of Assessment and Program Review leads the assessment of undergraduate learning outcomes each year, focusing on gathering evidence of *Critical Thinking* in 2022. The evidence is used to understand student learning and experiences concerning their critical thinking skills. The findings also assist the institution in learning about potential equity gaps, and subsequently identifying additional resources to improve undergraduates' development of critical thinking skills.

As a [General Education](#) (GE) learning outcome at CPP, *Critical Thinking* is defined as students being able to construct arguments based on sound evidence and reasoning to support an opinion or conclusion at or near graduation. This report summarizes the findings of student achievement regarding *Critical Thinking* from a combination of direct evidence via written artifacts scored by CPP faculty, and indirect evidence drawn from student responses to related questions on the 2020 [National Survey of Student Engagement](#) (NSSE).

Direct Evidence: Critical Thinking Rubric

Methodology

In Spring 2022, faculty teaching senior-level courses from each of the eight colleges were invited to provide the Office of Assessment and Program Review with student artifacts to be scored using the [critical thinking rubric](#) (Appendix A). The rubric was developed and approved by the Academic Assessment Committee.

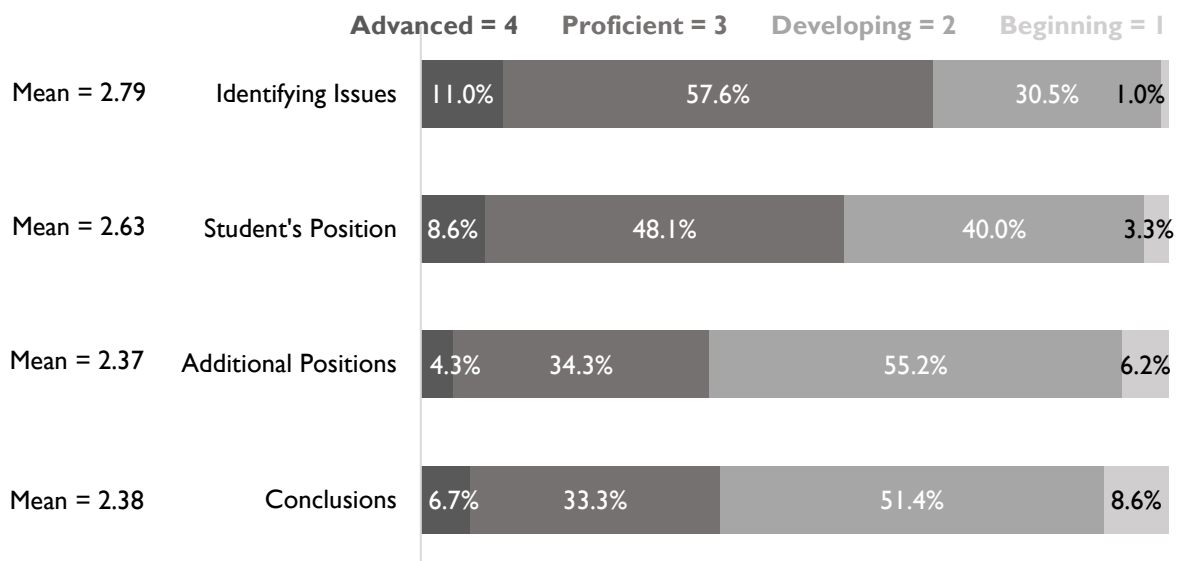
A total of 1,332 senior-student work artifacts were collected from majors in seven of the eight colleges. A stratified random sample of 210 artifacts was drawn to reflect CPP's undergraduate population by college, URM status, and first-generation status. Prior to scoring, each student was assigned a unique ID to maximize anonymity. Artifacts were then redacted of information that could be used to identify the student and faculty member (i.e., names, course titles)

The written artifacts were scored by a group of 11 faculty from 6 colleges and the library using the critical thinking rubric. Over a two-day period, faculty participated in a norming session to calibrate the rubric, and then independently read and scored student artifacts. Each artifact was scored by two faculty members, and artifacts with discrepancies greater than two points were scored by a third reviewer. Subsequently, means derived from all scorers for each Rubric criterion were calculated for every student, with values to two decimals, with the latter value rounded down to the nearest whole number. The rubric defined critical thinking through four criteria (identifying issues, student's position, additional positions, and conclusions) and four levels of performance (beginning, developing, proficient, and advanced).

Results

In addition to computing frequencies to obtain percentages for each of the rubric criteria, t-tests were used to compare potential differences in performance based on gender, URM status, first-generation status, and Pell grant status. The chart below displays the overall percentage of students who scored at each level of achievement in each criterion of critical thinking.

Critical Thinking Rubric Scores Percentage of Students at each Achievement Level



Critical Thinking by Criterion

It is our goal and expectation that seniors achieve “proficient” and “advanced” levels of critical thinking by the time they graduate, and our findings show that the majority of CPP seniors achieved the desired level of performance on two of the criteria. CPP seniors performed the strongest on *Identifying Issues*. Defined as the extent to which students understand the subject matter, we found that 68.6% of seniors demonstrated “proficient” and “advanced” levels of performance. The majority of our seniors (56.7%) also demonstrated “proficient” and “advanced” levels on *Student's Position* where students offer an intervention, perspective, or thesis/hypothesis.

Unfortunately, the lowest levels of performance were in *Additional Positions* and *Conclusions*. *Additional Positions* is concerned with how students consider and present evidence of additional contexts, arguments, and perspectives of others, and only 38.6% of seniors demonstrated the expected “proficient” and “advanced” performance, while 61.4% fell below this mark. Similarly, less than half (40%) of seniors performed at the “proficient” and “advanced” levels for *Conclusions*, the criterion concerned with how students come to informed and reasoned conclusions about a subject by specifically and objectively weighing the evidence for each. This means that 60% of seniors did not perform at the expected level.

Critical Thinking by Demographic Group

Additional analyses were conducted to compare student performance by key demographic characteristics; that is, under-represented minority (URM) status¹, first-generation status, Pell Grant status, and gender. There were no statistically significant differences found based on gender, URM status, and first-generation status on any of the critical thinking rubric criteria. There were, however, differences by Pell Grant status.

Pell Grant recipients performed better than non-Pell Grant recipients in all but *Additional Positions*. A statistically significant difference was found for *Additional Positions* with non-Pell Grant recipients performing notably better than Pell Grant recipients (18.8% difference at the “advanced” and “proficient” levels.)

The chart in Appendix B displays the percentage of seniors who are Pell Grant recipients and those who are not Pell Grant recipients at each level of performance in each criterion.

¹ URM status includes students who identify as American Indian/Alaska Native, Black or African American, and Hispanic/Latino

Indirect Evidence: National Survey of Student Engagement (NSSE)

Indirect assessment allows us to infer students' skills and knowledge through methods such as surveys, focus groups, and interviews. CPP uses the National Survey of Student Engagement (NSSE) to better understand student perception of their improvements and confidence levels in relation to key learning outcomes. Considering that CPP seniors achieved desired performance levels in only two of the four critical thinking criteria, self-reported evidence from NSSE findings can offer valuable additional insight.

Methodology

As part of CPP's commitment to ensuring educational experiences that foster student learning and success, CPP participated in the NSSE in Spring 2020. With a response rate of 25%, this survey collected information from 1,747 first- and senior-year students regarding their participation in various educational practices. NSSE scores serve as complementary indirect evidence of student learning concerning critical thinking. In addition, as the survey is national, [benchmark data](#) from comparative institutions is provided to add a more nuanced context.

Results

When asked about the frequency of their engagement with critical thinking, CPP seniors reported frequencies that were generally on par with the national average (NSSE total) as well as their CSU peers in the "sometimes" to "often" range. There is also little difference between first-year students and seniors with the exception of combining ideas from different courses when completing assignments. While it makes intuitive sense that seniors would have a greater pool of courses from which to draw ideas, the lack of greater differences between first-year and senior students regarding other critical thinking-related experiences is surprising as we would expect seniors to be challenged to engage in these activities more frequently.

During the current school year, about how often have you done the following:					
1 = Never, 2 = Sometimes, 3 = Often, 4 = Very often		Mean Response			
		CPP	Master's	CSU	NSSE TOTAL
Combined ideas from different courses when completing assignments?	FY	2.5	2.5	2.6	2.6
	SR	3.0	2.9*	3.0*	2.9*
Connected your learning to societal problems or issues?	FY	2.5	2.5	2.6*	2.6*
	SR	2.7	2.8*	2.8*	2.8*
Included diverse perspectives (political, religious, racial/ethnic, gender, etc.) in course discussion or assignments?	FY	2.5	2.5	2.6*	2.6*
	SR	2.5	2.6*	2.7*	2.6*
Examined the strengths and weaknesses of your own views on a topic or issue?	FY	2.7	2.8	2.8	2.8*
	SR	2.8	2.8*	2.8*	2.8*
Tried to better understand someone else's views by imagining how an issue looks from their perspective?	FY	2.9	2.9	2.9*	2.9
	SR	2.9	3.0	3.0*	3.0
Learned something that changed the way you understand an issue or concept?	FY	2.9	2.8	2.9	2.9
	SR	3.0	3.0	3.0	3.0
Connected ideas from your courses to your prior experiences and knowledge	FY	2.9	3.0*	3.0*	3.0*
	SR	3.1	3.2*	3.2*	3.2*

*Please note that these scores are significantly different from the corresponding CPP score, $p < .05$

Considering that coursework facilitates key critical thinking skills, the NSSE findings below add additional understanding by reflecting students' perceptions of how often this occurs. Here, CPP seniors felt that their coursework emphasized critical thinking components "some" and "quite a bit," not differing substantially from their CSU peers or the national average. Small increases in frequency were, however, seen between CPP first-year students and seniors in each of the ways critical thinking components were emphasized in coursework.

During the current school year, how much has your coursework emphasized:					
1 = Very little, 2 = Some, 3 = Quite a bit, 4 = Very much		Mean Response			
		CPP	Master's	CSU	NSSE TOTAL
Applying facts, theories, or methods to practical problems or new solutions?	FY	2.8	2.9*	2.8	2.9*
	SR	3.1	3.1	3.0	3.1
Analyzing an idea, experience, or line of reasoning in depth by examining its parts?	FY	2.8	2.9	2.9	2.9*
	SR	3.0	3.0	3.1*	3.0
Forming a new idea or understanding from various pieces of information?	FY	2.8	2.9*	2.9*	2.9*
	SR	2.9	3.0*	3.0*	3.0

*Please note that these scores are significantly different from the corresponding CPP score, $p < .05$

Lastly, seniors were asked to rate their confidence level as it pertains to critical thinking. NSSE findings show that they felt “quite a bit” confident about their ability to complete tasks requiring critical thinking, and analysis of arguments and information, on par with their peers at comparative master’s institutions. Although CPP seniors and the comparison group have the same reported average for how confident they are, CPP seniors rated their confidence just slightly less than the comparison group.

How much confidence do you have in your ability to complete tasks requiring:			
1 = Very little, 2 = Some, 3 = Quite a bit, 4 = Very much		Mean Response	
		CPP	Master's
Critical thinking and analysis of arguments and information?	SR	3.4	3.4*

*Please note that these scores are significantly different from the corresponding CPP score ($p < .05$) with an effect size less than .3 in magnitude. This question was not asked of first-year students, and no comparative data were available for CSU and NSSE Total.

Summary and Discussion

Critical thinking skills are crucial for all students due to their foundational role for many aspects of everyday life and the workplace. In fact, critical thinking was ranked second as a “very important” skill for college graduates to succeed in the workforce, according to AAC&U’s 2020 survey of employers². Also, according to the National Foundation for Educational Research, it will become increasingly essential in the coming years for individuals entering the workforce to obtain critical thinking skills throughout their education. The World Economic forum further concurs, noting that critical thinking skills are vital as companies are rapidly transforming tasks and job skills in response to technological advances and societal change.³ These external reports should be kept in mind, as we unpack the evidence from our Critical Thinking assessment scores and the NSSE findings. Our findings reveal a nuanced story regarding the critical thinking abilities of CPP seniors.

Our direct assessment of student work revealed that the majority of our seniors met CPP performance expectations in just two of the four criteria used to assess critical thinking. We found that 68.6% of seniors demonstrated “proficient” and “advanced” levels of performance for *Identifying Issues*, and 56.7% on *Student’s Position*. Although this hits the mark, this also means that 31.4% and 43.3% of CPP seniors fell short of this expectation for *Identifying Issues* and *Student’s Position*, respectively. This begs the question, are we content with this level of performance even though the majority of our students performed at the expected level? If we are not, then it is vital to explore and implement strategies to raise the critical thinking skills of our graduating seniors.

Only 38.6% of seniors performed at the “proficient” and “advanced” level for *Additional Positions*, which means that 61.4% of our graduating seniors did not perform at the desired level for this criterion. While this is of concern, it may be attributed to the nature of assignments students were given. Not all assignment descriptions and prompts were aligned to the criteria outlined in the critical thinking rubric. For instance, there were assignments that did not require additional sources, so alternative viewpoints and sources were not always included. The possible impact of this on faculty scores should be considered when drawing conclusions pertaining to this particular criterion. To minimize this issue in the future, communicating the intentional alignment of assignments to all rubric criteria should be a priority for the Office of Assessment and Program Review for future university-level assessment efforts.

² <https://www.aacu.org/research/how-college-contributes-to-workforce-success>

³ <https://www.weforum.org/reports/the-future-of-jobs-report-2020/digest#report-nav>

It is heartening to note no statistically significant differences were found when disaggregating direct assessment data by gender, URM status, and first-generation status. There was a significant difference found for non-Pell recipients performing better in *Additional Positions*, and apart from that, Pell recipients performed better and at higher expected levels than non-Pell recipients on all other rubric criteria.

NSSE findings add further dimension to our direct assessment of critical thinking. CPP seniors are on par with CSU peers and the national average regarding the extent to which coursework emphasize key critical thinking skills, as well as how often they engaged in critical thinking-related activities. Campitelli and Gobet (2011) assert that repetition of an activity is a necessary contributing factor in improving performance. What is eye-opening is that our seniors felt “quite a bit” confident in their ability to complete critical thinking tasks, even though scores on the critical thinking rubric suggest that most seniors are not demonstrating critical thinking skills at expected levels.

As we consider these results in light of the elements of an inclusive polytechnic university, it is appropriate to consider the degree to which we incorporate instruction in critical thinking skills across the curriculum and co-curriculum. For instance, to what extent do we rely on GE courses to teach students critical thinking? How do individual degree programs build on and advance crucial critical thinking skills in upper-division program courses? Research has suggested that critical thinking must be studied and practiced in its own right (i.e., not reading philosophers’ work, writing a paper, etc.) and must be an explicit part of the curriculum in order for students to fully develop the skills (e.g., Van Gelder, 2005).

Improving Student Learning

Discussing this report with faculty and/or key staff (e.g., academic advisors, career advisors) in your program may help determine program-level actions needed to improve student achievement in the Critical Thinking learning outcome. If your program has evidence of learning for a related outcome, it may be useful to consider those results as part of your discussion.

The following questions may be useful in guiding discussions:

- For which components/criteria of Critical Thinking do students demonstrate satisfactory levels of achievement? How do students in your program compare?
- For which components/criteria of Critical Thinking do you feel students need to improve?
- What types of assignments are used in your program to develop student’s ability to apply their critical thinking skills to become skilled thinkers/analyzers?
 - Are there ways to include scaffolded assignments where students can actively engage in exercises to further develop the lower-level processes involved in critical thinking (Van Gelder, 2005)?
- To what extent is scaffolded feedback on assignments provided? When/where is it needed the most to strengthen student learning in this outcome?
- What are some course or program modifications that may facilitate student learning in the necessary critical thinking skillset and improve on the components/criteria you identified as needing improvement? While not an exhaustive list, typical categories of changes made as a result of assessment evidence may include:
 - Curriculum (e.g., adequacy of courses, course sequencing, etc.)
 - Pedagogy (e.g., more assignments where students can cultivate their critical thinking, provide scaffolded assignments or prompts to ensure students acquire the skills, dedicate a specific amount of class time to a skill identified as needing improvement, incorporate a class activity to enhance student learning, etc.)
- What recommendations do you have for CPP to improve students’ critical thinking skills?

We recommend keeping a record of the decisions your program makes about the evidence, and the actions taken to improve Critical Thinking skills. This information may be useful when completing future assessment reports and program review/accreditation self-studies.

References

- Campitelli, G., & Gobet, F. (2011). Deliberate Practice: Necessary But Not Sufficient. *Current Directions in Psychological Science*, 20(5), 280–285. <https://doi.org/10.1177/0963721411421922>
- Taylor, A., Nelson, J., O'Donnell, S., Davies, E., and Hillary J. (2022). The Skills Imperative 2035: What does the literature tell us about essential skills most needed for work? Slough: NFER
- Van Gelder, T. (2005). Teaching Critical Thinking. *College Teaching*, 53(1), 41–46. <https://doi.org/10.3200/CTCH.53.1.41-48>

Appendix A

CRITICAL THINKING (APPROVED BY ACADEMIC ASSESSMENT COMMITTEE)

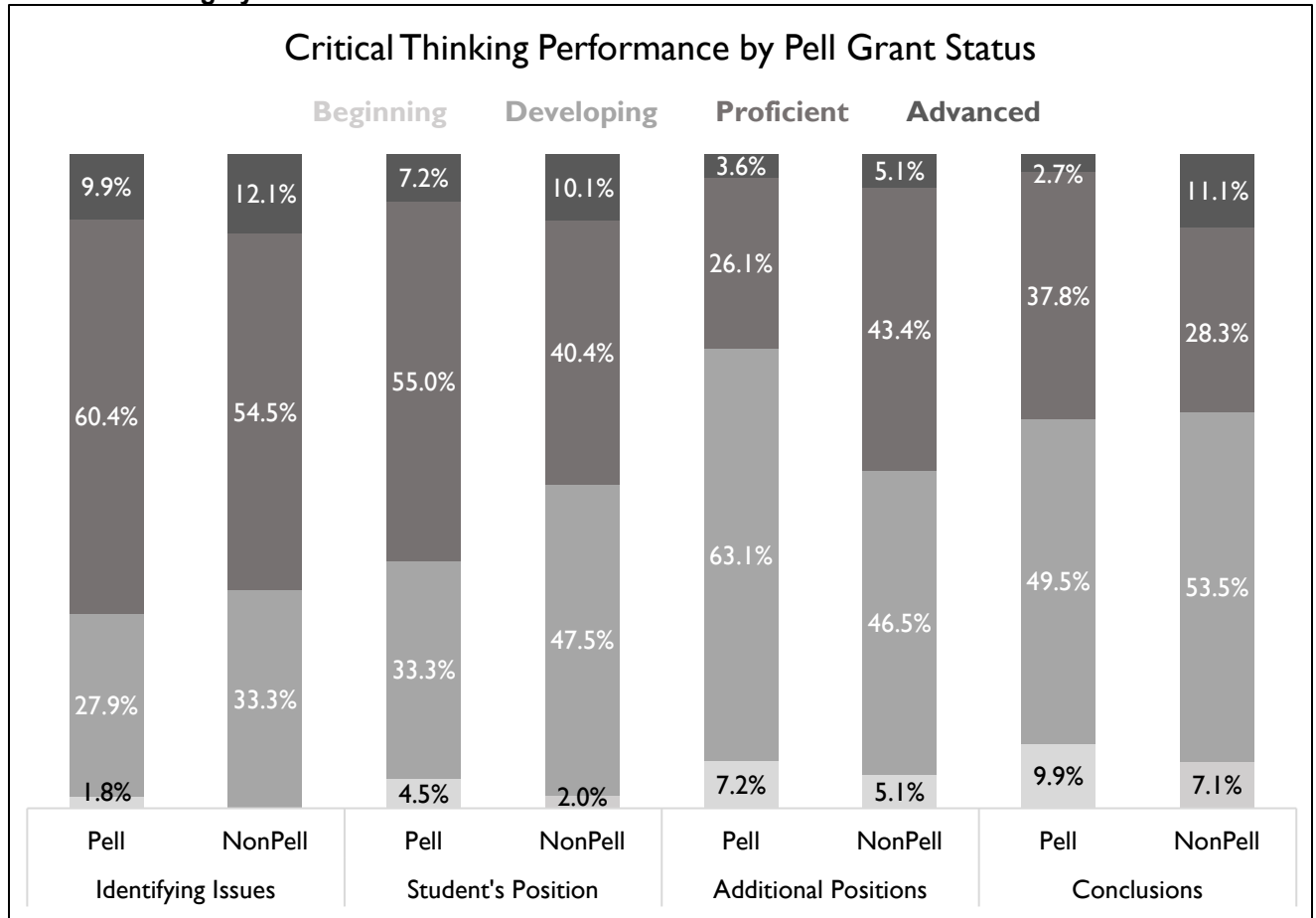
GE SLO Id.

Construct arguments based on sound evidence and reasoning to support an opinion or conclusion.

Evaluation Criteria	Advanced (4)	Proficient (3)	Developing (2)	Beginning (1)
Identifying Issues: Student understands the subject matter.	Identifies the main problems/issues clearly and accurately, identifies subordinate concerns, and clearly addresses the relationship between them.	Identifies the main problem clearly or accurately, and identifies subordinate concerns but may not adequately understand the relation between them.	Identifies the problem/issue vaguely or incompletely and/or confuses main and subordinate concerns.	Identifies the problem/issue inaccurately and does not adequately consider subordinate concerns.
Student's Position: Student offers an intervention, perspective, thesis/hypothesis.	States a clear position taking into account the subject's context and complexity and is relevant to the problem/issue under consideration.	States a clear position that is relevant to the problem/issue under consideration.	States a position that is contextualized but may be purely descriptive/summative.	No position is offered, the position is simplistic or obvious, or the position is inaccurate.
Additional Positions: Student considers context and the perspectives of others.	Includes additional sources that provide productive context and relevant perspectives; represents these sources ethically/accurately; and substantively engages with them in support of their position.	Includes additional sources that provide productive context and relevant perspectives; adequately understands these positions (e.g. avoids misunderstandings, over-simplification, or fallacious inferences); and may engage with them in a disconnected or tangential way.	Includes additional sources whose perspectives are relevant to the topic; may misrepresent, reduce, or ignore source's position; and engages with sources in a disconnected or simplistic manner.	Includes minimal/irrelevant sources, engages with sources weakly or not at all, and/or misrepresents, reduces, or ignores the source's position.
Conclusions: Student comes to ethical, informed, reasoned conclusions about the subject.	Presents a clearly articulated and reasoned interpretation of the information; interpretation reflects an informed evaluation of the evidence and perspectives.	Presents a reasoned interpretation of the information; interpretation may not be supported by the information presented.	Presents a synthesis of the information; interpretation is absent or unsupported.	Presents a synthesis of information that is partial and may not logically be supported by the information presented.

Appendix B

Critical Thinking by Pell Status



Note: A statistically significant difference was found in the *Additional Positions* criterion.

18.8% difference at the "proficient" and "advanced" levels