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Unveiling Minds: Investigating Critical Thinking Traits of Students in Private Catholic Schools in Siquijor Province

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Abstract. The study aimed to identify the critical thinking traits of students as possible determinants of their critical thinking skills and their relationship to selected variables. The researcher utilized a descriptive-correlational design and employed a systematic sampling technique to identify 130 randomly selected students from private Catholic institutions in the Province of Siquijor. Validated questionnaires were used, and multiple regression analysis, chi-square test, and weighted mean were employed for data analysis. The study found that senior high school students exhibit "high" levels of critical thinking traits in the following areas: truth-seeking, open-mindedness, analyticity, systematicity, critical thinking self-confidence, inquisitiveness, and cognitive maturity. Their critical thinking skills in interpretation, analysis, evaluation, inference, and self-regulation are also "high". Furthermore, students who exhibit higher levels of truth-seeking, open-mindedness, and critical thinking self-confidence tend to have better critical thinking skills. Female students display more positive critical thinking traits compared to their male counterparts. Students in the Science, Technology, Engineering, and Mathematics (STEM) and Technical Vocational Livelihood (TVL) tracks exhibit the most desirable critical thinking traits and skills compared to other groups of students. These findings indicate the need for a concerted effort to maintain and improve critical thinking traits and skills across all student groups, with particular emphasis on gender disparities and stream-specific differences. Educators and policymakers can use these insights to better prepare students for academic success and future challenges.

Keywords: Critical thinking; Private catholic school; Philippines.

1.0 Introduction

Problems with students' lack of problem-solving and critical thinking skills remain pervasive, despite emphasis on these skills as essential in today's workforce (Lestari, Haryani & Sumarti, 2020; Irwanto, Rohaeti, & Prodjosantoso, 2019). Coping with the demands of a constantly evolving world entails going beyond the conventional method of increasing one's knowledge capacity (Holmarsdottir et al., 2023). People must sharpen and refine their higher-order thinking skills, particularly their critical thinking ability (Firdaus et al., 2019; Hart, 2023). The ability to think critically is inextricably linked to a critical disposition or attitude of individuals (Hunter, Brabazon, & Quinton, 2023). According to Sulaiman (2018), a vehicle is incapable of transporting someone to a certain destination if there is inadequate fuel. Indeed, the vehicle is essential; it is unacceptable to be a genuine thinker in the absence of the necessary dispositions. Thus, critical thinking serves as the vehicle, while critical thinking disposition serves as the fuel.

In the Philippines, the Department of Education (DepEd) designed the Basic Education Exit Assessment (BEEA) to identify the Grade 12 students' 21st-century skills. According to Cordon and Polong (2020), the outcomes of the assessments are crucial to raising the standard of education because they reveal how well students are performing

and provide the information needed to develop reforms or policies that will benefit the learners. However, the study of Bulangis (2021) on BEEA revealed that students have low proficiency in problem-solving, information literacy, and critical thinking. Undeniably, problem-solving, information literacy, and critical thinking skills are necessary in all facets of people's lives (Darling-Hammond et al., 2019). However, there is a prominent decline in students' competency in twenty-first-century skills, according to Siregar, Rosli , and Nite (2023). This decline is evident in the TIMMS results of students in the Philippines wherein the country got the lowest rank in Mathematics among the 58 countries involved in the study (CNN Philippines Staff, 2019).

According to Safitri et al. (2023), between 2016 and 2017, researchers focused significantly on the improvement of students' mathematical capabilities, notably mathematical problem-solving and reasoning thinking abilities. In the next year, 2018–2019, research focused on investigating instructional techniques for increasing students' problem-solving ability. In the years 2021–2022, research focused on improving students' cognitive capabilities in science and mathematics, particularly in terms of mathematical reasoning abilities. However, Rauscher and Badenhorst (2021) recommended that more research must be done to determine which dispositions should be emphasized to meet the dispositional requirements in technology education. In the words of Poondej and Lerdpornkulrat (2015), considering the disposition dimensions of that range of critical thinking is more important than examining the cognitive abilities dimension.

With the above premise, the researchers, who are educators who majors in Math, desired to investigate the relationship between students' critical thinking traits and critical thinking skills. They also wanted to explore the connection between the students' profile (i.e. sex and academic strand) and the aforementioned variables. Thus, this study was conducted.

2.0 Methodology

2.1 Research Design

The research utilized the descriptive-correlational survey as a research design. The descriptive nature was used to gain information on the students' critical thinking disposition and describe their critical thinking skills. Also, the descriptive process would go beyond gathering and tabulation of data but also the interpretation of the meaning and significance of the elements to be described. On the other hand, the study was also correlational because it examined the relationship between the variables identified in the study.

2.2 Research Locale

The study focused on Siquijor's Catholic senior high school programs, which included Assisi High School, Inc., Ave Maria Academy, Carmelite College of Siquijor, Inc., Saint Isidore, the Farmer Catholic School, Saint John High School, and Saint Vincent Academy. These private institutions under the Diocese of Dumaguete are well-known for providing high-quality Catholic education. Carmelite College of Siquijor, managed by the Carmelite Sisters of Our Lady, is the island's only Catholic higher education institution, with an average class size of 27. All these schools have the necessary facilities, including computer laboratories and science labs, and adhere to the Department of Education's safety and usability standards.

2.3 Research Participants

The respondents of the study were the Grade 12 students enrolled in the Catholic institutions during academic year 2022-2023. Out of the 188 total students from six schools, 130 were taken as respondents. These students were chosen using the systematic sampling design in which every second student in the list was chosen as part of the study.

2.4 Research Instrument

The study used two sets of standardized survey questionnaires. The first set is for assessing critical thinking traits. This tool was adopted from Boonsathirakul and Kerdsomboon's (2021) study, "The Investigation of Critical Thinking Disposition among Kasetsart University Students." The second set, the Critical Thinking Assessment-Scale Short Form, was adopted from the work of Payan-Carreira et al. (2022) in their study, "Development and Validation of a Critical Thinking Assessment-Scale Short Form." These survey questionnaires have three sections. The first part is the disclosure statement, and the second part contains the students' profiles in terms of sex and academic strand. The third part is intended to assess the learners in the areas of critical thinking traits and skills

such as (Tohir et al., 2021) interpretation, analysis, evaluation, inference, explanation, and self-regulation when presented with mathematical situations.

A dry run was conducted to test the reliability of the instrument with students carefully identified to ensure they were not among the target respondents. The results yielded a reliability coefficient of 0.62 for truth-seeking, open-mindedness (0.57), analyticity (0.80), systematicity (0.77), critical thinking self-confidence (0.83), and 0.65 for inquisitiveness as well as cognitive maturity. Items for truth-seeking, open-mindedness, critical thinking self-confidence, inquisitiveness, and cognitive maturity scored less than 0.7, so these constructs' items were revised. The questionnaire was also presented to experts in mathematics for content validity. These experts are School heads, Mathematics Coordinators, and Master teachers in mathematics with vast experience in the field. Their suggestions were considered in the refinement of the questionnaire with permission from the authors to modify the questionnaire in the Philippine context.

However, the Critical Thinking Assessment-Scale Short Form (Payan-Carreira et al., 2022) was not subjected to a dry run because the study's confirmed factor analysis has established the validity and reliability of the corresponding six-factor empirical framework of the Critical Thinking Assessment- Scale Short Form using Cronbach alphas for the overall instrument and the six scales were both high for the overall scale of 0.969 and 0.750–.965 for the six factors. The following values were obtained: 0.772, for interpretation, 0.888 for analysis, 0.858 for evaluation, 0.905 for inference, 0.853 for explanation, and 0.905 for self-regulation.

The researchers utilized Multiple Linear Regression Analysis to examine the relationship between students' critical thinking traits and their critical thinking skills. They employed a Chi-Square Test to determine the relationship between students' profile, based on sex and academic strand/track, and (a) their level of critical thinking traits and (b) their critical thinking skills. Additionally, the Weighted Mean was used to assess (a) the level of students' critical thinking traits and (b) the level of their critical thinking skills.

2.5 Data Gathering Procedure

After the consolidation, all the corrections and suggestions from panel members and incorporated into all inputs for the improvement of the study. A letter of request to conduct the study was sent to the School President of Carmelite College and the School Superintendent of the Diocesan Schools through the respective school principals of Assisi High School, Ave Maria Academy, Saint Isidore, the Farmer Catholic School, Saint John High School, and Saint Vincent Academy.

The list of identified students was obtained from the registrar's office with the permission of the school principal. The respondents and their parents also received a consent letter. Furthermore, the conduct of orientation was provided to the respondents before the distribution of questionnaires. During distribution, the researcher explained to the students the goal and importance of the study. The questionnaires were retrieved immediately after the students were done answering the questionnaire items. Confidentiality was strictly observed throughout the process.

2.6 Ethical Considerations

Throughout the study, the researchers exercised all necessary ethical considerations. Because humans were chosen as study participants, information was kept confidential. The researchers also made sure to protect the dignity and privacy of the respondents and minimize potential risks. The researchers followed the ethical protocols established by Foundation University's Ethics Committee. Consultation was pursued to ensure that the research topic would be clearly sound, significant, and ethically correct. The researchers asked the participants to sign the disclosure statement after they had fully understood the risks and benefits of the study.

3.0 Results and Discussion

3.1 Students' Critical Thinking Disposition

Table 1 shows the results of the critical thinking traits of the senior high students. The students have a "high" level of critical thinking disposition with 4.84 weighted mean. This result is affirmed by Sellars et al. (2018), who found that critical thinking disposition does indeed develop over time through a combination of experience, education, practice, feedback, exposure to diverse perspectives, open-mindedness, and intellectual curiosity. Rowe (2018)

also asserted that by actively cultivating these factors, individuals can enhance their inclination and ability to think critically in various contexts and domains.

Table 1. Descriptive statistics of students' critical thinking disposition (n = 130)

Areas	Mean	Interpretation	Level
Truth-Seeking	4.79	Agree	High
Open-Mindedness	4.86	Agree	High
Analyticity	4.51	Agree	High
Systematicity	4.94	Agree	High
Critical Thinking Self-Confidence	4.69	Agree	High
Inquisitiveness	5.03	Agree	High
Cognitive Maturity	5.07	Agree	High
Overall	**4.84**	**Agree**	**High**

This result supports Ahmad and Duski's (2020) claim that critical thinking has been established as a primary goal in the academic field and one of the characteristics of a senior high school graduate. As noted by Celik and Ozdemir (2020), academic achievement can influence critical thinking disposition. Cruz, et al. (2020) also stated that academic achievement must be reinforced through experience, lifelong learning, and consistent effort.

Furthermore, systematicity ($w\bar{x}$ =4.94) and analyticity ($w\bar{x}$ =4.51) are both "highly" achieved by the students with the provision to engage in problem-solving procedures in a systematic manner throughout the process. In the same vein, open-mindedness ($w\bar{x}$=4.86), truth-seeking ($w\bar{x}$=4.79), and critical thinking self-confidence ($w\bar{x}$ =4.69) are all "high," indicating that students are naturally inclined to employ critical thinking when making decisions. The findings indicate that students are better prepared to seek new knowledge, engage critically with information, and adapt to new challenges and opportunities throughout their lives. According to Cui et al. (2021), integrating systematicity and analyticity may indicate how students utilize reasoning and evidence to solve issues using a systemic mindset.

3.2 Students' Critical Thinking Skills

Table 2 unveils the student's critical thinking abilities. This result is based on the cognitive abilities that define the ideal thinker. Students' critical thinking skills are seen to be generally "high" with an overall composite weighted mean of 4.45. According to Facione (2015), critical thinking skills are useful in a variety of contexts, including problem-solving, decision-making, and intellectual development.

Table 2. Descriptive statistics of students' critical thinking skills (n = 130)

Areas	Mean	Interpretation	Level
Interpretation	4.53	Usually	High
Analysis	4.42	Usually	High
Evaluation	4.49	Usually	High
Inference	4.44	Usually	High
Explanation	4.21	Frequently	Somewhat High
Self-Regulation	4.59	Usually	High
Overall	**4.45**	**Usually**	**High**

3.3 Relationship between Students' Critical Thinking Disposition and Skills

The data in Table 3 reveal the relationship between the students' critical thinking disposition, which is measured by seven (7) constructs and their overall critical thinking skills. Using Multiple Linear Regression Analysis, it is revealed that the F-test significance or overall p-value (0.000) is less than the level of significance (0.05). This means that the sample data provide enough evidence to reject the null hypothesis for the entire population. This signifies that some of the explanatory or independent variables (7 constructs of critical thinking disposition) are significant predictors of students' overall critical thinking skills. Based on the regression output, it is revealed that students' critical thinking dispositions in the following constructs are significant predictors of their overall critical thinking skills: truth-seeking (p = 0.007); open-mindedness (p = 0.028); and critical thinking self-confidence (p = 0.034).

Table 3. Multiple linear regression analysis for the relationship between the critical thinking disposition and thinking skills (n = 130)

Variables	Coefficients	SE	t Stat	p-value
Intercept	-0.617	0.569	-1.084	0.280
Truth-Seeking	0.320	0.116	2.765	**0.007**
Open-Mindedness	0.276	0.124	2.225	**0.028**
Analyticity	-0.101	0.107	-0.945	0.346
Systematicity	0.216	0.118	1.823	0.071
Critical Thinking Self-Confidence	0.256	0.120	2.140	**0.034**
Inquisitiveness	0.014	0.134	0.103	0.918
Cognitive Maturity	0.061	0.114	0.529	0.598
R = 0.655				
R^2 = 0.429				
adjusted R^2 = 0.396				
F-ratio = 13.089				
p-value = 0.000 (significant)				

Level of significance = 0.05

Furthermore, the coefficients of these 3 constructs are all positive, signifying that the students who manifest higher skills in truth-seeking, open-mindedness, and critical thinking self-confidence dispositions tend to attain higher critical thinking skills. In this regard, truth-seeking, open-mindedness, and self-confidence serve as a foundation for other critical thinking behaviors such as inference, interpretation, evaluation, and explanation, as well as transversal competence, which intersects and encompasses all critical thinking skills. Attard (2020) concurs with this conclusion, stating that a person can search for truth in the interconnectedness of events and achieve comprehensive understanding because the present world is an era of information explosion and so people must find a way to screen information.

Similarly, the findings of Gogus, Göüş, and Bahadir (2019) found a positive association between critical thinking skills and four sub-dimensions of critical thinking disposition: analyticity, systematicity, self-confidence, and inquisitiveness. Specifically, evaluation is positively correlated with systematicity. According to Changwong, Sukkamart, and Sisan (2018), critical thinking is a higher level of reflective thinking that involves individuals becoming more aware of their perceptions, feelings, actions, and decisions, and according to Erdoğan (2019), what they do, and focusing on deciding what to do and what to believe.

Meanwhile, other constructs of critical thinking dispositions (analyticity, systematicity, inquisitiveness, and cognitive maturity) do not significantly relate to the overall critical thinking ability of the students (all p-values > $\alpha = 0.05$). The prevailing result suggests that other factors could predict the specified critical thinking disposition constructs. As emphasized by Pu. et al. (2019), the dominant viewpoint in any field, critical thinking skills and dispositions are all positively related to internal motivation to think.

3.4 Relationship between Students' Profile and Their Critical Thinking Disposition

Table 4 indicates the data in identifying the relationship between the profile of the students and their overall critical thinking disposition. Using Chi-Square Test (x^2), it is identified that there is a significant relationship between the sex and the overall critical thinking disposition of the students ($p = 0.008 < \alpha = 0.05$). The values of the weighted means suggest that female students ($w\bar{x} = 5.00$) display higher overall critical thinking disposition than their male counterparts ($w\bar{x} = 4.72$). One possible explanation for the gender difference in critical thinking disposition is that female students tend to be more critical (Sk & Halder, 2020) and male students are less motivated to learn than female students (Ahmad & Duskri, 2018).

Table 4. Chi-Square test for the relationship between the students' profile and critical thinking disposition (n = 130)

Variables	x^2	df	p-value	Decision	Remark
Sex and Critical Thinking Disposition	9.73	2	0.008	Reject H_o	Significant
Academic Strand and Critical Thinking Disposition	21.53	4	0.000	Reject H_o	Significant

Level of significance = 0.05

Another possible explanation is that female students outperform male students on average in secondary school, as revealed in the study by Marc Jackman and Morrain-Webb (2019). A similar finding was also manifested in the study of Fitriani et al. (2018), which showed that the critical thinking disposition of female and male students

differs in several components, including inquisitiveness, maturity, self-confidence, and open-mindedness. Female students outperformed males in composite inquisitiveness and maturity, while males outperformed females in self-confidence and open-mindedness. The Analyticity disposition component has a dominant correlation in all components of male and female critical thinking disposition. However, Sk and Halder (2020) have found that gender had no significant moderating effect on emotional intelligence and critical thinking disposition.

The table also reveals that the students' academic strands are being grouped. This is done to satisfy the assumptions of the use of the Chi-Square Test. As shown, the strands are grouped according to their competencies wherein Accounting, Business and Management (ABM) and Electrical Installation and Management (EIM) are grouped with the idea that they are more on the business and entrepreneurship strand. Science, Technology, Engineering and Mathematics (STEM) and Technical Vocational Livelihood (TVL) are also grouped since they are more focused on skill development in terms of communication, critical thinking, body coordination, tool savvy, troubleshooting, and safety, while Humanities and Social Sciences (HUMSS) and General Academic Strand (GAS) strands focus on the study of human behavior and societal changes, and analysis of arts, culture, literature, and politics. With this grouping, the Chi-Square Test yields a significant relationship between the students' strands and their overall critical thinking disposition.

The data further indicate that the STEM and TVL groups have the highest critical thinking dispositions among the other two groups—the ABM and EIM; and the GAS and HUMSS groups. Although the requirements for the humanities and social sciences differ from those for science, technology, engineering, and mathematics, critical thinking is considered essential for both.

The STEM approach to contemporary teaching and learning is critical to effective, relevant learning experiences and profound knowledge that can connect STEM and TVL disciplines. Indeed, both students and teachers share equal responsibility for achieving better quality outcomes, particularly in HOTS. As a result, Baharin, Kamarudin, and Manaf (2018) asserted that, with the support of technology innovation, the STEM instructional method should incorporate problem-solving, creative thinking, disposition, and analytical reasoning that have the potential to enhance HOTS among students.

3.5 Relationship between Students' Profile and Their Critical Thinking Skills

Table 5 reflects that the sex of the students is not significantly related to their critical thinking skills ($p = 0.078 > \alpha = 0.05$). This means that regardless of their sex, the students manifest the same level of critical thinking skills. However, previous research in the field suggested that gender influences critical thinking skills. This is because female students differ from male students in terms of their understanding, fascination, and acquisition of styles. Female students were more engaged in their learning than male students (Bhagat & Chang, 2018; Daher et al., 2021; Yang et al., 2018). Gender disparities in the scientific process, skills, and critical thinking have an impact on students.

Table 5. Chi-Square test for the relationship between the students' profile and critical thinking skills (n = 130)

Variables	x^2	df	p-value	Decision	Remark
Sex and Critical Thinking Skills	6.82	3	0.078	Fail to reject H_o	Not significant
Academic Strand and Critical Thinking Skills	16.57	6	0.011	Reject H_o	Significant

Level of significance = 0.05

The table further shows that the academic strand of the students is significantly related to their critical thinking skills ($p = 0.011 < \alpha = 0.05$) with Science, Technology, Engineering and Mathematics (STEM) and Technical-Vocational Livelihood Track (TVL) groups manifesting the highest weighted mean than the other two groups of students, namely the ABM and EIM group; and the GAS and HUMSS group. STEM and TVL students benefit from the outcome because their content knowledge has a strong real-world application, and the students are well prepared for the modern era. This strand, in contrast to the Humanities and Social Science (HUMSS) and General Academic Strand (GAS) strands, focuses on human behavior and societal changes, as well as arts, culture, literature, and politics. While Accounting, Business and Management (ABM) and Electrical Installation and Management (EIM) add value to client management and the delivery of high-quality services and products. On the contrary, Gepila et al., (2022) claimed that ABM students' thinking skills in terms of remembering and creating

are average. They also asserted that the students have poor thinking skills in terms of comprehension, application, analysis, and evaluation, and that the majority of students have poor critical thinking abilities.

On the other hand, Farillon (2022) found that Science, Technology, Engineering and Mathematics (STEM), General Academic Strand (GAS), and Accounting, Business and Management (ABM) students learned to reason well, developed critical thinking skills, and performed well in Science. This demonstrates that the students have a strong understanding of Science, which will be useful when explaining various phenomena and Science-related problems. These students may excel at scientific argumentation, discourse, and in-class debates. This could imply that whatever they critically considered demonstrates scientific reasoning and critical thinking skills. This finding did not corroborate with Ramos (2018) who posited that students enrolled in both General Academic Strand (GAS) and Technical Vocational (TECHVOC) at the level of senior high schools failed to demonstrate the necessary thinking and reasoning level skills.

Furthermore, Dumitru (2019) believes that studying the arts, humanities, and culture is the best way to develop critical thinking skills. For example, learning philosophy embodies critical thinking; literature teaches us how to interpret, analyze, and evaluate; and history teaches us to be curious and critical. Meanwhile, archaeology sharpened students' truth-seeking and systematic skills, while the arts fostered open-mindedness, self-confidence, and cognitive maturity. Cultural studies provide explanation, self-regulation, and open-mindedness. All of these specific fields foster the growth of thinking skills and attitudes. It follows then that critical thinking is inherent in the social sciences; these domains have substantial contributions to the formation of critical thinkers. Overall, these findings contradict Prinsloo's (2018) claim that comparing critical thinking patterns across music and art students against science and engineering students indicated comparable critical thinking processes.

4.0 Conclusion

The findings show that critical thinking traits and thinking skills are closely related concepts that significantly impact an individual's ability to think critically. Teachers can help students improve their communication skills by employing strategies that promote clarity, coherence, and effectiveness. Teachers can also help students improve their explanatory skills by fostering a supportive learning environment where they can feel confident and empowered to express their ideas. Designing cohesive activities that promote active engagement and integrate content and critical thinking skills into academic studies enables students to learn collaboratively, share different points of view, and participate in meaningful discussions. Furthermore, an interdisciplinary approach is critical for addressing the complex challenges of the twenty-first century and advancing knowledge in different fields. This approach promotes collaboration, innovation, and comprehensive understanding; all of these are critical for future research, education, and problem-solving. Researchers propose replicating the study in public schools to compare thinking skills and traits across various academic disciplines to identify specific strengths, areas for improvement, and disparities among diverse student populations.

5.0 Contributions of Authors

Fritzie F. Pagente was responsible for conceptualizing the topic, gathering data, encoding, and editing, while Dr. Maria Chona Futalan, her supervising adviser, handled data analysis, proofreading, and additional editing.

6.0 Funding

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7.0 Conflict of Interests

The authors declared that there has no conflicts of interest as far as this study is concerned.

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